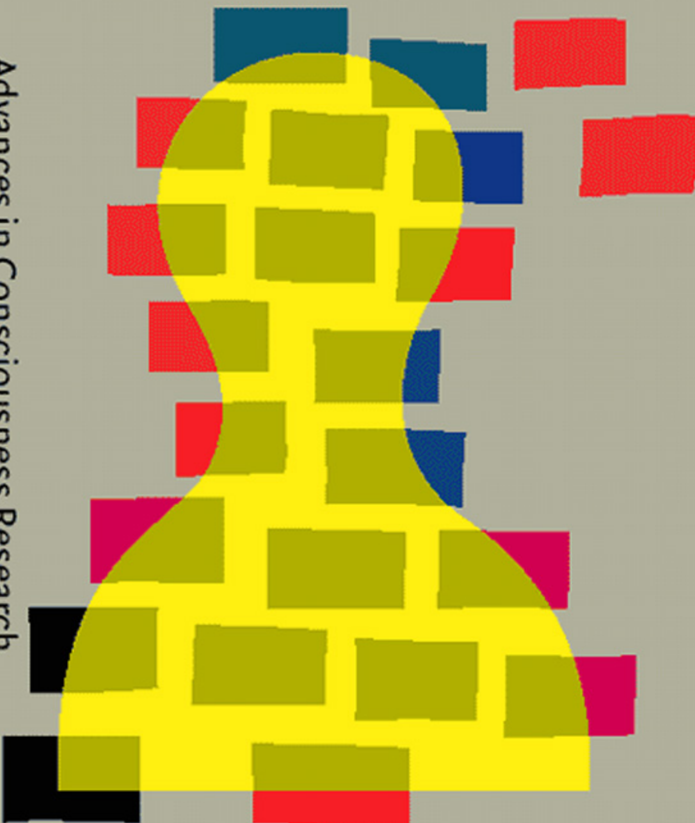
Philosophy of the Brain

Georg Northoff

Advances in Consciousness Research



Philosophy of the Brain

Advances in Consciousness Research

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Philosophy of the Brain: The Brain problem
by Georg Northoff

Philosophy of the Brain

The Brain problem

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For John who enriches my life much more than any brain could ever do

Table of contents

Acknowledgements ix

Chapter 1

The 'Brain problem': 'Mind problems', hypothesis of 'embedment' and the neurophilosophical method 1

1.1 The 'Brain problem' 1
1.2 Definition of the brain and 'dilemma of the brain' 8
1.3 Hypothesis of 'embedment' 19
1.4 Neurophilosophy as a method for investigation of the brain 25

Chapter 2

Neuroepistemological account of the brain: 'Epistemic–empirical relationship' 59

2.1 'Spatial embedment': The body and the own body 61
2.2 'Temporal embedment': The own body and other bodies 82
2.3 'Mental embedment': The brain and the own body 104
2.4 'Reflexive embedment': The own brain and other brains 142

Chapter 3

'Philosophy of the brain': Empirical hypothesis of the brain, 'epistemology of the brain', and 'ontology of the brain' 175

3.1 Empirical hypothesis of the brain: 'Dynamic brain', 'event coding', and 'embedded brain' 175
3.2 'Epistemology of the brain': 'Embedded epistemology', 'epistemology of events and environments' and First-, Second-, and Third-Person Epistemology 207
3.3 'Ontology of the brain': 'Embedded brain', 'embedded ontology' and 'self-reference' of the brain 260

Chapter 4

The 'Embedded brain': 'Mind problems', hypothesis of 'Embedment', and 'Paradigm shifts' **337**

4.1 The determination of the brain **338**

4.2 The 'Dilemma of the brain' **347**

4.3 Hypothesis of 'Embedment' **354**

4.4 'Paradigm shift' **361**

References **365**

Author index **403**

Subject index **405**

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Boston, February 2003

Chapter 1

The 'Brain problem'

'Mind problems', hypothesis of 'embedment' and the neurophilosophical method

"Strange coincidence, that every man whose skull has been opened had a brain!"

Ludwig Wittgenstein

1.1 The 'Brain problem'

1.1.1 'Mind problems' in the 'philosophy of mind'

The mind and its relationship to the brain have been investigated extensively in neuroscience and philosophy. However, either way of their determination raises principal problems whose solution seem rather difficult. These problems shall be called **'mind-problems'** (see Figure 1) and are discussed either implicitly or explicitly in the 'philosophy of mind'.

Empirically, the mind is determined by neuronal states, which are supposed to characterize the brain. Neuronal states of the brain are investigated empirically and related directly to different psychological and physiological functions. Meanwhile mental states can neither be investigated empirically nor related directly to neuronal states. Unlike neuronal states, mental states are not accessible in Third-Person Perspective, which makes their direct empirical investigation impossible. Since they are accessible in First-Person Perspective only, mental states can neither be related directly to psychological and physiological functions nor to neuronal states. Due to the inability to directly relate mental states to neuronal states, mental states cannot be detected and recognized within the brain as being characterized by neuronal states. Both problems, empirical accessibility of mental states with respect to the brain and the empirical relation between brain states and mental states remain, therefore unclear. Accordingly, one may speak of an **'empirical mind problem'**.

Both subjective experience and contents of mental states cannot be detected and recognized within the neuronal states and thus within the brain. For example, subjective experience of certain events within the environment cannot be related

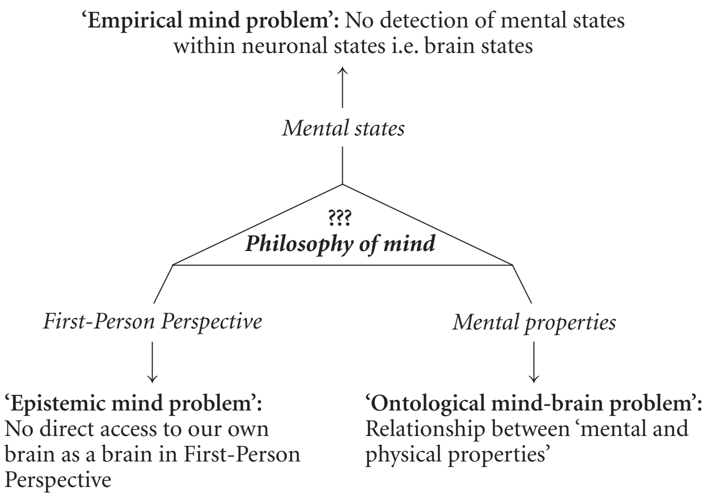


Figure 1. Philosophy of mind and 'Mind-problems'

directly to the neuronal states of the brain. Neither the subjective experience, i.e., the 'What is it like' nor its content, i.e., the event to which the subjective experience refers, can be detected and recognized within neuronal states. If, however, mental states cannot be detected and recognized within neuronal states, they cannot be related directly to the brain itself. From this inability to relate directly mental states to neuronal states, the principal impossibility of an empirical relation between mental states and brain states as neuronal states is inferred (see also Searle 2000: 566). However, the brain might be characterized not only by neuronal states exclusively but also by some other type of state as well. In this case, the inference from the inability of empirically relating mental and neuronal states to the principal impossibility of an empirical relation between mental states and brain states remains no longer necessary. The possibility of the 'empirical mind problem' presupposes subsequently the empirical framework of an exclusive characterization of the brain by neuronal states.

Epistemically, the mind is determined by mental states, which are accessible in First-Person Perspective. In contrast, the brain, as characterized by neuronal states, can be accessed in Third-Person Perspective. The Third-Person Perspective focuses on other persons and thus on the neuronal states of others' brains while excluding the own brain. In contrast, the First-Person Perspective could potentially provide epistemic access to the own brain and its respective neuronal states. However, the First-Person Perspective provides access only to the own mental states but not to the own brain and its neuronal states. We subsequently remain unable to detect and recognize our own brain (as a brain) in First-Person Perspective. Epistemic access to the own brain as a brain is not necessarily excluded since it may also be indirect through some intermediate state like, for example, (experience of) mental states (in First-Person Perspective). Moreover, it remains unclear whether mental states, as experienced in First-Person Perspective, refer either to a mind or (rather indirectly) to our own brain; the epistemic reference of mental states remains to be elucidated. Both problems, epistemic accessibility to our own brain in First-Person Perspective and epistemic reference of mental states thus remain unclear. Accordingly, one might speak of an **‘epistemic mind problem’**.

Either the First-Person Perspective, referring to mental states, is distinguished (and thus dissociated) from the Third-Person Perspective, which rather refers to neuronal states. Or the First-Person Perspective is reduced, subordinated or eliminated in favour of the Third-Person Perspective. In the first case, the First-Person Perspective can no longer be linked to the brain because otherwise it could not be distinguished from the Third-Person Perspective. In the latter case, the First-Person Perspective can be linked to the brain. However, the question for the distinction between First- and Third-Person Perspective arises. If the First-Person Perspective is reduced to the Third-Person Perspective, it should refer to neuronal states. This however is not the case since it e.g. First-Person Perspective rather refers to mental states. Either solution implicitly or explicitly presupposes the epistemic dichotomy between First- and Third-Person Perspective with respect to mental and neuronal states: In the case of distinction between First- and Third-Person Perspective, their epistemic dichotomy is explicitly presupposed. Though implicitly this remains also true in the case of subordination or elimination of the First-Person Perspective in favour of the Third-Person Perspective because otherwise there would be no need for its resolution by either subordination or elimination. The discussion about the ‘epistemic mind problem’ presupposes subsequently the epistemic framework of an dichotomy between First- and Third-Person Perspective with respect to mental and neuronal states.

Ontologically, the mind is determined either by ‘mental properties’ or ‘physical properties’. There are two possible cases: (i) The mind is distinguished from the brain by making a distinction between ‘mental properties’ and ‘physical properties’. It remains unclear, whether such an ontological dichotomy between ‘mental ontology’, as presupposed by ‘mental properties’, and ‘physical ontology’, as presupposed by ‘physical properties’, is in accordance with our own i.e. natural world. Accordingly, the ontological determination of the mind and its relation to the brain are problematic. (ii) The mind is not distinguished from the brain by reducing ‘mental properties’ to ‘physical properties’ on the basis of the dependence of mental states on the physical states of the brain. However, it remains unclear, whether ‘mental ontology’, as presupposed by ‘mental properties’, can be accounted for by ‘physical ontology’, as presupposed by ‘physical properties’. In addition to ontological determination of the mind, the ontological relationship between brain and mind is therefore problematic. Either way of ontological determination of the mind raises thus the question for the ontological relationship between mind and brain. Accordingly, one might speak of an **'ontological mind-brain relationship problem'**.

The ontological relationship between mind and brain can subsequently be characterized by dualism or monism (see 3.3.3). Various versions of both dualism and monism have been developed in past and present philosophical discussion. These versions concern both determination of 'mental properties' and the ontological relationship between brain and mind. 'Mental properties' are determined by mental states (see, for example, Nagel 1986 as well as 3.3.1), information (see, for example, Chalmers 1996 as well as, 3.3.3) or physical states (see 3.3.1). The relationship between mind and brain is determined by supervenience (see 3.3.2), panpsychism (see 3.3.1 and 3.3.3), reductionism (see 3.3.3), eliminativism, etc. (see 3.3.1 and 3.3.3). Despite their elaborated character, all these versions nevertheless presuppose the possibility of the ontological dichotomy between 'mental ontology' (or 'informational ontology') and 'physical ontology'. Even if 'mental ontology' is supposed to be accounted for by 'physical ontology', at least the possibility of 'mental ontology' must be presupposed because reduction to 'physical ontology' would otherwise not be necessary. The discussion about the mind-brain relationship and thus the 'philosophy of mind' in general presuppose subsequently the ontological framework of 'mental ontology' and 'physical ontology': The **'philosophy of mind'** as such would be impossible without the concurrent implicit or explicit presupposition of both 'physical ontology' and 'mental ontology'.

1.1.2 'Brain Problem' in the 'philosophy of the brain'

In contrast to the mind and its relationship to the brain, the discussion of the empirical, epistemic and ontological determination of the brain itself is rather neglected in philosophy. While determination of the mind is considered as highly controversial (see 1.1.1), definition of the brain is regarded as rather unproblematic and clear-cut. Determination of the brain can subsequently be characterized rather by implicit presuppositions and unquestioned definitions. Both, implicit determination of the brain in philosophy (see 1.2.1. for more extensive discussion) and its potential linkage to the 'mind problems', shall be illustrated briefly in the present section and more extensively in the following part (see 1.2.1). Considering the involvement of the brain in the 'mind problems' (see 1.1.1), determination of the brain itself may be discussed explicitly. Various options of empirical, epistemic and ontological determination of the brain may be considered which, in turn, might influence the determination of the mind. As such, potential escapes from the impasses posed by the 'mind problems' may be revealed.

Empirically, the brain is (usually) defined by neuronal states (in neuroscience) that are regarded as constitutive for the brain as a brain. However, considering the dependence of mental states on brain states (see 1.1.1), exclusive characterization of the brain by neuronal states might be inappropriate. Neuronal states are characterized as (classical; see 3.3.3 for further determination) physical states. If definition of brain states by neuronal states might be inappropriate, brain states may no longer be determined as physical states (in the classical sense). Other potential options for the empirical determination of brain states include definition by mental states (as, for example, in panpsychistic theories; see 3.3.1), functional i.e. computational and informational states (see 3.3.1) or dynamic states as non-mental and non-physical states (see 3.1.2). Definition of the brain by these different types of states may, in turn, influence the determination of empirical investigation of mental states and their relation to brain states. The 'empirical mind problem' might subsequently be undermined and complemented by an **'empirical brain problem'**.

Epistemically, the brain is (usually) defined by physical abilities and inabilities (in epistemology and philosophy). Epistemic abilities and inabilities are rather related to the mind than the brain. However, considering the inability of the brain to detect and recognize itself as a brain in First-Person Perspective (see 1.1.1), determination of the brain by physical abilities and inabilities exclusively might be inappropriate. One may therefore attribute at least one specific epistemic inability to the brain i.e. the inability to detect and recognize itself as a brain. Another potential option for the epistemic determination of the brain consists in the direct definition of the brain by those epistemic abilities which are usually associated with the mind like, for example, the First-Person Perspective. Definition of the brain by epistemic abilities and inabilities may, in turn, influence the determination of the epistemic relationship between First-Person Perspective, mental states, and brain states. The 'epistemic mind problem' might subsequently be undermined and complemented by an **'epistemic brain problem'**.

Ontologically, the brain is (usually) defined by 'physical properties' (in ontology and philosophy). 'Mental properties', in contrast, are rather related to the mind. However, considering the dependence of the possibility of the mind on the existence of a brain (see 1.1.1), ontological determination of mind and brain by 'mental and physical properties' might be inappropriate. Whereas determination of the mind by either 'mental or physical properties' remains problematic (see 1.1.1), definition of the brain by 'physical properties' has rarely been questioned. If the definition of the brain by 'physical properties' is inappropriate, the brain might be defined by other 'ontological properties' like, for example, 'mental properties' (see T. Nagel as well as 3.3.1 and 3.3.3). Another potential option for the ontological determination of the brain consists in the assumption of 'non-mental and non-physical properties' (as, for example, by 'informational properties'; (see 3.3.1 and 3.3.3). Or one may abandon the notion of 'ontological properties' al-

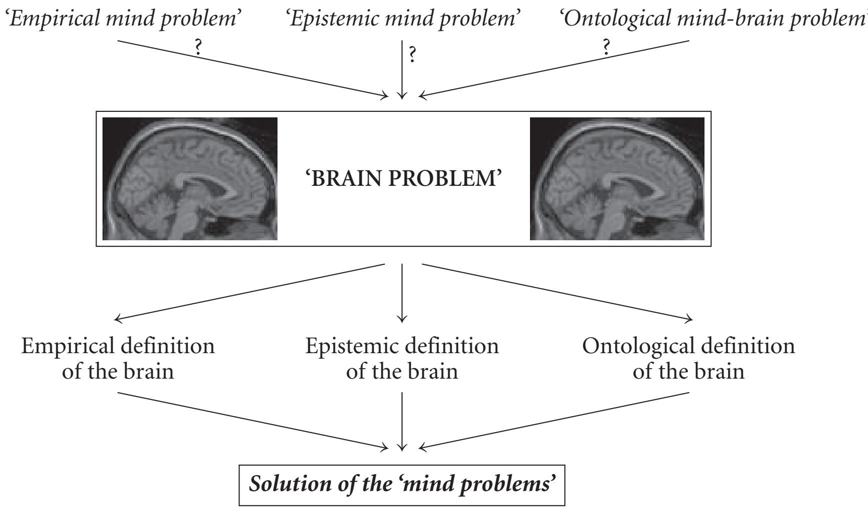


Figure 2. Linkage between the 'Brain problem' and the 'Mind problems'

together by replacing them with 'ontological relation' (see 3.3.2 and 3.3.3). These different definitions of the brain may, in turn, influence the determination of the ontological relationship between mind and brain. The 'ontological mind-brain relationship problem' might subsequently be undermined and complemented by an **'ontological brain problem'**.

Taken together, one may speak of a so-called **'brain problem'** (see Figure 2). The 'brain problem' can be defined as the problem of empirical, epistemic and ontological determination of the brain. The 'brain problem' as an empirical problem i.e. 'empirical brain problem' concerns the determination of brain states and their relation to neuronal and mental states. The 'brain problem' as an epistemic problem i.e. 'epistemic brain problem' concerns the determination of epistemic abilities and inabilities of the brain itself. The 'brain problem' as an ontological problem i.e. 'ontological brain problem' concerns the specific ontological determination of the brain itself independent from the mind. The 'brain problem' is reflected in the so-called 'dilemma of the brain' (see 1.2.2) – 'brain problem' and 'dilemma of the brain' are necessarily tied together. Resolution of the 'brain problem' should subsequently lead to resolution of the 'dilemma of the brain'. As such the 'brain problem' might undermine and complement the 'mind problems' (see 1.1.1): The 'brain problem' undermines the 'mind problems' by tracing the problems in empirical, epistemic, and ontological determination of the mind back to particular ways of determination of the brain. The 'brain problem' complements the 'mind problems' by accounting for the brain which as such is rather neglected in determination of the mind though it is involved directly or indirectly as one essential component

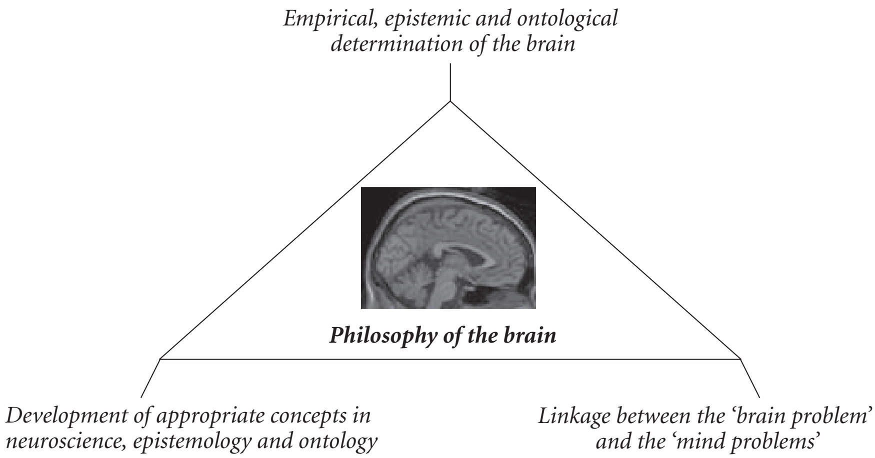


Figure 3. Characterization of the ‘philosophy of the brain’

in the ‘mind problems’. Resolution of the ‘brain problem’ should therefore lead to solution and transformation of the ‘mind problems’. The ‘brain problem’ provides subsequently a broader and foundational framework for the ‘mind problems’ (see 3.3.3. for an exact definition of such a ‘broader and foundational framework’). Empirical, epistemic and ontological determination of the brain might be regarded as a necessary condition for the possibility of developing a **‘philosophy of the brain’** (see Figure 3). A ‘philosophy of the brain’ can be defined by three characteristics which built upon each other: (i) empirical, epistemic and ontological determination of the brain, (ii) development of appropriate empirical, epistemic and ontological concepts as the appropriate framework for the determination of the brain, and (iii) consideration of implications of both determination and concepts for traditional philosophical problems by linking the ‘brain problem’ to the ‘mind problems’. As such the ‘philosophy of the brain’ might undermine and complement the ‘philosophy of mind’: The ‘philosophy of the brain’ undermines the ‘philosophy of mind’ by tracing the ‘mind problems’ back to the ‘brain problem’. The ‘philosophy of the brain’ complements the ‘philosophy of mind’ by discussing explicitly determination of the brain as one essential component in the ‘mind problems’. The ‘philosophy of the brain’ might subsequently provide a broader and foundational framework (see 3.3.3. for exact definition of ‘foundational’) for the ‘philosophy of mind’.

The present book focuses on the ‘brain problem’ and consecutive development of a ‘philosophy of the brain’. The ‘brain problem’ is exposed in further detail in the present chapter. First, implicit or explicit determination of the brain in current neuroscience, epistemology and ontology is discussed in further detail by raising the questions for its What, How, When, Where and Why (see 1.2.1). Second, the 'brain problem' is reflected in the 'dilemma of the brain' which describes contradictory assumptions with respect to the brain (see 1.2.2). Third, the brain is determined in empirical, epistemic and ontological respect by suggesting the hypothesis of 'embedment' (see 1.3). Fourth, a special method i.e. neurophilosophy is developed in order to enable empirical, epistemic and ontological determination of the brain (see 1.4). The second chapter investigates epistemic abilities and inabilities of the brain itself by developing a so-called 'epistemic-empirical relationship' (see Chapter 2). This 'epistemic-empirical relaitonship' can be considered as the basis for novel empirical (see 3.1), epistemic (see 3.2) and ontological (see 3.3) determination of the brain in the third chapter. The second and third chapter can thus be considered as the core chapters of the present book. The fourth and final chapter refers to and provides resolution of the 'brain problem' and the 'dilemma of the brain' (see 4.1 and 4.2). Moreover, it demonstrates solution and transformation of the 'mind problems' by resolution of the 'brain problem' (see 4.3). Finally, the novel determination of the brain may lead to a 'paradigm shift' in neuroscience, epistemology, ontology and philosophy (see 4.4).

In order to get an overview, one might start by reading the first (1.1–1.3) and fourth chapter. From there on, one may decide the further reading according to the respective interest. If one is primarily interested in relation between empirical brain function and epistemic abilities/inabilities, one should focus on the second chapter and Chapter 3.1. If one is primarily interested in epistemic and ontological questions, one should focus rather on Chapters 3.2 and 3.3. If one is strongly interested in methodological questions, one should focus on Chapter 1.4. However, all sections and chapters are closely linked to and built upon each other so that for a full understanding all chapters should be read. In order to preempt criticism from both neuroscientists and philosophers, it should be noted that the main focus of the present book is put on the linkage between empirical brain function, epistemic abilities/inabilities and ontological implications. Both, neuroscientific and philosophical details can subsequently not be as elaborated as necessary. It should therefore be kept in mind that the present book is a neurophilosophical investigation rather than a purely philosophical or neuroscientific inquiry. As such, it focuses on the resolution of the 'brain problem' with the consecutive development of an outline for a 'philosophy of the brain'.

1.2 Definition of the brain and 'dilemma of the brain'

The 'brain problem' is manifest in the empirical, epistemic and ontological domain (see 1.1.2). This is reflected in presupposition of a particular determination of the brain in neuroscience, epistemology and ontology (see 1.2.1) which is often presupposed rather implicitly. Moreover, this determination of the brain, either implicitly or explicitly, leads to contradictory assumptions accounting for a so-called 'dilemma of the brain' (see 1.2.2). For this reason, this section illustrates the 'brain problem' in further detail.

1.2.1 The definition of the brain

In the following, the often remaining implicit determination of the brain in philosophy shall be investigated briefly by raising its What, How, When, Where and Why. The 'What' focuses on the definition of the brain. The 'How' illustrates possible ways of characterization of the brain while the 'When' points out its constitutive features. The 'Where' discusses the different methods and disciplines being preoccupied with the investigation of the brain. Finally, the 'Why' focuses on the reasons and advantages of having a brain. Each question concerns all three domains empirical, epistemic and ontological. The questions will be raised here in the first chapter and answered in the fourth i.e. final chapter.

What is the brain?

Empirically, the brain is often regarded as a purely physical device. Neuronal states can be accounted for entirely by laws of (classical) physics so that the brain is determined as a 'physical brain' which resembles machines similar to, for example, computers. Since neuronal states of the brain are distinguished from mental states, the latter cannot be detected within the former. The empirical dissociation between neuronal and mental states leads subsequently to detachment of mental states from the brain, resulting in the 'empirical mind problem' (see 1.1.1). Definition of the brain as a biological device emphasizes the role and function of the brain within an organism (see Searle 1997 as well as 3.3.3). However, since the brain as a biological device can still be reduced to the (classical) physical laws, there is no principal difference between the biological and physical definition of the brain.

Epistemically, the brain is often characterized by Third-Person Perspective exclusively. The Third-Person Perspective allows for 'physical judgment' (see 2.4.3) and thus for recognition of neuronal states in the brain (of another person or the own brain as another brain; 2.3.1). The First-Person Perspective, in contrast, remains unable to account for neuronal states; instead it is rather associated with 'phenomenal experience' of mental states (see 2.4.1). Since mental states cannot be detected within the brain itself, the First-Person Perspective is separated i.e. detached from the brain. The epistemic dissociation between First- and Third-Person Perspective leads subsequently to detachment of the First-Person Perspective from the brain, resulting in the 'epistemic mind problem' (see 1.1.1). This is also reflected in the dissociation between 'subject of recognition' and 'object of recognition' with respect to the brain. The brain has often been regarded as the 'object of recognition' being accessible in Third-Person Perspective. Whereas the brain has not been related to the 'subject of recognition' the latter presupposing First-Person Perspective (see 3.2.1). Instead, the epistemic abilities of the 'subject of recognition' and the First-Person Perspective have rather been attributed to a mind as distinguished from the brain.

Ontologically, the mind is characterized by 'mental properties' and 'mental ontology' while the brain is often described by 'physical properties' and 'physical ontology'. However, since the mind cannot be detected within the brain itself, 'mental properties' are separated i.e. detached from the 'physical properties' of the brain and ultimately from the brain altogether (except in panpsychism; 3.3.1 and 3.3.3). Consequently, 'mental ontology' is distinguished from 'physical ontology'. The ontological dissociation between 'physical properties/ontology' and 'mental properties/ontology' leads subsequently to detachment of the mind from the brain, resulting in the 'ontological mind-brain relationship problem' (see 1.1.1). The mind-brain problem discusses the ontological relationship between brain and mind and thus between 'physical and mental ontology'. Considering the fact that there is no mind (in humans) without the existence of a brain while, at the same time, the former cannot be detected within the latter, the mind-brain problem becomes even more puzzling.

How can we characterize the brain?

Empirically, the brain is often characterized by neuronal states as physical states exclusively. However, because neuronal states i.e. physical states cannot account for mental states, one may speak of 'empirical underdetermination' of the brain. Or the brain is characterized by mental (or informational) states (see the discussion of the theories by T. Nagel and D. Chalmers in 3.3.1 and 3.3.3). Since, however, mental (or informational) states cannot be detected within the brain itself, one may speak of 'empirical overdetermination' of the brain in this case.

Epistemically, the brain is often characterized by Third-Person Perspective and 'Third-Person Epistemology' exclusively (see 3.2.1 and 3.2.3). Yet, since the First-Person Perspective remains absent in the case of an absent brain, one may speak of 'epistemic underdetermination' in this case. The brain might also be characterized by First-Person Perspective and 'First-Person Epistemology' (see, for example, T. Nagel 1986). Since, however, the epistemic abilities and inabilities of the First-Person Perspective cannot be detected within or directly linked to the brain itself, one may speak of 'epistemic overdetermination'.

Ontologically, the brain is often characterized by 'physical properties' exclusively. Given that 'physical properties' cannot account for mental states (and 'mental properties'), one may speak of 'ontological underdetermination' of the brain.

The brain could also be characterized by ‘mental properties’ (or ‘informational properties’; see 3.3.1 and 3.3.3). ‘Mental properties’ (or ‘informational properties’) cannot be detected within the brain itself and one may therefore speak of ‘ontological overdetermination’.

When can we speak of a brain?
Empirically, the brain is often regarded as the highest center that provides the integration between the different bodily functions. However, the principles underlying and determining processing and function of the brain remain unclear. Neither the ‘neural code’ nor the ‘unifying theoretical principle’ of the brain are known yet. In contrast, the ‘unifying theoretical principles’ are known in the case of other organs as, for example, heart and muscles. The function of ‘blood pumping’ can be regarded as constitutive for the heart, the ‘contraction theory’ as characteristic for the muscle (see Searle 1997: 198), and the function of digestion is constitutive for the stomach (see also Schopenhauer 1966, Vol. II, 65). Accordingly, the constitutive empirical feature, which defines the brain as a brain in empirical regard, remains unclear.

Epistemically, the brain is often characterized by various physical abilities ranging from sensory-motor functions to cognitive functions (the latter often being regarded as epistemic). These physical abilities may also be performed by artificial devices like machines and computers (see 3.1.4). Meanwhile the epistemic abilities and inabilities of the brain remain unclear. Even if some of the physical abilities like, for example, cognitive functions may be regarded as epistemic abilities, the specific epistemic inabilities of the brain remain nevertheless unclear. The specific epistemic inability may distinguish the brain from other devices like computer in epistemic respect. Accordingly, the constitutive epistemic feature, which defines the brain as a brain in epistemic regard, remains unclear.

Ontologically, the brain is often characterized by ‘physical properties’ (or ‘informational properties’). Other devices, e.g. machines and computers, can be characterized by ‘physical properties’ (or ‘informational properties’) as well. These ‘ontological properties’ can subsequently not be considered as constitutive for the brain as a brain. The brain has also been characterized by ‘mental properties’ (see, for example, Nagel 1986). However, since these ‘mental properties’ cannot be detected within the brain itself, this ontological definition remains at least questionable (see 3.3.1 for further discussion). Alternatively, one may assume an ontological characteristic which is different from both ‘physical and mental properties’ and thus from ‘ontological properties’ altogether. Accordingly, the constitutive ontological feature, which defines the brain as a brain in ontological regard, remains unclear.

Where can we investigate the brain?

Empirically, the brain and its brain states are often characterized by neuronal states as physical states. Neuronal states, i.e. physical states, are accessible only in Third-Person Perspective. Neuroscience, which investigates neuronal states, can therefore be defined as 'Third-Person Neuroscience' (see 3.2.1 for definition). Unlike neuronal states, mental states are accessible only in First-Person Perspective. As such mental states are excluded from 'Third-Person Neuroscience'. Accordingly, restriction of neuroscience to 'Third-Person Neuroscience' leads to exclusion of mental states from empirical investigation (see 3.2.1) which makes a 'neuroscience of mind' impossible.

Epistemically, the brain and its brain states are often characterized by physical abilities and inabilities while epistemic abilities and inabilities are rather related to mental states and the mind. As such the brain is excluded from epistemology. Epistemology can subsequently be characterized rather as an 'epistemology of the mind' than an 'epistemology of the brain' (see 3.2.1). Accordingly, restriction of epistemology to mental states as an 'epistemology of the mind' leads to exclusion of brain states and thus the brain itself from epistemic investigation which makes an 'epistemology of the brain' impossible.

Ontologically, the brain is often characterized by 'physical properties' while the ontological discussion focuses rather on 'mental properties' and their ontological relationship to 'physical properties'. Due to its focus on 'mental properties', ontology presupposes at least the ontological possibility of the mind, either implicitly or explicitly, which results in ontological distinction between mind and brain. As a result, the brain is excluded from ontology. Ontology can subsequently be characterized rather as an 'ontology of the mind' than an 'ontology of the brain'. Accordingly, the restriction of ontology to 'mental properties' as an 'ontology of the mind' leads to exclusion of the brain itself from ontological investigation which makes an 'ontology of the brain' impossible.

Why do we have a brain?

Empirically, the brain is often characterized by integration between different bodily functions, which is supposed to be necessary for adaptation of the organism to the environment. The brain may thus be necessary for adaptation to the environment. However, the exact empirical mechanisms by means of which the brain organizes and integrates the different bodily functions with respect to the environmental context remain unclear. It is, for example, unclear whether integration between different functions can be considered as the constitutive empirical feature of the brain (see above). The constitutive empirical feature of the brain must be attributed a particular function which, in turn, may account for better adaptation of the organism to the environment. However, neither the constitutive empirical feature of the brain i.e. its ‘neural code’ (see above) nor its particular function for the organism within the environment are known yet.

Epistemically, the brain is often characterized by various abilities as, for example, cognition and emotion, which are supposed to be necessary for better orientation of the organism within the environment. The brain may in consequence be necessary for orientation within the environment. However, the exact epistemic mechanisms by means of which the brain integrates and organizes cognition and emotions with respect to the environmental context remain unclear. It is, for example, unclear whether these abilities can be considered as the constitutive epistemic feature of the brain (see 1.2.1). The constitutive epistemic feature must be attributed a particular function, which, in turn, may account for better orientation of the organism within the environment. However, neither the constitutive epistemic feature of the brain i.e. a specific epistemic ability or inability (see above) nor its particular function for the organism within the environment are known yet.

Ontologically, the brain is often characterized by the ability to develop different (and virtual) types of ontology like, for example, ‘physical and mental ontology’. These different ontologies are supposed to be necessary for both better distinction between different environments and more accurate prediction of potential (i.e. virtual) changes in the latter by the organism. However, the exact ontological mechanisms by means of which the brain is able to develop different (and virtual) types of ontology remain unclear. It is, for example, unclear whether ‘physical properties’, which are often supposed to be the constitutive ontological feature of the brain (see above), can account for the ability of our brain to develop different (and virtual) types of ontology. However, neither the constitutive ontological feature of the brain i.e. ‘physical properties’, ‘mental properties’ or another ontological characteristic (see above), nor its particular function for the organism within the environment are known yet.

1.2.2 The ‘dilemma of the brain’

In the following, various dilemma, predominating either implicitly or explicitly the current discussion about mind and brain, shall be revealed. The term ‘dilemma’ points out logically contradictory assumptions i.e. two assumptions (A1, A2) that contradict each other. These assumptions are derived from conclusions (C1, C2) which, in turn, are inferred from two premises (P1, P2) respectively. A dilemma in this sense may be prevalent in different domains. Accordingly, we distinguish between ‘empirical dilemma’, ‘epistemic dilemma’, ‘ontological dilemma’, ‘disciplinary dilemma’ and ‘logical dilemma’. It is suggested that these dilemma can be traced back to a particular definition of the brain. They therefore illustrate the ‘brain problem’ in a paradigmatic way.

The 'Empirical dilemma'

The 'empirical dilemma' points out contradictory assumptions about the possibility of empirical linkage between mental states and brain states. On one hand, mental states cannot be linked to brain states because they cannot be detected and recognized within the brain states i.e. neuronal states themselves. On the other hand, mental states can be linked to brain states because their possibility as such is dependent on the existence of brain states i.e. neuronal states.

A1: Impossibility of linkage between mental states and brain states

- P1: Mental states cannot be detected within neuronal states.
- P2: Brain states can be characterized as neuronal states.
- C1: Linkage between mental states and brain states is impossible.

A2: Possibility of linkage between mental states and brain states

- P1: The possibility of mental states depends necessarily on the existence of neuronal states.
- P2: Brain states can be characterized as neuronal states.
- C2: Linkage between mental states and brain states is possible.

The 'Epistemic dilemma'

The 'epistemic dilemma' points out contradictory assumptions about the possibility of epistemic linkage between First-Person Perspective and brain states. On one hand, the First-Person Perspective can be characterized by mental states, which as such cannot be linked (directly) to states of the (own) brain i.e. neuronal states. This is so because mental states refer to events in experience in First-Person Perspective while neuronal states refer to stimuli in observation in Third-Person Perspective (see 3.1.3 and 3.2.1). On the other hand, mental states can be modulated and altered by changes in (the own) brain states i.e. neuronal states (though only necessarily but not sufficiently because neuronal states are only a necessary but not sufficient condition for mental states; see 3.1.3). The First-Person Perspective can thus be linked to (the own) brain states.

A1: Impossibility of linkage between First-Person Perspective and brain states

- P1: The First-Person Perspective can be characterized by mental states.
- P2: Mental states refer to events while brain states as neuronal states refer to stimuli.
- C1: Linkage between First-Person Perspective and brain states is impossible.

A2: Possibility of linkage between First-Person Perspective and brain states

P1: The First-Person Perspective can be characterized by mental states.
P2: Mental states are necessarily (though not sufficiently) altered by changes in (the own) brain states as neuronal states.
C2: Linkage between First-Person Perspective and (the own) brain states is possible.

The 'Ontological dilemma'

The 'ontological dilemma' points out contradictory assumptions about the possibility of ontological linkage between mind and brain. On one hand, the mind can be characterized by 'mental properties' that as such cannot be detected and recognized within the 'physical properties' of the brain (by means of which the brain is often defined in ontological respect). Linkage of the mind to the brain remains therefore impossible. On the other hand, the possibility of development of 'mental ontology', as presupposed by the mind, depends on the existence of a brain i.e. the one of the respective philosopher itself. The mind can thus be linked to the (own) brain.

A1: Impossibility of linkage between mind and brain

P1: The mind can be characterized by 'mental properties'.
P2: 'Mental properties' cannot be detected within the 'physical properties' of the brain (i.e. 'physical brain').
C1: Linkage between mind and (physical) brain is impossible.

A2: Possibility of linkage between mind and brain

P1: The mind presupposes 'mental ontology'.
P2: The possibility of development of 'mental ontology' depends necessarily on the existence of the brain (as a 'physical brain') i.e. the one of the respective philosopher itself.
C2: Linkage between mind and (physical) brain i.e. the own brain is possible.

The 'Disciplinary dilemma'

The 'disciplinary dilemma' points out contradictory assumptions about the possibility of transdisciplinary linkage between philosophy and neuroscience. On the one hand, philosophy presupposes logical conditions, which must be distinguished from natural conditions (see 1.4.1), as presupposed in investigation of the brain in neuroscience. Due to these differences in conditions, direct linkage between philosophy and neuroscience remains impossible. On the other hand, the possibility of development of logical conditions, as presupposed in philosophy, depends necessarily on the existence of the brain (i.e. the one of the respective philosopher itself) and its natural conditions because we are not able to philosophize without a brain. Philosophy i.e. logical conditions can thus be linked to neuroscience i.e. natural conditions.

A1: Impossibility of linkage between philosophy and neuroscience

P1: Philosophy presupposes logical conditions.
P2: Neuroscience presupposes natural conditions, which must be distinguished from logical conditions.
C1: Linkage between philosophy and neuroscience is impossible.

A2: Possibility of linkage between philosophy and neuroscience

P1: Philosophy presupposes logical conditions.
P2: The possibility of development of logical conditions depends necessarily on the existence of the brain (i.e. the one of the respective philosopher itself) which presupposes natural conditions by itself as investigated neuroscience.
C2: Linkage between philosophy and neuroscience is possible.

The 'Logical dilemma'

The 'logical dilemma' points out contradictory assumptions with regard to the role of the brain. On one hand, the brain can be investigated as an 'object of recognition'. On the other hand, the brain, as an 'object of recognition', is investigated with the brain itself (i.e. the one of the investigator) as a 'subject of recognition': While philosophizing about the brain, we apparently philosophize with the brain. However, the brain cannot be both 'subject and object of recognition' at the same time. Either the brain is the 'subject of recognition', which excludes that it is its own 'object of recognition'. Or the brain is the 'object of recognition' which excludes that it is its own 'subject of recognition'. As a result, characterization of the brain by both 'subject and object of recognition' remains logically contradictory. One may therefore speak of a 'logical dilemma' which reflects a problem of 'self-reference' of the brain (see 3.3.4 for more extensive discussion). This is nicely accounted for by the so-called 'brain paradox' (see also Northoff 2001a). An initial presentation of the 'brain paradox' – though not in a strictly logical sense – can be traced back to Schopenhauer who first considered the brain to be both 'subject of recognition' and 'object of recognition' (which were inserted in the quote by me): 'But in so far as the brain knows, it is not itself known, but it is the knower, the subject of all knowledge (i.e. the 'subject of recognition'). But in so far as it is known in objective perception, that is to say, in the consciousness of other things, and thus secondarily, it belongs, as organ of the body, to the objectification of the will (i.e. the 'object of recognition').' (Schopenhauer 1966, Vol. II, 259). Kuhlenbeck, relying on Schopenhauer, formulates the same with respect to the relation between consciousness and brain: “…our phenomenal world of consciousness is a brain phenomenon, but the brain itself, as we know it, is a phenomenon of consciousness; or, in shorter form: consciousness is a brain phenomenon, but the brain itself is a brain phenomenon” (Kuhlenbeck 1965: 595). According to Kuhlenbeck (1960: 181, 1972: 376) the ‘brain paradox’ is the logical proof of the principal i.e. theoretical insolvability of the mind-brain problem. Relying on these initial versions by Schopenhauer and Kuhlenbeck, we now want to reformulate the ‘brain paradox’ in a strictly logical sense as an **‘antinomy’**.

The brain (as a subject) recognizes all subjects as brains.

A psychiatrist (PS) and a philosopher (PH) meet in a conference on consciousness. The psychiatrist, who works in functional brain imaging, investigates the ability of the brain to recognize one’s own and other persons. The philosopher is a specialist in the matter of self-recognition and self-consciousness. Both discuss epistemic implications of functional brain imaging for recognition of one’s own and other persons and brains.

PS: I recognize you as a brain.
PH: Sounds interesting. What about other persons?
PS: I recognize all persons as brains.
PH: Who gives you that ability?
PS: My brain. My brain recognizes all persons as brains.
PH: Who are you?
PS: A person, of course.
PH: How do you recognize yourself?
PS: As a person, of course.
PH: Who recognizes yourself as a person?
PS: My brain.
PH: If your brain recognizes yourself not as a brain but as a person then your assumption, “My brain recognizes all persons as brains” must be wrong.

The brain apparently references its own brain through the mind, whereas others brains are referred to as brains. Such a double reference leads apparently to irreducible ‘self-contradiction by accepted ways of reasoning’ (Quine 1976: 5). The sentence constituting the ‘brain paradox’ as an antinomy is true if and only if it is false. This is, for example, the case in the famous antinomy of Epimenides (himself a Cretan), ‘All Cretans are liars‘. If the brain recognizes itself as the ‘subject of recognition’ it cannot recognize any other brain as the ‘subject of recognition’ but only as ‘objects of recognition’. If the brain recognizes all other brains as ‘subjects of recognition’ it cannot recognize itself as the ‘subject of recognition’ but only as an ‘object of recognition’. Consequently, the sentence is true if and only if it is false:

It is either true for one's own brain and false for others' brains, or false for one's own brain and true for others' brains.

Relying on a more or less similar structure as suggested by Kant (1998), the 'brain paradox' as an antinomy may also be formulated in a different way which shall be called the **Kantian version** of the antinomy. If there are two contradictory assumptions (A1 and A2), each leading to contradictory inferences, one may speak of an antinomy.

A1 The brain recognizes all subjects as subjects but not as brains.
A2 The brain recognizes all subjects as brains but not as subjects.

A1 and A2 are contradictory with regard to the recognition of subjects. In addition to contradiction between the two assumptions, contradictory inferences may be drawn from each assumption. One may infer from A1 a principal inability to recognize brains (as brains). This however remains contradictory to our knowledge about the brain as such. We must subsequently be able to recognize brains since otherwise we could have no knowledge about brains as brains. One may infer from A2 a principal inability to recognize subjects (as subjects). This however remains contradictory to the recognition of our own person as a subject. We must subsequently be able to recognize subjects since otherwise we could not recognize our own person as a subject.

Alternatively, one may constitute the 'brain paradox' also as a **'veridical paradox'** leading to reductio ad absurdum (Quine 1976: 1–3).

> The brain (as a subject) recognizes all brains (i.e. subjects) as objects if and only if it does not recognize all brains as objects.

This version of the 'brain paradox' parallels with the example of the village barber who shaves all and only those men in the village who do not shave themselves. If we say that the barber does not shave himself, the example is contradictory. If we say that he shaves himself, the example remains contradictory as well. The brain as a subject recognizes all brains i.e. subjects as objects if and only if it does not recognize itself as an object. Either the brain can recognize itself as an object, in which case it remains unable to recognize other subjects since it is no longer a subject by itself. Or the brain cannot recognize itself as an object in this case, in which case it can no longer recognize all brains i.e. subjects as objects. Accordingly, either case remains contradictory reflecting reductio ad absurdum.

Finally, one may constitute the 'brain paradox' also as a **'falsidical paradox'** as characterized by a fallacy in the underlying presupposition (Quine 1976: 1–3).

> The brain (as an object) recognizes all brains (i.e. objects) as subjects if and only if it does not recognize all brains as subjects.

This version of the 'brain paradox' parallels with Zenon's paradox, which relied on the false assumption that any infinite succession of intervals of time has to add up to eternity. In our case, the underlying presupposition of recognition of other brains as subjects by the brain as an object must be considered as false. The brain as an 'object of recognition' remains principally unable to recognize other brains since only the brain as a 'subject of recognition' can do so.

1.3 Hypothesis of 'embedment'

In order to answer the questions (1.2.1) and resolve the dilemma (1.2.2), we develop the hypothesis of 'embedment' which shall be outlined briefly in the following. The hypothesis of 'embedment' concerns definition of 'embedment' (1.3.1), definition of hypothesis (1.3.2) and definition of the brain (1.3.3) (see Figure 4). Finally, the strategy of the present investigation is revealed (1.3.4).

1.3.1 Defining 'embedment'

The term 'embedment' can be defined by an 'intrinsic' relationship between brain, body and environment. The term 'embedment' includes two components 'embodiment' and 'embeddedness'. 'Embodiment' refers to the 'intrinsic' relationship between brain and body while 'embeddedness' describes the 'intrinsic' relationship between brain/body and environment. 'Embedment' must be contrasted to 'isolation'. 'Isolation' can be defined by absence of an 'intrinsic' relationship between brain, body and environment. As such it includes 'disembodiment' (see 3.3.2) and 'disembeddednes' (see 3.3.2). 'Isolation' refers to both 'extrinsic' relationship and absence of relationship (see below for further definition). Both 'extrinsic' and absent relationship must be distinguished from the 'intrinsic' relationship, as presupposed in 'embedment' can be described by 'bilateral dependency' and 'selective-adaptive coupling'. 'Bilateral dependency' implies mutual i.e. reciprocal dependency between brain, body and environment. For example, in the case of 'embedment' the brain can be considered as a necessary condition for the body while the body, in turn, is a necessary condition for the brain. The same also remains true in the case of 'embeddedness'. Brain/body are a necessary condition for the environment while, at the same time, the latter is a necessary condition for the former (see 3.3.2). If 'bilateral dependency' is replaced by 'unilateral dependency', one may describe the relationship as 'extrinsic' rather than 'intrinsic'. If 'uni/bilateral dependency' is replaced by 'independency', one may speak of an absence of relationship.

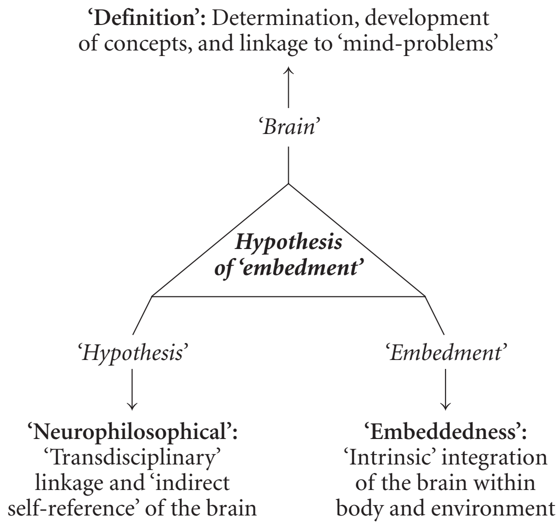


Figure 4. Characterization of the hypothesis of 'embedment'

'Selective-adaptive coupling' describes the process of 'matching' between brain, body and environment resulting in 'optimal fits' (see 3.3.2. for more details). For example, brain and body adapt to each other: The functional abilities of the brain are constrained by the body while the latter, in turn, reflects the functional abilities of the former. As such brain and body adapt to each other with respect to specific, i.e. selective, functional abilities. The same is true for the relationship between brain/body and environment. The specific state and functional organization of the brain are selected by the respective environmental events and context (see 3.1.2) – the brain is tailored to the environment. Whereas the respective environmental events and context themselves are predetermined and pre-selected by the specific functional abilities of the respective brain/body – the environment is adapted to the brain. If there is only selection but no adaptation, one may speak of ('extrinsic') 'linkage' rather than ('intrinsic') 'coupling'. If there is only adaptation but no selection, one may speak of 'dissolution' rather than 'coupling'. If there is neither selection nor adaptation, one may speak of absence of relationship (see 3.3.2 for further details).

1.3.2 Defining 'neurophilosophical hypothesis'

The hypothesis of 'embedment' can be defined as a 'neurophilosophical hypothesis' (see also 1.4.4). As such it must be distinguished from both 'empirical hypothesis' and 'philosophical theory'. Unlike 'empirical hypothesis', the hypothesis of ‘embedment’ includes epistemic and ontological determination of the brain: Epistemic determination is reflected in elucidation of epistemic abilities and inabilities of the brain itself (see Chapter 2). Ontological determination is reflected in the investigation of different ontological definitions of the brain i.e. ‘isolated brain’ and ‘embedded brain’ (see 3.3.1 and 3.3.2). Due to inclusion of epistemic and ontological determination of the brain, the ‘neurophilosophical hypothesis’ of ‘embedment’ must be distinguished from mere ‘empirical hypothesis’. Unlike ‘philosophical theory’, the hypothesis of ‘embedment’ concerns not only epistemic and ontological definition but empirical determination of the brain as well. This is reflected in empirical determination of the brain as a ‘dynamic brain’ (see 3.1.2) and its characterization by ‘event coding’ (see 3.1.3). Due to inclusion of empirical determination of the brain, the ‘neurophilosophical hypothesis’ of ‘embedment’ must be distinguished from mere ‘philosophical theory’. Since the hypothesis of ‘embedment’ contains elements of both ‘empirical hypothesis’ i.e. empirical determination of the brain and ‘philosophical theory’ i.e. epistemic and ontological determination of the brain, it must be regarded as a ‘neurophilosophical hypothesis’ being truly ‘transdisciplinary’.

Due to its ‘transdisciplinary’ character, the hypothesis of ‘embedment’ focuses on the linkage between empirical, epistemic, and ontological determinations, which may build upon each other: The brain is defined in empirical respect (see 3.1.2); this definition is then related to an empirically plausible epistemic (see Chapter 2 and 3.2.1) and ontological (see 3.3.1 and 3.3.2) determination of the brain. At the same time, novel epistemic and ontological concepts (see 3.2.1 and 3.3.3) are developed which are more appropriate for an empirically plausible epistemic and ontological determination of the brain than the traditional ones. Finally, one may ask for the necessary conditions for the principal possibility of the hypothesis of ‘embedment’ as such. The determination of the brain can be considered as the crucial core of the hypothesis of ‘embedment’. The author of the present book, Georg Northoff, developed this hypothesis with his own brain; without his own brain, Georg Northoff could have not developed this hypothesis. The hypothesis of ‘embedment’ may subsequently be regarded as a ‘hypothesis about the brain by a brain’. Consequently, there is a problem of ‘self-reference’ of the brain (see 3.3.4. for further details): If ‘direct self-reference’ of the brain is possible, we may be principally able to verify i.e. prove the hypothesis of ‘embedment’. If, in contrast, only ‘indirect self-reference’ of the brain (through some intermediate states) is possible, we may be able to gather some indirect evidence supporting the hypothesis of ‘embedment’ while its verification i.e. proof remains principally impossible. If ‘self-reference’ of the brain remains impossible altogether (both ‘direct’ and ‘indirect’), we may neither be principally able to verify i.e. prove the hypothesis of ‘embedment’ nor to gather indirect evidence in support of it. It is suggested here that our brain, and thus also the one of the author Georg Northoff, can be characterized by 'indirect self-reference' (see 3.3.4. for further detail). The hypothesis of 'embedment' may subsequently be supported by indirect evidence while it cannot be verified or proven as such. Accordingly, the hypothesis of 'embedment' (in the present sense) remains necessarily a hypothesis.

1.3.3 Defining the brain

The definition of the brain and thus the 'philosophy of the brain' as the crucial core of the hypothesis of 'embedment' consist essentially of three parts: (i) definition of the brain in empirical, epistemic and ontological respect; (ii) development of novel, appropriate and corresponding concepts in neuroscience, epistemology and ontology; (iii) demonstration of direct linkage between the 'brain problem' (see 1.1.2) and the 'mind problems' (see 1.1.1) (see also Figure 3).

The brain is determined in empirical, epistemic and ontological respect. It is postulated that 'embedment' (see 1.3.1) provides the underlying 'unifying theoretical principle' for determination of the brain in the different domains. Consideration of 'embedment' may subsequently reveal the constitutive empirical, epistemic and ontological features of the brain that define the brain as a brain. Epistemic and ontological characterization of the mind has been discussed extensively in philosophy (see 1.1.1). Empirically, (the function of) the mind has been investigated in psychology and, most recently, in neuroscience (i.e. cognitive neuroscience). Whereas the function of the brain has been extensively explored in neuroscience, the constitutive epistemic and ontological features of the brain itself have rather been neglected. Neither its specific epistemic abilities and inabilities nor the particular type of ontology, required by the brain itself, have been revealed so far. Moreover, even the constitutive empirical feature of the brain i.e. its 'neural code' or 'brain code' and its underlying 'unifying theoretical principle' remain unclear (see 1.2.1).

The empirical, epistemic and ontological definition of the brain may require the development of novel empirical, epistemic and ontological concepts as more appropriate frameworks. They may subsequently be considered as more appropriate than the traditional concepts that were developed independently from determination of the brain; the traditional concepts may thus be undermined and complemented by the novel ones. Similar to the definition of the brain, 'embedment' provides the underlying 'unifying theoretical principle' for development of these novel and more appropriate concepts. One may subsequently distinguish between 'philosophy of the brain' and 'philosophy of embedment'. The 'philosophy of the brain' focuses on the empirical, epistemic and ontological determination of the brain and its implications for philosophical problems like, for example, the 'mind problems' (see also 1.1.2). The 'philosophy of embedment', in contrast, investigates necessary and sufficient conditions for the possibility of ‘embedment’. Since the brain as an ‘embedded brain’ is a necessary natural condition for the possibility of ‘embedment’, the ‘philosophy of the brain’ may be regarded as an essential component of the ‘philosophy of embedment’. However, in addition to the brain, there may also be other necessary and sufficient natural and logical conditions for the possibility of ‘embedment’. The ‘philosophy of embedment’ provides subsequently a broader and more foundational framework (see 3.3.3. for exact definition of ‘foundational’) for the ‘philosophy of the brain’ so that the former can neither be reduced to the latter nor equated with it.

The empirical, epistemic and ontological definition of the brain leads to the resolution of the ‘brain problem’ (see 1.1.2). Due to the close relation between the ‘brain problem’ and ‘mind problems’ (see 1.1.1), resolution of the former may be accompanied by solution and transformation of the latter (see also Figure 2). Whereas resolution of the ‘brain problem’ is assumed to presuppose ‘embedment’ (see above), the possibility of the ‘mind problems’ as such may rather presuppose ‘isolation’ (see 1.3.1). Investigation of the ‘mind problems’ in relation to the ‘brain problem’ may subsequently imply a shift in the underlying ‘unifying theoretical principle’ from ‘isolation’ to ‘embedment’. Consideration of ‘embedment’ may reveal the close linkage between the ‘brain problem’ and the ‘mind problems’: The ‘empirical mind problem’, the ‘epistemic mind problem’, and the ‘ontological mind-brain relationship problem’ (see 1.1.1) may have their origin in a specific empirical, epistemic and ontological determination of the brain. However, since investigation of the brain has been neglected almost entirely (see 1.1.2), the respective determination of the brain, underlying these ‘mind problems’, remains hidden. In a first step, this hidden determination of the brain shall be elucidated which, in a second step, shall be replaced by a novel and empirically more plausible empirical, epistemic, and ontological definition of the brain. These novel definitions of the brain lead to resolution of the ‘brain problem’ which, in turn, implies solution and transformation of the ‘mind problems’ as demonstrated in a third step. Accordingly, resolution of the ‘brain problem’ can be considered as a necessary condition for the possibility of the solution and transformation of the ‘mind problems’.

1.3.4 Strategy of investigation

Until now, the brain has mostly been investigated in neuroscience and thus in terms of natural conditions while epistemic and ontological investigations of the brain, presupposing rather logical conditions, have been neglected almost entirely. In order to do so, natural and logical conditions must be linked to each other (see 1.4.2). This requires a special methodology i.e. neurophilosophy that provides linkage between natural and logical conditions and thus between neuroscience and philoso-

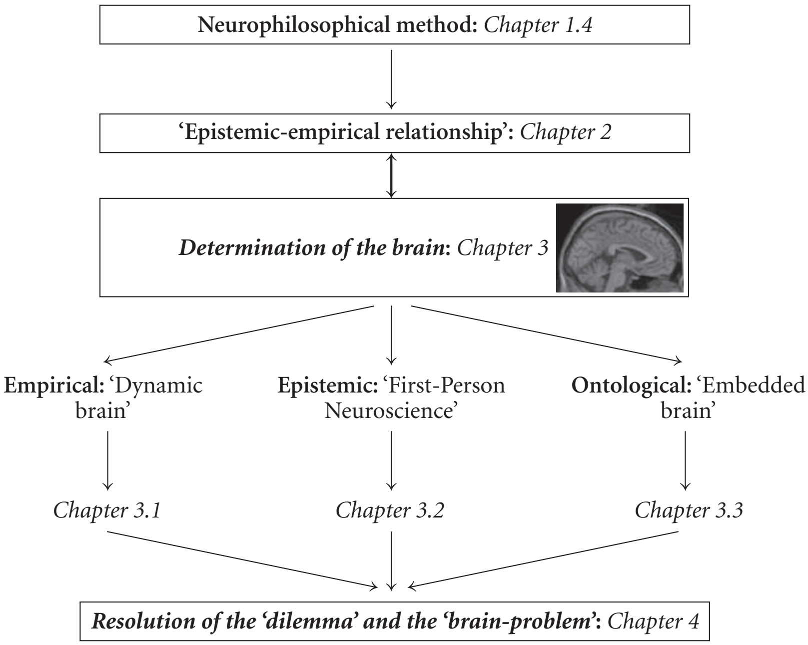


Figure 5. Strategy of investigation

phy. This methodology shall be developed and outlined in Chapter 1.4. Applying neurophilosophical methodology, the brain can be coupled with epistemic abilities and inabilities. This is reflected in so-called 'epistemic-empirical relationship' as developed in the second chapter. One may consider this 'epistemic-empirical relationship' as a systematic and detailed account of 'neuroepistemology' (see 3.2.1 for exact definition as well as Oeser & Seitelberger 1988; Hedrich 1998 for introduction of this term). 'Epistemic-empirical relationship', in turn, serves as the basis for empirical, epistemic and ontological determination of the brain (see Figure 5). Empirically, the brain is defined as a 'dynamic brain' (see 3.1) which, conceptually, requires the development of a novel, corresponding and more appropriate method in neuroscience i.e. 'First-Person Neuroscience' (see 3.1.2 and 3.2.1). Epistemically, the brain is defined by 'autoepistemic limitation' (see 2.3.1) which, conceptually, requires the development of a novel, corresponding and more appropriate concepts of both neuroscience i.e. First-Person Neuroscience and epistemology i.e. 'embedded epistemology' (see 3.2.1). Ontologically, the brain is defined as an 'embedded brain' (see 3.3.2) which, conceptually, requires the development of a novel, corresponding and more appropriate concept of ontology i.e. 'embedded ontology' (see 3.3.3). This empirical, epistemic and ontological definition of the brain is validated by means of its ability to answer the questions and resolve the dilemma (see 4.1. and

4.2) as raised in the present chapter (see 1.2). Moreover, the direct linkage between the 'brain problem' and the 'mind problems' is demonstrated (see 4.3). Finally, the shift in the underlying 'unifying theoretical principle' from 'isolation' to 'embedment' and thus from 'isolated brain' to 'embedded brain' leads to a 'paradigm shift' in neuroscience, epistemology, ontology and philosophy (see 4.4).

1.4 Neurophilosophy as a method for investigation of the brain

1.4.1 Defining 'Neurophilosophy'

The term 'neurophilosophy' is often used either implicitly or explicitly for the characterization of an investigation of philosophical theories in relation to neuroscientific hypothesis. According to Breidbach, 'neurophilosophy' has already been implicitly practiced at the turn of last century by, for example W.Wundt (Breidbach 1997: 393–394). Yet, it was P. Churchland who explicitly introduced the term 'neurophilosophy' (Churchland 1986). Since then it has often been used almost inflationary without delineating a specific thematic field and developing a specific methodology (see Northoff 1995a, 2000b, 2001c). One may distinguish the following approaches to neurophilosophy (see Northoff 2001c) which shall be subsumed under the headings of 'Phenomenal or Cognitive Neurophilosophy', 'Empirical Neurophilosophy', and 'Theoretical Neurophilosophy'.

'Phenomenal or Cognitive Neurophilosophy' focuses predominantly on anthropological phenomena, such as free will (Walter 1998), personal identity (Northoff 2001b, 2003c, e), subjectivity (Metzinger 1993), action (Hurely 1998), phantom sensations (Heinzel 1999), etc. Descriptions of these phenomena are linked to both philosophical theories and a scientific description of their possible potentially underlying neuronal and cognitive mechanisms. Accordingly, 'phenomenal or cognitive neurophilosophy' covers a broad spectrum of anthropological problems.

'Empirical Neurophilosophy' focuses on 'empirical consistency' and 'empirical falsification' (1.4.4) of philosophical theories. For example, criteria for personal identity, as discussed in philosophy, can be transformed into a self-rating scale for empirical assessment of personal identity before and after brain surgery (see Northoff 1996a, 2001b). Phenomenal and epistemic characteristics of the First-Person Perspective may also be translated into an activation paradigm used in functional imaging of the brain (Northoff 2003a; Heinzel et al. 2003; Northoff et al. 2003b, c, d). This could eventuate in the investigation of the neural mechanisms that underlie philosophical concepts. In recent literature the term 'neurophilosophy' 'concerns the application of neuroscientific concepts to traditional philosophical questions' (Bickle & Mandik 2001: 1). Since 'neurophilosophy' in this sense aims at revealing the neural correlates of originally philosophical terms (like free will, personal identity, consciousness, etc), one could also refer to it as 'neuroscience of philosophy'. Both 'Phenomenal or Cognitive Neurophilosophy' and 'Empirical Neurophilosophy' may be regarded as crucial parts of such a 'neuroscience of philosophy' which, in turn, may reflect, at least partially, what Hume called 'science of man' (Hume 1978).

'Theoretical Neurophilosophy' focuses predominantly on the development of a definition and methodological principles and strategies for linkage between philosophical theory and neuroscientific hypothesis (see Northoff 2003d). These methodological principles may differ from the ones that are presupposed in philosophy and neuroscience respectively. They may also differ from the ones that are applied in the connection between philosophical concepts and the concepts from other sciences (like physics or chemistry). 'Theoretical Neurophilosophy' is closely related to the 'philosophy of neuroscience'. This is reflected in recent literature (see Bechtel et al. 2001; Bickle & Mandik 2001): Like philosophy of psychology and philosophy of physics, the 'philosophy of neuroscience' represents an 'attempt to address foundational issues in neuroscience' (see Bechtel et al. 2001: 7). For example, the question about how to explain neuroscience is raised i.e. whether neuroscientific explanations are in accordance with the deductive-nomological model as suggested by Hempel. Further questions that are examined concern induction, causality, etc. particularly in neuroscience. Another central question involves the problem of 'naturalization'. Can neuroscience apply the same strategies for 'naturalization' of philosophical terms as other disciplines (like physics and chemistry)? Are the general methodological principles for 'naturalization' also valid in neuroscience or is there a need to develop special strategies particularly for neuroscience? The latter issues do not only concern philosophical problems in neuroscience but dilemma in 'neurophilosophy' itself (see 1.2 and Northoff 2001a, 2000b). One may therefore not only speak of a 'philosophy of neuroscience' but, in addition, of a 'philosophy of neurophilosophy'. 'Theoretical Neurophilosophy', as defined in the above mentioned sense, includes both 'philosophy of neuroscience' and 'philosophy of neurophilosophy'.

Whereas numerous investigations these days may qualify as 'Phenomenal and Cognitive Neurophilosophy' or 'Empirical Neurophilosophy,' an exact definition and description of the methodological principles and strategies in neurophilosophy are still lacking. In the following an attempt is made to investigate the specific aspects of neurophilosophical methodology, which distinguish neurophilosophy from both philosophy and neuroscience. Various principles of transdisciplinary methodology are suggested in order to connect philosophical theories and neuroscientific hypothesis. The arguments and the principles themselves are cast on a general level. They may therefore be regarded also as methodological strategies for the linkage between philosophical theories and scientific hypothesis in general.

As such they prepare the ground for their utilization in 'neurophilosophy', which will follow in the second chapter. The question in what way they are specific for the linkage between philosophical theories and neuroscientific hypothesis in particular, remains open and should be discussed separately. This methodological section should therefore be conceived as a preliminary stage in the development of 'philosophy of neurophilosophy' as part of a 'Theoretical Neurophilosophy'.

1.4.2 Principles of transdisciplinary methodology

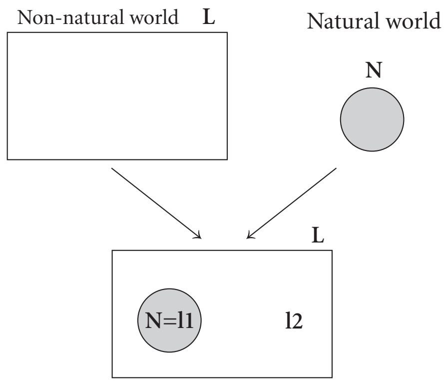
One crucial distinctive feature in the linkage between philosophical theories and neuroscientific hypothesis in particular, as opposed to scientific hypothesis in general, could concern the issue of 'self-referentiality' (see also 3.3.4 for a more detailed elaboration). For example, neurophilosophy links philosophical theories about the mind with neuroscientific hypothesis about the brain. Depending on the respective epistemic-ontological presuppositions either one, mind or brain by itself is at least a necessary condition for the epistemic possibility of the linkage between philosophical theories and neuroscientific hypothesis. In order to avoid 'logical circularity', the linkage between philosophical theories and neuroscientific hypothesis requires special principles for transdisciplinary methodology (see 1.4.3 and 1.4.5 as well as 3.3.4).

The 'Principle of asymmetry'

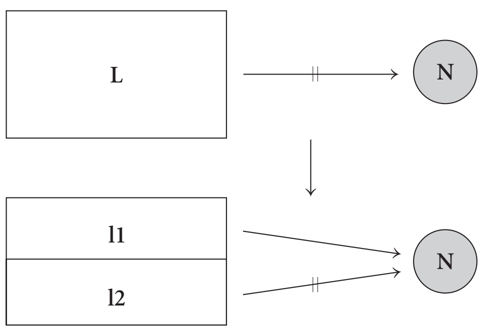
'Transdisciplinary methodology' in neurophilosophy links logical and natural conditions of which the relation can be characterized by the 'principle of asymmetry' (see Figure 6). Logical conditions refer to all possible i.e. logically conceivable worlds. They include both natural and non-natural worlds with only the former underlying our physical and biological laws. Natural conditions, in contrast, refer only to the natural world and thus to the respective physical and biological laws. Since logical conditions comprise both natural and non-natural worlds, they necessarily include natural conditions (Chalmers 1998). Natural conditions, which reflect the natural world exclusively, do not include logical conditions. The relation between natural and logical conditions can thus be characterized by 'asymmetry' the latter including the former while the former exclude the latter (see Figure 6).

The 'principle of asymmetry' is reflected in the following formulas (P = premise, C = conclusion, L = Logical conditions, l1 and l2 = different subsets of logical conditions, N = Natural conditions).

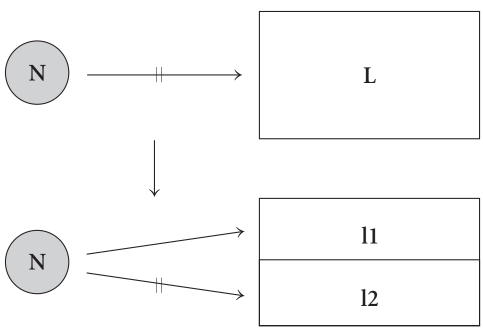
P1 L = l1 + l2
P2 l1 =/ l2
P3 l1 = N



a. Logical (L, l1, l2) and natural (N) conditions



b. 'Conditional fallacy' from logical (L, l1,l2) to natural (N) conditions



c. 'Conditional fallacy' from natural (N) to logical conditions (L, l1, l2)

Figure 6.

C1 l2 =/ N
C2 L =/ N

This 'principle of asymmetry' has the following implications with respect to inference between natural and logical conditions. First, direct inference from logical to natural conditions remains impossible. Since logical conditions include a wider range of conditions than natural conditions, direct inference from the former to the latter may confuse non-natural i.e. logically conceivable worlds with the natural i.e. actual world.

Second, direct inference from natural to logical conditions remains impossible as well. Since natural conditions include a smaller range of conditions than logical conditions, direct inference from the former to the latter may falsely equate non-natural worlds with the natural world. Ignoring the principle of asymmetry will lead to a 'conditional fallacy' (see Figure 6). 'Conditional fallacy' refers to inferences between logical and natural conditions that, due to their inclusion of different though overlapping conditions, are not allowed. As such 'conditional fallacies' may lead to false assumptions about the relationship between natural and non-natural worlds.

The mind-brain problem has been regarded as a philosophical problem, which as such presupposes logical conditions (see also Praetorius 2000: XVII for giving another example i.e. with respect to intentionality). Recent advances in neuroscience, however, have promoted efforts to solve this problem from a neuroscientific point of view, which presupposes natural conditions. Subsequently, it is often claimed that the mind-brain problem can be solved completely by neuroscience and thus by consideration of natural conditions (see, for example, Churchland 1986). However, this claim may be considered as an instance of a 'conditional fallacy' which confuses natural and logical conditions. The mind-brain problem refers to logical conditions including both natural and non-natural worlds. In contrast, neuroscience refers to natural conditions including the natural world only. Direct application of and inference from empirical findings in neuroscience to the mind-brain problem may thus falsely equate non-natural worlds with the natural world. This, however, may lead to false conclusions since non-natural worlds include a wider range of conditions than the natural world. The neuroscientist therefore commits a 'conditional fallacy' when he directly applies and infers from his empirical findings to the mind-brain problem. Conversely, solutions of the mind-brain problem, as suggested in philosophical discussions, may not necessarily apply to our actual brain and mind, as investigated in neuroscience. Logical conditions may not necessarily 'match' with natural conditions. Direct inference from philosophical mind-brain solutions to our actual brain (and mind) remains therefore impossible as well since it leads to confusion between non-natural and natural worlds. The philosopher remains subsequently trapped in a 'conditional fallacy' when he directly applies his mind-brain solutions to our actual brain (and mind).

In addition to their asymmetry, overlap between natural and logical conditions should be considered as well (see Figure 6). Logical conditions refer to both natural and non-natural worlds and include therefore the natural world to which natural conditions refer. There is subsequently an overlap between natural and logical conditions with respect to the natural world. Accordingly, criteria for the distinction between different subsets of logical conditions and their subsequent linkage with natural conditions are needed. The transdisciplinary methodology, which characterizes neurophilosophy, can thus be located on the border between natural and logical conditions. As such it allows for both differentiation and linkage between natural and logical conditions and thus between neuroscientific hypothesis and philosophical theory. For example, logical conditions, as presupposed in philosophical mind-brain solutions, may indeed apply to the actual brain (and mind) which reflects natural conditions. This, however, remains true only if the logical conditions, to which the philosopher refers to, are identical to natural conditions (see Figure 6) – the possibility of a 'conditional fallacy' is excluded. If, however, the logical conditions are not identical to the natural conditions, the possibility of a 'conditional fallacy' is given. Due to the asymmetric nature of the relationship between logical and natural conditions, any attempts to eliminate the former in favor of the latter must necessarily fail. Such attempts of elimination are described by McCauley (2001: 439–441), who relies on the theories developed by the Churchlands (see Churchland & Churchland 2001) (such as 'co-evolution s' with 'little intertheoretic mapping'). In our case, this implies the consecutive and complete elimination of the logical conditions and thus of any philosophical theory in favor of natural conditions and neuroscientific hypotheses. However, such an elimination would only be possible in the case of a symmetric relationship between logical and natural conditions – since this is not the case, elimination in this radical sense remains a priori impossible.

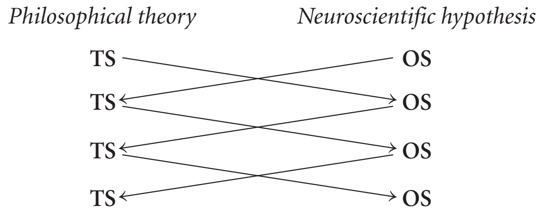
The 'Principle of bidirectionality'

The 'principle of bi-directionality' consists in the necessity of bi-directional linkage between philosophical theories and neuroscientific hypotheses and thus between logical and natural conditions. On one hand, philosophical theories can be linked to a neuroscientific hypothesis which allows for investigation of 'empirical consistency' (see 1.4.4) of the former. If the respective philosophical theory remains 'empirically consistent', one may assume that it reflects those logical conditions, which are identical (i.e. l1) to natural conditions. In contrast, if the respective philosophical theory is revealed as 'empirically inconsistent', one may assume that it reflects those logical conditions, which are non-identical (i.e. l2) to natural conditions. In this case, one may either accept a gap between philosophical theory and neuroscientific hypothesis with consecutive impossibility of development of neurophilosophical hypothesis. Or one may modify the philosophical theory in orientation on the respective neuroscientific hypothesis which implies 'definitorial shifting' and 'conceptual re-clarification' (see 1.4.4). On the other hand, a neuroscientific hypothesis can be linked to a philosophical theory which allows for investigation of 'logical consistency' (see 1.4.4) of the former. A neuroscientific hypothesis may be investigated in regards to its respective ontological and epistemic presuppositions i.e. its 'net implications' (Quine 1969: 80–82). As such natural conditions may be linked to logical conditions by revealing those that are identical (i.e. l1) to natural conditions. Moreover, one may vary these natural/logical conditions by imaginative variation (see 1.4.4 for definition and Chapter 2 for application) in order to elucidate those logical conditions, which are non-identical (i.e. l2) with natural conditions. As a result, the 'principle of bidirectionality' allows for mutual comparison between philosophical theory and neuroscientific hypothesis with respect to their respective conditions i.e. logical and natural conditions. Accordingly, the general framework for the possibility of comparison between philosophical theory and neuroscientific hypothesis can be provided.

Within this general framework, one (philosophical theory or neuroscientific hypothesis) of them provides the 'background theory' as the 'reference system'/'coordinate system' (Quine 1969: 48–50) for the respective other. Due to the bi-directional nature in the relationship between logical and natural conditions, any attempts to reduce philosophical theories to neuroscientific hypotheses remains impossible. Such attempts of reduction are described by McCauley (2001: 439–441), who in turn relies on the theories by the Churchlands (see Churchland & Churchland 2001), when he speaks of 'co-evolution m' with 'extensive intertheoretic mapping' (see also above). He is certainly right that, due to the overlap between natural and logical conditions, 'intertheoretic mapping' between philosophical theories and neuroscientific hypotheses is possible. However, in contrast to his claim, 'intertheoretic mapping' must necessarily remain incomplete since there is no complete overlap between logical conditions i.e. the philosophical theories and the natural conditions i.e. the neuroscientific hypotheses. Complete 'intertheoretic mapping' in the sense of McCauley would thus only be possible in the case of a unidirectional relationship between logical and natural conditions – since this is not the case complete reduction remains a priori impossible.

The 'Principle of transdisciplinary circularity'

The 'principle of transdisciplinary circularity' describes systematic processes of oscillation and circulation between philosophical theory and neuroscientific hypothesis (see also Figure 7a) with the consecutive development of a neurophilosophical hypothesis (see 1.4.4. for exact definition). Due to methodological differences with respect to natural and logical conditions (see 1.4.2), direct comparison and linkage



a. ‘Disciplined circularity’ between philosophical theory (TS = theoretical sentences) and neuroscientific hypothesis (OS = observation sentences)

Philosophical theory	*Neuroscientific hypothesis*
TS 1	**OS 1**
TS 2	**OS 2**
TS 3	**OS 3**
TS 4	**OS 4**

b. Characterization of philosophical theory (TS = theoretical sentences) and neuroscientific hypothesis (OS = observation sentences)

Philosophical theory	*Neuroscientific hypothesis*
TS 1 → OS	**OS 1 → TS**
TS 2 → OS	**OS 2 → TS**
TS 3 → OS	**OS 3 → TS**
TS 4 → OS	**OS 4 → TS**

c. ‘Empirical implication’ in philosophical theory (TS = theoretical sentences) and ‘theoretical explication’ of neuroscientific hypothesis (OS = observation sentences)

Figure 7.

between philosophical theory and neuroscientific hypothesis remains impossible. Instead, methods for indirect comparison and linkage, which are reflected in the processes of oscillation or circulation, have to be developed. Since these processes follow certain systematic and predefined methodological steps, one may speak of a ‘disciplined circularity’ (Varela 1996).

One may consider this ‘disciplined circularity’ (see Figure 7a) between philosophical theories and neuroscientific hypotheses as a linkage between ‘theoretical sentences’ and ‘observation sentences’. ‘Theoretical sentences’ refer to logical conditions and are thus independent from the actual world. They reflect ontological

Philosophical theory	*Neuroscientific hypothesis*
TS 1	OS 1
TS 2	OS 2
TS 3	OS 3
TS 4	OS 4
TS 1 → OS	OS 1 → TS
TS 2 → OS	OS 2 → TS
TS 3 → OS	OS 3 → TS
TS 4 → OS	OS 4 → TS

d. Investigation of ‘empirical consistency’ in philosophical theory (TS = theoretical sentences) and ‘logical consistency’ in neuroscientific hypothesis (OS = observation sentences)

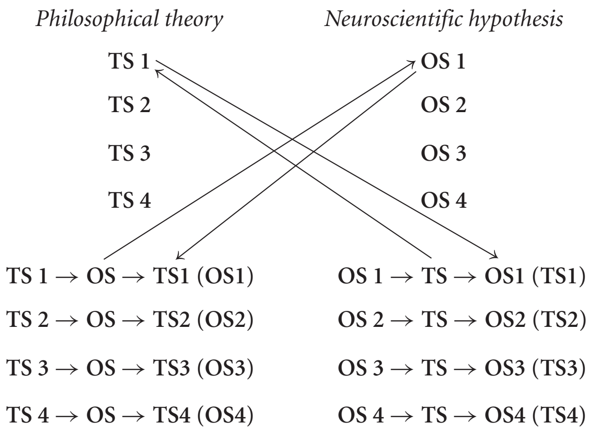
Figure 7.

and epistemological assumptions which are discussed explicitly in philosophical theory (see Figure 7b). ‘Observation sentences’, in contrast, refer to natural conditions and empirical observations within the actual world: ‘... an observation sentence is one on which all speakers of the language give the same verdict when given the same concurrent stimulation’ (Quine 1969: 86–87).

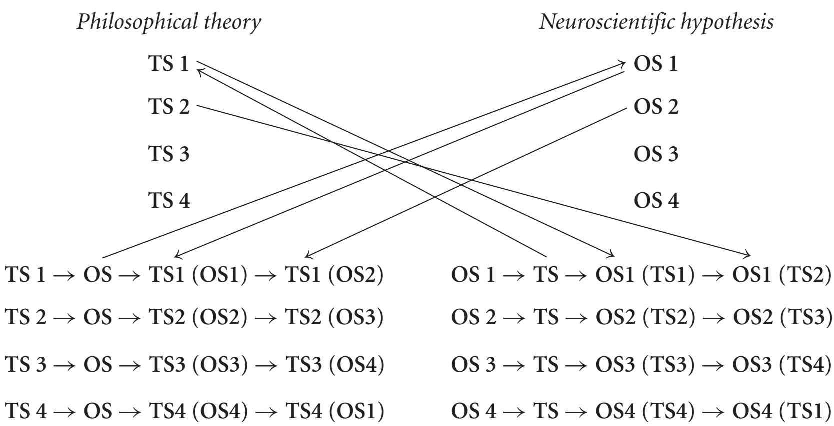
First, ‘explications’ and ‘implications’ shall be revealed (see Figure 7c). ‘Explications’ refer to ontological and epistemic presuppositions, which are implicitly presupposed in neuroscientific hypotheses. ‘Implications’, in contrast, refer to potential empirical consequences of philosophical theories. Accordingly, the first step consists of revealing the ‘theoretical explications’ in a neuroscientific hypothesis and ‘empirical implications’ in philosophical theory. Particular ‘observation sentences’ may involve specific ‘theoretical sentences’ while excluding others. This linkage between explicit ‘observation sentences’ and implicit ‘theoretical sentences’ may be revealed by ‘theoretical explication’. ‘Empirical implication’ points out the possibility and impossibility of inferring ‘observation sentences’ from ‘theoretical sentences’. Certain ‘observation sentences’ may be excluded while others may be likely to infer. Subsequently, mutual ‘theoretical explication’ and ‘empirical implication’ of ‘theoretical sentences’ and ‘observation sentences’ may be considered as a necessary condition for generating a specific framework for comparison and linkage between neuroscientific hypothesis and philosophical theory.

Secondly, ‘logical and empirical consistency’ shall be tested for (see Figure 7d). ‘Theoretical explications’ i.e. the respective ontological and epistemic presupposition in a neuroscientific hypothesis shall be compared with ontological and epistemic theories as discussed in philosophy. It is then possible to test for relation and linkage of neuroscientific hypothesis to philosophical theories and logical conditions i.e. their 'logical consistency'. Conversely, 'empirical implications' of philosophical theories shall be compared with empirical findings as reflected in neuroscientific hypotheses. One can then test for plausibility and compatibility of philosophical theories with a neuroscientific hypothesis and natural conditions i.e. their 'empirical consistency'. The second step consists of comparison of 'theoretical explications' and 'empirical implications' with neuroscientific hypotheses and philosophical theories respectively in order to test for their 'logical and empirical consistency' (see also 1.4.4 for further definition of both terms). Comparison between 'theoretical sentences' and 'observation sentences' may refer to ontological/epistemological presuppositions, empirical observations or the respective concepts. If one wants to compare the concepts themselves, 'logical and empirical inconsistencies' i.e. differences between 'theoretical sentences' and 'observation sentences' in both ontological/epistemological presuppositions and empirical observations shall be excluded. Otherwise, the origin i.e. source of similarities and/or differences between 'theoretical sentences' and 'observation sentences' remains unclear. Subsequently, mutual comparison of 'theoretical sentences' and 'observation sentences' with respect to 'logical and empirical consistency' may be regarded as a necessary condition for the possibility of comparison between philosophical theories and neuroscientific hypotheses.

Thirdly, 'analogisation' and 'homogenisation' shall be performed (see Figure 7e). 'Logical inconsistency' in neuroscientific hypotheses may be transformed into 'logical consistency'. This may be accounted for by modification of either 'theoretical explications' i.e. ontological/epistemological presuppositions in neuroscientific hypotheses or ontological/epistemological theories themselves, as discussed in philosophy. Ontological/epistemological assumptions are 'analogised' and 'homogenized' between neuroscientific hypothesis and philosophical theory. Conversely, 'empirical inconsistency' in philosophical theory may be transformed into 'empirical consistency'. This may be accounted for by modification of either 'empirical implications' i.e. empirical consequences of philosophical theory or neuroscientific hypotheses themselves. As such empirical hypotheses are 'analogised' and 'homogenized' between neuroscientific hypothesis and philosophical theory. Accordingly, the third step includes mutual 'analogisation' and 'homogenisation' between philosophical theory and neuroscientific hypothesis, which is necessary to achieve 'logical and empirical consistency'. The 'net implications' of both 'observation sentences' and 'theoretical sentences' are thus not only compared with each other but, in addition, modified in orientation on the respective other. Differences between 'observation sentences' and 'theoretical sentences' can then no longer be traced back to differences in either ontological/epistemological assumptions i.e. logical



e. 'Analogization' and 'homogenization' between philosophical theory (TS = theoretical sentences) and neuroscientific hypothesis (OS = observation sentences)



f. 'Inverse illustration'and 'cross-disciplinary comparison' between philosophical theory (TS = theoretical sentences) and neuroscientific hypothesis (OS = observation sentences)

Figure 7.

conditions or empirical hypothesis i.e. natural conditions. Comparison and linkage between 'observation sentences' and 'theoretical sentences' and thus between natural and logical conditions becomes possible. Subsequently, mutual analogisation' and 'homogenisation' between 'observation sentences' and 'theoretical sentences' may be considered as a necessary condition for the possibility of linkage between neuroscientific hypothesis and philosophical theory.

Fourthly, 'inverse illustration' and 'cross-conditional disciplinary comparison' shall be created (see Figure 7f). One may investigate the influence and consequences of modified 'theoretical explications' i.e. ontological/epistemological presuppositions on/for the neuroscientific hypothesis themselves. The neuroscientific hypothesis itself may remain either independent from the modified ontological/epistemological presuppositions or it may have to be modified in order to be compatible with the modified ontological/epistemological presuppositions that, consecutively, may result in the development of a neurophilosophical hypothesis. The relevance of ontological and epistemological presuppositions for neuroscientific hypothesis can be determined. Conversely, one may investigate the influence and consequences of modified 'empirical implications' i.e. empirical hypothesis on/for the philosophical theories themselves. The philosophical theory itself may remain either independent from the modified empirical hypothesis or it may have to be modified as well in order to be compatible with the modified empirical hypothesis that, consecutively, may result in the development of a neurophilosophical hypothesis. The relevance of empirical hypotheses for philosophical theories can be determined. Accordingly, in order to investigate the need for mutual modification with consecutive development of neurophilosophical hypotheses, the fourth step consists in mutual 'inverse illustration' and 'cross-disciplinary comparison' between philosophical theory and neuroscientific hypothesis. 'Net implications' of both 'observation sentences' and 'theoretical sentences' are not only modified but the influence and consequences of these modifications on/for the original 'observation sentences' or 'theoretical sentences' is investigated which may reveal the need for modification of the respective 'observation sentence' or 'theoretical sentence' itself. The relevance of the modifications, which reflects the direct interaction between ontological/epistemological assumptions and empirical hypothesis within both, 'theoretical sentences' and 'observation sentences', can be accounted for. Subsequently, 'inverse illustration' and 'cross-disciplinary comparison' may be considered a necessary condition for revelation of direct interaction between ontological/epistemological assumptions and empirical hypothesis within philosophical theory and neuroscientific hypothesis (see Eicke 2002 for application).

The 'principle of transdisciplinary circularity' shall be illustrated by the example of Parfit's (1989) 'spectrum arguments', which deal with the relation between personal identity and the brain (see Northoff 2000b, 2001b). In his philosophical theory about personal identity, he makes implicit presuppositions about the brain i.e. empirical hypothesis. These implicit empirical hypotheses are, however, not in accordance with current neuroscientific hypotheses about the function of the brain. Parfit's empirical hypothesis about the brain must therefore be modified which, in turn, may make modification of his philosophical theory of personal identity necessary. An 'empirical implication' (step 1) of Parfit's account of the brain is that there is a linear relation between brain cells and cognitive function.

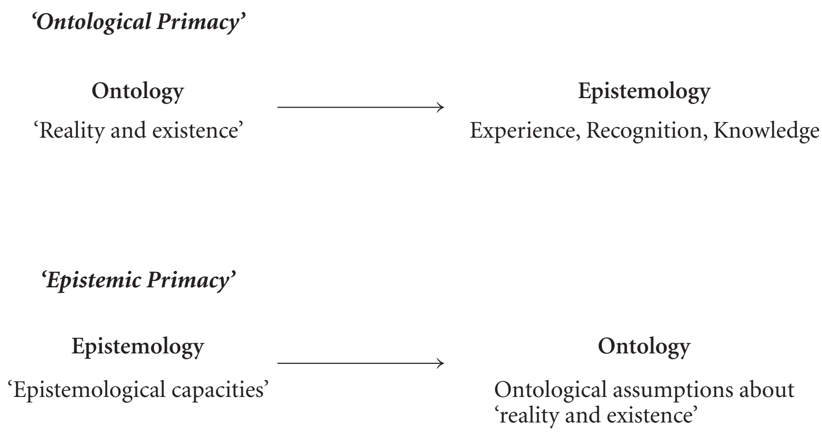
This is reflected in his assumption about a one-to-one relationship between brain cells and personal identity. However, comparing (step 2) his view of the brain with current neuroscientific hypotheses about the function of the brain, differences are revealed so that Parfit's assumption must be characterized by 'empirical inconsistency'. One may therefore modify Parfit's assumption about the brain in orientation on a current neuroscientific hypothesis, which reflects 'analogisation' and 'homogenisation' (step 3). Accordingly, one may assume either one-to-more or more-to-one relation between brain cells and cognitive function. The implications of this modified view of the function of the brain for his theory of personal identity can then be investigated by relying on 'inverse illustration' and 'cross-conditional comparison' (step 4). As a result, the interaction between empirical hypothesis of brain function and Parfit's philosophical theory of personal identity can be accounted for. This may consecutively result in the development of an 'empirical and logically consistent' neurophilosophical hypothesis about the relation between brain and personal identity (see Northoff 2000a, 2001b).

The need for the development of the 'principle of transdisciplinary circularity' stems from the failure of both elimination and reduction of logical conditions i.e. philosophical theories in favour of natural conditions i.e. neuroscientific hypotheses. Since neither elimination nor reduction remains possible both have to be considered. This amounts close to what McCauley (2001: 439–441), who in turn relies on the theories by the Churchlands (see Churchland & Churchland 2001), calls 'co-evolution p' where the primacy of the natural conditions i.e. the neuroscientific hypotheses is weakened in the interests of 'epistemic pluralism'. However, if both logical and natural conditions have to be considered, the question for their relationship i.e. the 'intertheoretic and intratheoretic relations' arises. It is at this point where the 'principle of transdisciplinary circularity' claims to provide a systematic methodological strategy for the linkage between logical conditions i.e. philosophical theories and natural conditions i.e. neuroscientific hypotheses (see however Churchland & Churchland 2001).

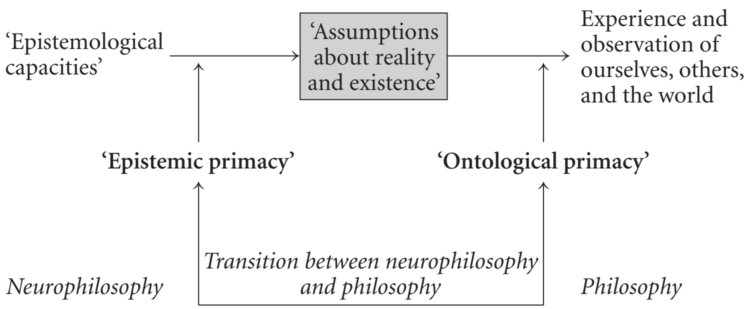
1.4.3 'Ontology' and 'epistemology' in neurophilosophy

'Ontological and epistemic primacy'

The methodological strategy, as presupposed in philosophy, relies on either implicit or explicit ontological presuppositions i.e. 'ontological intuitions' (van Gelder 1998b: 122). These ontological presuppositions are assumed to provide the broader and foundational framework (see 3.3.3 for exact definition of 'broader' and 'foundational') for epistemology, which shall be characterized as 'ontological primacy' and 'unilateral dependence' (see also Figure 8). Since epistemic abilities like experience, recognition and knowledge, as investigated in epistemology, re-



a. 'Ontological and Epistemic Primacy'



b. Complementarity between 'epistemic primacy' i.e. neurophilosophy and 'ontological primacy' i.e. philosophy

Figure 8.

main impossible without presuppositions about 'reality and existence' i.e. ontology, ontology is broader and foundational for epistemology. Moreover, epistemology is necessarily dependent on ontology since epistemology remains 'empty' without 'reality and existence'. Meanwhile, presuppositions about 'reality and existence' seem to be independent from their experience, recognition and knowledge. Consequently, epistemology is unilaterally dependent on ontology. The term 'ontology' characterizes what really exists, differences between distinct kinds of existences, and conditions for the possibility of existences. 'Ontology' shall be described by 'reality and existence' within the present context (see also 3.3. for further elaboration). It should be noted that the term 'ontology' is not distinguished from the term 'metaphysics' in the present context (see also Walter 1998, Footnote 16, 125). Ontology as a philosophical discipline can therefore be characterized by ontological assumptions about ‘reality and existence’. Since both ‘reality and existence’ and ontological assumptions about ‘reality and existence’ may differ i.e. dissociate from each other, both should be distinguished. The term ‘epistemology’ characterizes our abilities and inabilities to account for and recognize the world and the corresponding discipline may therefore investigate our relation to the world. In this context, epistemology shall describe our ‘epistemic abilities and inabilities’ i.e. ‘epistemological capacities’ to experience, recognize, and observe ourselves, others, and the world (see 3.2 for more elaboration).

Ontological assumptions about ‘reality and existence’ presuppose epistemological presuppositions by themselves i.e. they ‘presuppose that we have knowledge and language for what is ontologically to be determined’ (Praetorius 2000: 293). ‘Epistemological capacities’ are necessary to access ‘reality and existence’ which, in turn, remains necessary for making presuppositions about it. If there are no ‘epistemological capacities’ for accessing ‘reality and existence’, ontological assumptions about it can no longer be made. Subsequently, the possibility of ontological assumptions about ‘reality and existence’ depends on the respective ‘epistemological capacities’ or, as W. James puts it, on our ‘perspective’. In the case of humans, for instance, ‘epistemological capacities’ are closely related to the brain as it is, for example, reflected in the recent development of ‘neuroepistemology’ (Kuhlenbeck 1965; Hedrich 1998; Northoff 2000b, 2001b). If our brain were different (i.e. its organisational principle; see 3.1.3), we would probably have different ‘epistemological capacities’. Different ‘epistemological capacities’ would provide us with a different access to ‘reality and existence’ which consecutively would lead to different ontological assumptions about ‘reality and existence’. For example, First- and Third-Person Perspective lead to different types of ontology (see 3.3.3 and 3.3.4 for further details). The First-Person Perspective is characterized by mental states and consecutively implies ‘mental ontology’. Meanwhile, the Third-Person Perspective shows rather physical states and is consecutively rather related to ‘physical ontology’. This shows that, different ‘epistemological capacities’ give us a different ‘perspective’ on ‘reality and existence’ and lead subsequently to different ontological assumptions.

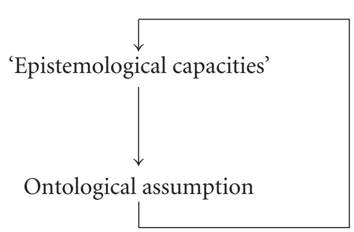
Consideration of epistemological presupposition for ontological assumptions requires ‘epistemic primacy’ as a methodological strategy. Epistemological presuppositions provide a broader and foundational framework for ontological assumptions which shall be described by ‘epistemic primacy’ (see also Figure 8a). Moreover, ontological assumptions are necessarily dependent on epistemology since ontology remains ‘blind’ without ‘epistemological capacities’. In the meantime presuppositions about ‘epistemological capacities’ seem to be independent from ontological assumptions about ‘reality and existence’. Accordingly, ontological assumptions i.e. ontology are unilaterally dependent on epistemology. Historically, ‘epistemic primacy' can be traced back to the methodological approach pursued by Locke and Hume which can be characterized as an 'epistemological turn': 'A third influence on Hume was John Locke, the founder of the British Empiricist school. Three aspects of Locke's thought are especially relevant. The first is what we may call 'epistemological turn'. This is the view that before tackling big questions about the nature of reality – such as the existence and nature of God, or the basic properties of matter, or the immortality of the soul 0- we need to investigate the human mind with a view ascertaining both its powers and limitations, so that we are enabled to determine, what we may realistically hope to know.' (Dicker 1998).

It should be noted that both methodological strategies 'ontological primacy' and 'epistemic primacy' are rather complementary than contradictory (see Figure 8b). While epistemology does not necessarily presuppose ontological assumptions about 'reality and existence' 'ontological primacy', which concerns 'reality and existence', is necessarily presupposed by epistemology. Conversely, 'epistemic primacy' concerns the necessity of 'epistemological capacities' for ontological assumptions about 'reality and existence'. It does not concern 'reality and existence' as such i.e. by itself. 'Ontological primacy' remains true for 'reality and existence' while 'epistemic primacy' is valid for ontological assumptions about 'reality and existence'. Accordingly, 'ontological primacy' and 'epistemic primacy' must be regarded as complementary rather than contradictory. As pointed out above, philosophy relies predominantly on 'ontological primacy' since it considers 'reality and existence' as the broader and foundational framework for epistemology. On the basis of 'ontological primacy', philosophy infers that ontology as a discipline, which makes ontological assumptions about 'reality and existence', provides the broader and foundational framework for epistemology. In contrast to 'ontological primacy', this inference can, however, not be considered as true since ontological assumptions about 'reality and existence' necessarily presuppose 'epistemological capacities' (see above). Philosophy, as a result, confuses 'reality and existence' i.e. ontology as such and ontological assumptions about 'reality and existence' i.e. ontology as a discipline. Philosophy considers therefore only the relation between 'reality and existence' and epistemology while it remains unable to account for the relationship between ontological assumptions about 'reality and existence' and 'epistemological capacities'. In order to account for the relationship between ontological assumptions about 'reality and existence' and 'epistemological capacities', 'epistemic primacy' remains necessary and the specific linkage between 'epistemological capacities' and ontological assumptions about 'reality and existence' must be investigated. This is the strategy that is pursued and suggested by neurophilosophy as it is, for example, reflected in neuroepistemology (see Chapter 2 and 3.2) and neuroontology (see 3.3). Since 'epistemic and ontological primacy' are well compatible with each other (see above), neurophilosophy and philosophy cannot be considered as mutually exclusive and thus as contradictory. Philosophy concerns the relationship between 'reality and existence' and epistemology. Neurophilosophy on the other hand focuses more on the relationship between ontological assumptions about 'reality and existence' and 'epistemological capacities'. Accordingly, philosophy and neurophilosophy must be regarded as complementary.

This is, for example, reflected in the mind-brain problem. The mind-brain problem is discussed in philosophy as an ontological problem which focuses on mind and brain as either different or identical ontological 'realities and existences'. The focus is put on the ontological-epistemological relationship i.e. the ontological characterization of both mind and brain, from which the respective types of epistemology are inferred. In neurophilosophy, the mind-brain problem is discussed with respect to the necessary conditions for its possibility as such which, in turn, reflect the 'epistemological capacities'. Neurophilosophy focuses therefore on elucidation of epistemic abilities and inabilities in relation to the brain as a necessary condition for the possibility of the mind-brain problem as an ontological problem (see 3.3.3 and Northoff 2000b, 2001a, b). If we have different 'epistemological capacities', we would potentially no longer be able to raise the mind-brain problem as an ontological problem. The focus is thus put on the epistemological-ontological relationship. The epistemic origin of ontological assumptions and thus the necessary epistemic conditions for the possibility of their generation can be revealed by relying on the epistemic-ontological relationship – this approach may be called 'genetic method'. Historically, this 'genetic method' can be traced back to Hume who did not only, negatively, criticize metaphysical theories but, in addition, positively, accounted for their origin in our epistemic i.e. psychological structures: 'Hume would then use the findings of this new science of human nature, negatively, to criticize the overly ambitious theories of rationalist metaphysicians. He would also use his findings, positively, to offer his own accounts of the origin of certain basic human beliefs; for example, the belief in causal connections between events; the belief in the existence of objects independently of our perceptions of them; and the belief in the existence of a continuing mind or self' (Dicker 1998: 3).

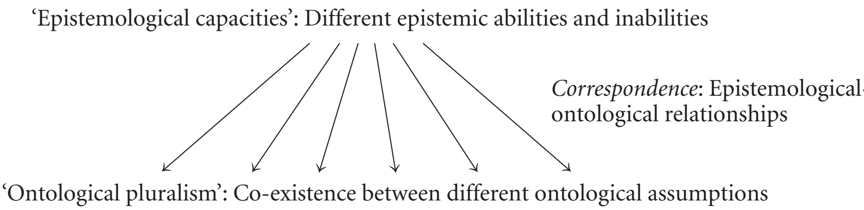
Finally, the relationship between 'epistemic primacy' and naturalism shall be discussed briefly. One may distinguish between different versions of naturalism: 'ontological naturalism' (see also 3.3.3), 'epistemological naturalism' (see also 3.2.1) and 'methodological naturalism'. 'Ontological naturalism' can refer to the physical world or the biological world (see also 3.3.3 for further discussion). 'Epistemological naturalism' may refer to 'epistemological capacities' of brains, machines, etc. (see 3.1.2). 'Methodological naturalism' may refer to different empirical observations physical, biological, phenomenological etc. First, 'epistemic primacy' does not imply 'ontological naturalism' because it is well compatible with the co-occurrence of different ontologies i.e. 'ontological pluralism' (see 1.4.3). 'Epistemic primacy' accounts for the linkage between 'epistemological capacities' and ontological assumptions about 'reality and existence'. Different ontological assumptions about 'reality and existence' i.e. naturalistic and non-naturalistic may be related to different 'epistemological capacities'. Accordingly, 'epistemic primacy' is not necessarily associated with 'ontological naturalism'. Secondly, 'epistemic primacy' does not imply 'epistemological naturalism'. 'Epistemic primacy' determines only a methodological strategy while it cannot be regarded as an epistemological position on its own as, for example, 'epistemological naturalism'. 'Epistemic primacy' as a methodological strategy may be applied within both naturalistic and non-naturalistic frameworks. 'Epistemic primacy' is therefore not necessarily associated with 'epistemological naturalism'. Thirdly, 'epistemic primacy' implies 'methodological naturalism'. 'Methodological naturalism' refers to the inclusion of empirical observations in epistemological and ontological investigations (see also Koppelberg 2000). An investigation of 'epistemological capacities' requires consideration of empirical observations since otherwise (i.e. in purely logical ways) they may not be accessible. The linkage between 'epistemological capacities' and ontological assumptions about 'reality and existence' remains therefore impossible without empirical observations. Accordingly, 'epistemic primacy' necessarily requires 'methodological naturalism' which is nicely reflected in the famous quote from Quine (1969: 126): 'I see philosophy not as an a priori propaedeutic or groundwork for science, but as continuous with science. I see philosophy and science as in the same boat – a boat which, to revert to Neurath's figure as I so often do, we can rebuild only at sea while staying afloat in it. All scientific findings, all scientific conjectures that are at present plausible, are therefore in my view as welcome for use in philosophy as elsewhere'.

'Ontological pluralism'
From a philosophical point of view, one may argue that 'epistemic primacy' nevertheless presupposes ontological assumptions which results in 'ontological circularity' (see Figure 8c). Whereas 'epistemological capacities' are a necessary condition for the possibility of ontological assumptions about 'reality and existence', the



c. 'Ontological circularity'

Figure 8.



d. ‘Ontological pluralism’

Figure 8.

possibility of ‘epistemological capacities’ already presupposes ontological assumptions about ‘reality and existence’ by itself. Accordingly, ‘epistemic primacy’ must be characterized by ‘ontological circularity’ since the necessary conditions, presupposed by itself, are those ontological assumptions for which it is considered to be necessary.

‘Ontological circularity’ can be avoided by the methodological strategy of ‘ontological tolerance’ and ‘ontological pluralism’. ‘Epistemic primacy’ focuses on the epistemological conditions for the possibility of ontological assumptions. It investigates the relation between ‘epistemological capacities’ and ontological assumptions about ‘reality and existence’. Which epistemological capacities are necessary in order to make what kind of ontological assumption? Instead of predefining and predetermining the field of possible potential ontological assumptions, as in ‘ontological primacy’, different ontological assumptions may be related to different ‘epistemological capacities’. The specification of ontological assumptions is no longer predefined and predetermined but rather oriented on the respective ‘epistemological capacities’. The field of potentially possible ontological assumptions remains open and ‘tolerant’ for different ontological assumptions (Pihlstroem 1996: 65). Different ontological assumptions about ‘reality and existence’ may co-occur and co-exist (see 3.3.3 for exact definition of co-occurrence and co-existence) which reflects ‘ontological pluralism’ (see Figure 8d). Since the different ontological assumptions depend on different ‘epistemological capacities’, no particular ontological assumption can be considered as ‘pre-eminent and all-inclusive’ anymore: ‘Many different world versions are of independent interest and importance, without any requirement or presumption to a single base. The pluralist, far from being anti-scientific, accepts the sciences at value. His typical adversary is the monopolistic materialist or physicalist who maintains that one system, physics, is pre-eminent and all-inclusive, such that every other version must eventually be reduced to it or rejected as false or meaningless’ (Goodman 1978: 4).

Due to ‘ontological pluralism’, ‘ontological circularity’ can be avoided. Even if the possibility of ‘epistemological capacities’ in general presupposes ontological assumptions, they may nevertheless differ from the ones which are inferred from particular ‘epistemological capacities’. If, however, the inferred ontological assumptions differ from the ones which are presupposed, the argument of ‘ontological circularity’ can no longer be maintained. In contrast, ‘ontological monism’, as often presupposed in philosophy, leads necessarily to ‘ontological circularity’ when one applies the strategy of ‘epistemic primacy’. ‘Ontological pluralism’ must subsequently be regarded as a necessary condition for avoiding ‘ontological circularity’ in ‘epistemic primacy’. ‘Ontological pluralism’ may be characterized in further detail in the following ways. First, ‘ontological pluralism’ does neither imply elimination of ontology as such nor of ontology as a discipline. Elimination of ontological predefinition and predetermination i.e. ‘ontological fixation’ should not be confused with elimination of any kind of ontology in general (see also Pihlstroem 1996: 68–72). ‘Ontological pluralism’ preserves the possibility of ontological assumptions about ‘reality and existence’ while avoiding their predefinition and predetermination. The field of potentially possible ontological assumptions is enlarged. Accordingly, ‘ontological pluralism’ enlarges the field of ontology rather than eliminating it. In contrast, ‘ontological monism’, as presupposed in ‘ontological primacy’, restricts the field of ontology by claiming a particular ontology as a starting point for further philosophical investigation.

Secondly, analogous to ‘ontological pluralism’, ‘epistemic primacy’ can be characterized by ‘epistemic pluralism’. ‘Epistemic pluralism’ (see 3.2.1 for further definition) points out that all distinct epistemic abilities and inabilities should be considered in an equal way without giving preference to any of one. There should be no ‘epistemic hierarchy’ because if such existed, one particular epistemic perspective would be regarded as an ‘absolute or neutral vantage point’ (see also 3.2.1 and 3.3.3 for discussion of such a ‘neutral vantage point’). This is nicely expressed in the following quote: ‘Because of our humanly restricted situations, we cannot step outside all possible human viewpoints and decide which one of our different conceptual schemes and ways of structuring the world (...) is the only ‘absolutely’ true one or closer to the truth than all others. These different purposeful ways of structuring the world are needed for different ‘spheres of life’. (...) In short, the world can be approached from many different points of view, through many conceptual schemes’ (Pihlstroem 1996: 65). Epistemic abilities and inabilities of both First- and Third-Person Perspective for example, should be considered in the same way without giving more or less weight to any of them. The First-Person Perspective may be regarded as a necessary epistemological presupposition for the possibility of ‘mental ontology’ (see 3.3.3 and Praetorius 2000: XIV–XV) while the Third-Person Perspective may rather be regarded as a necessary condition for the possibility of ‘physical ontology’. Subsequently ‘epistemic pluralism’ and ‘ontological pluralism’ are closely related to each other (see also 3.3.3).

Thirdly, the question of an ‘independent existence of the world’ remains open and unsolved in ‘ontological pluralism’. ‘Ontological pluralism’, as defined in the above mentioned sense, does not focus on an ‘all-inclusive’ ontological explanation of the world but rather on an epistemological-ontological relationship. Instead of arguing either for or against an ‘independent existence of the world’, ‘ontological pluralism’ focuses on the investigation of the ‘epistemological capacities’ which are necessary for raising this problem. Accordingly, the focus is shifted from the ‘independent existence of the world’ itself to the necessary conditions for its possibility as such. The ontologist may then argue that such a strategy presupposes at least some ‘ontological realism’. However, even if ‘ontological pluralism’ presupposes some ‘ontological realism’, it nevertheless leaves open the question for an ‘independent existence’: ‘No sort of realist can escape the problem of ‘independent’ existence of the world – or the problem of explaining what this independence is. The realist might simply mean that the independence of reality amounts to the bare, unconceptualized existence of a reality which we never created. However, even if she affirms that there is an unconceptualized reality which we did not make but which we attempt to represent and describe rightly, she is not speaking about an unconceptualized reality any more. The pragmatic realist sees that this kind of reality cannot be spoken about; yet she must also accept that all reality is not man-made. No easy solution to this tension is available‘. (Pihlstroem 1996: 161–162).

Fourthly, it is important to note that ‘ontological pluralism’ should not be considered as an ‘ontological position’ by its own since it is rather a methodological strategy. As such it provides the methodological tools for the possibility of linkage between ‘epistemological capacities’ and ontological assumptions about ‘reality and existence’. ‘Ontological pluralism’ should for example neither be confused with ‘ontological neutrality’ (Heil 1998) nor with ‘ontological pluralism’ which both are specific ‘ontological positions’. The main feature of ‘ontological pluralism’ as a methodological strategy is that it allows for a variety of different ontological positions which may co-occur and co-exist.

Fifthly, ‘ontological pluralism’ remains open for both ‘internal validation’ and ‘external validation’. ‘Internal validation’ refers to investigation of ‘logical consistency’ as a so-called ‘analytic self-consistency’ (Hedrich 1998: 117–118). The relation between the ontological input, which reflects ontological presuppositions, and ontological output, which reflects the respective philosophical theory, is investigated in logical regard. ‘Logical inconsistency’ reflects discrepancy and discordance between ontological input and output while they remain concordant in the case of ‘logical consistency’. ‘External validation’ refers to investigation of ‘empirical consistency’ as a so-called ‘synthetic context-consistency’ (Hedrich 1998: 117–118). Compatibility and plausibility of ontological input is investigated with respect to empirical hypothesis. ‘Empirical inconsistency’ reflects discrepancy and discordance between ontological input and empirical hypothesis while they remain concordant in the case of 'empirical consistency'. In the case of either 'logical or empirical inconsistency', one may modify the ontological input and/or the empirical hypothesis in orientation on the principles of transdisciplinary methodology (see 1.4.2). The ontological input should thus be validated with regard to both 'logical and empirical consistency'. Unlike in philosophy and 'ontological primacy', the ontological input can therefore no longer be considered as independent from the respective context. 'Analytic self-consistency' is only a necessary but not sufficient condition for validation since it has to be accompanied by 'synthetic context-consistency'. Since the ontological input has to be coordinated and harmonized with the respective context, ontological input and ontological output may differ from each other. 'Ontological identity', as presupposed in 'analytic self-consistency', is replaced by 'ontological iterativity' between ontological input and output (see also Walter 1998:63; Hedrich 1998:116) which characterizes a conjunction between 'analytic self-consistency' and 'synthetic context-dependency'.

1.4.4 'Neurophilosophical hypothesis'

Defining 'Neurophilosophical hypothesis'
A 'neurophilosophical hypothesis' can be defined as an assumption about the linkage between philosophical theory and neuroscientific hypothesis (see Figure 9). The linkage between philosophical theory and neuroscientific hypothesis follows certain methodological principles i.e. 'principle of asymmetry', 'principle of bidirectionality' and 'principle of transdisciplinary circularity' (see 1.4.2). These methodological principles provide a 'systematic relation' rather than a 'intuitive relation' between philosophical theories and neuroscientific hypotheses. Since a neurophilosophical hypothesis can be defined by systematic linkage between philo-

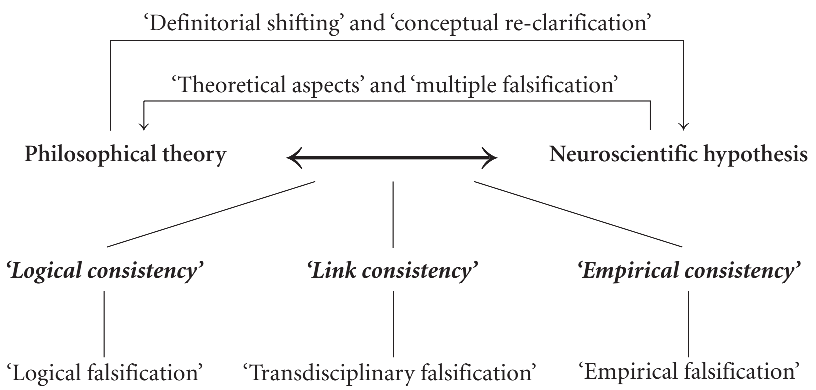


Figure 9. 'Neurophilosophical hypothesis'

sophical theory and neuroscientific hypothesis, it remains open for three distinct modes of falsification (see Figure 9). There is 'logical falsification' which aims at 'logical consistency' as a means for 'internal validation' (see 1.4.3). Second, there is 'empirical falsification' which aims at 'empirical consistency' as a means for 'external validation' (see 1.4.3). Third, there is 'transdisciplinary falsification' which aims at 'link consistency' as a means for 'cross-disciplinary validation'. 'Cross-disciplinary validation' focuses on the way philosophical theory and neuroscientific hypothesis are related and linked to each other. One may speak of 'link consistency' when their linkage is in full accordance with the principles of transdisciplinary methodology (see 1.4.2). For example, differentiation between natural and logical conditions as well as between the different subsets of logical conditions shall be made. Moreover, the interaction between ontological/epistemological assumptions and empirical hypothesis shall be investigated within both philosophical theory and neuroscientific hypothesis. If, in contrast, the linkage is not in accordance with the principles of transdisciplinary methodology, one may speak of 'link inconsistency'.

First, 'neurophilosophical hypotheses' must be distinguished from 'empirical hypotheses', as presupposed in science i.e. neuroscience. Empirical hypotheses as, for example, 'neuroscientific hypotheses' are subjected to 'empirical falsification' only. The focus is put predominantly on 'empirical consistency' while 'logical consistency' and 'logical falsification' are rather neglected. Accordingly, 'neurophilosophical hypotheses' must be distinguished from empirical hypotheses by inclusion of explicit ontological/epistemological assumptions which makes investigation of 'logical consistency' and thus 'logical falsification' necessary. Due to inclusion of ontological/epistemological assumptions i.e. theoretical aspects, the meaning of the term 'hypothesis' is broadened in the case of 'neurophilosophical hypothesis', as compared to 'empirical i.e. neuroscientific hypothesis'. This broadened meaning is reflected in the necessity of consideration of both types of falsification, 'empirical and logical falsification'.

Secondly, 'neurophilosophical hypothesis' must be distinguished from 'philosophical theory' as well. Ontological/epistemological assumptions are subjected to 'logical falsification' only. The focus is put predominantly on 'logical consistency' while 'empirical consistency' and 'empirical falsification' are rather neglected. Accordingly, 'neurophilosophical hypothesis' must be distinguished from philosophical theory by inclusion of explicit empirical hypothesis which makes investigation of 'empirical consistency' and thus 'empirical falsification' necessary. In contrast to philosophical theories, 'neurophilosophical hypotheses' do not predefine and predetermine its terms using these as a starting point for further investigation. Instead, the definition itself may be subject to modification and revision on empirical grounds which may lead to so-called 'definitorial shifting' (Northoff 2000b, 2001c). Definition and determination of terms may be adjusted to empirical hypothesis (see also Praetorius 2000:30) which allows for 'empirical consistency' and 'link consistency'. Accordingly, 'neurophilosophical hypothesis' must be distinguished from philosophical theory by the possibility of 'definitorial shifting' and 'empirical falsification'. For example, D. Parfit (1989) presupposes a definition of the brain in his 'spectrum arguments' which is not consistent which current empirical data (see 1.4.2 and Northoff 2001b). He implicitly presupposes a one-to-one relation between cells and function in the brain. However, numerous empirical studies demonstrated that several cells might subserve one particular function. Moreover, the same cells could subserve different functions. There is subsequently no clear-cut one-to-one relation between cells and function as presupposed by D. Parfit. Even though his definition of the brain may be 'logically consistent', it nevertheless remains 'empirically inconsistent'. Such 'empirical inconsistency' may be irrelevant for his 'philosophical theory' about personal identity because both terms, brain and personal identity, are predefined and predetermined. In contrast, 'empirical inconsistency' is important to consider in a 'neurophilosophical hypothesis' about personal identity (see Northoff 2001b). Accordingly, Parfit's definition of the brain must be modified and adjusted in accordance with empirical data which, in turn, may make corrections in the theory of personal identity necessary. Subsequently, definition of both terms 'brain' and 'personal identity' may be subjected to the process of 'definitorial shifting' in 'neurophilosophical hypothesis'.

Thirdly, 'neurophilosophical hypothesis' must be distinguished from both empirical hypothesis and philosophical theory. 'Conceptual clarification' describes the explication of hidden i.e. implicit presuppositions and definitions in terms and theories (see also van Gelder 1998b:120–122). 'Neurophilosophical hypotheses' focus on hidden i.e. implicit empirical hypothesis in 'philosophical theories' as, for example, with respect to the function of the brain (see above the example with D. Parfit). Mutual adjustment between philosophical theory and empirical hypothesis requires not only 'logical and linguistic analysis' but also 'conceptual clarification'. In addition, modification of both definitions and concepts with consecutive 'conceptual re-clarification' is possible in 'neurophilosophical hypothesis' (see also D. Chalmers 1996:51, whose distinction between 'explication' and 'explanation' parallels more or less with our distinction between 'conceptual clarification' and 'conceptual re-clarification'). 'Conceptual re-clarification' may allow for investigation of 'link consistency' as a test for systematic interaction between philosophical theory and empirical hypothesis. Accordingly, 'neurophilosophical hypothesis' must be distinguished from both empirical hypothesis and philosophical theory by the possibility of 'conceptual re-clarification' with consecutive investigation of 'link consistency' and 'transdisciplinary falsification'. Due to the inclusion of 'link consistency' and 'transdisciplinary falsification', philosophical theory and empirical hypothesis can be linked and related to each other in systematic ways. This, in turn, opens the possibility for the development of 'neurophilosophical hypothesis' where empirical hypothesis and philosophical theories may be combined and linked in different though systematic and consistent ways.

Experiments

We pointed out that 'neurophilosophical hypothesis' may be characterized by the conjunction of 'logical, empirical and 'transdisciplinary falsification' (see 1.4.4). According to the distinct modes of falsification, different types of experiments are necessary. The 'unit of neurophilosophical significance' (see Quine 1953: 39, who uses an analogous expression 'unit of empirical significance') consists in linkage between philosophical theory and neuroscientific hypothesis. Philosophical theories reflect logical conditions while neuroscientific hypothesis can rather be accounted for by natural conditions. Subsequently, the 'unit of neurophilosophical significance' consists in linkage between logical and natural conditions. Logical conditions are considered within the context of natural conditions which accounts for the investigation of 'empirical consistency' of philosophical theory. Natural conditions are considered within the context of logical conditions which accounts for the investigation of 'logical consistency'. The linkage between natural and logical conditions is considered as well which accounts for the investigation of 'link consistency'. Falsification of the 'unit of neurophilosophical significance' should aim predominantly at the linkage between natural and logical conditions. Traditionally, 'empirical consistency' is tested for by 'empirical experiments' that rely on the manipulation of natural conditions. 'Logical consistency' is tested for through 'logical experiments' i.e. 'thought experiments', which rely on imaginative variation of logical conditions. In addition to these traditional ways, the falsification of the 'unit of neurophilosophical significance' can be characterized by a third form of falsification i.e. 'transdisciplinary falsification' (see above). 'Transdisciplinary falsification' aims at 'link consistency' which reveals the nature of the linkage i.e. either 'systematic' or 'intuitive' between logical and natural conditions.

How can we test the 'logical consistency' of natural conditions? How can we test the 'empirical consistency' of logical conditions? Both 'empirical experiments' and 'logical experiments' should be applied in a novel way. 'Empirical experiments' should be applied to logical conditions in order to test their 'empirical consistency'. Since logical conditions refer to philosophical theories, they have to be transformed into neuroscientific hypothesis which, in turn, are accessible to 'empirical experiments'. As a result philosophical theories may be tested for experimentally so that, relying on Hume, one may speak of a so-called 'experimental philosophy' (Hume 1978: XVI). The concept of personal identity for example refers to philosophical theory rather than neuroscientific hypothesis (see Northoff 2001b, 2003c for full detail). Subsequently, personal identity itself remains inaccessible to empirical investigation. However, the theory of personal identity may refer to certain criteria which reflect necessary and/or sufficient logical conditions for personal identity.

As revealed in philosophical discussions these criteria may include psychological and physiological criteria. These criteria may then be transformed into psychological and physiological hypotheses i.e. empirical hypotheses which as such are accessible to 'empirical experiments'. As a result, personal identity before and after brain tissue transplantation in Parkinson's disease may be investigated empirically by transformation of these criteria into subjective visual-analogue questionnaires (see Northoff 2001b, 2003c). One may therefore consider such an approach as an 'empirical experiment' for investigation of 'empirical consistency' of the philosophical theory of personal identity. 'Logical experiments' on the other hand should be applied to natural conditions in order to test their 'logical consistency'. Accordingly, natural conditions should be varied imaginatively in 'logical experiments' i.e. 'thought experiments'. Distinction between natural and logical conditions as well as between necessary and non-necessary conditions may be revealed.

Judgments

'Neurophilosophical hypothesis' may be characterized by rejection of the semantic distinction between purely 'analytic' judgments and purely 'synthetic' judgments. 'Neurophilosophical hypothesis' can be characterized by consideration of 'empirical consistency' which accounts for 'synthetic context-consistency' (see 1.4.2). If, however, the respective empirical context is considered in definition of terms, 'neurophilosophical hypothesis' can no longer be regarded as purely 'analytic'. Unlike philosophical judgments, 'neurophilosophical hypothesis' therefore implies 'rejection of analyticity' (Quine 1969: 86) and consecutively inclusion of a 'synthetic' component. Conversely, due to inclusion of theoretical aspects and 'logical consistency' (see above), 'neurophilosophical hypothesis' cannot be regarded as purely 'synthetic'. Unlike neuroscientific judgments, 'neurophilosophical hypothesis' therefore implies 'rejection of synthecity' and consecutively inclusion of an 'analytic' component. Due to the conjunction between 'analyticity and synthecity', the 'absolute' distinction between philosophical theories and neuroscientific hypothesis is blurred in 'neurophilosophical hypothesis': 'Carnap has recognized that he is able to preserve a double standard for ontological questions and scientific hypothesis only by assuming an absolute distinction between the analytic and synthetic; I need not say again that this is a distinction which I resist' (Quine 1953: 43). 'Neurophilosophical hypothesis' may subsequently be characterized by inclusion of both 'analytic' and 'synthetic' components which may be linked and balanced in different ways. Certain 'neurophilosophical hypotheses' may show a stronger 'analytic' component ('more or less analytic') while the 'synthetic' component remains in the background. The latter may be stronger than the former ('more or less synthetic'). However, both 'analytic' and 'synthetic' components must necessarily be present since otherwise 'neurophilosophical hypothesis' degenerate into either 'philosophical theory' or 'neuroscientific hypothesis'.

In addition to inclusion of both 'synthetic' and 'analytic' components, 'neurophilosophical hypothesis' may be characterized by rejection of the epistemic distinction between 'a priori' and 'a posteriori' (see also Kripke 1972). Since 'philosophical theories' are subjected to 'empirical consistency', they may be modified throughout further investigation by means of 'definitorial shifting' and 'conceptual re-clarification' (see 1.4.3). Subsequently, 'neurophilosophical hypotheses' can no longer be regarded as purely 'a priori' judgments. Neuroscientific hypothesis on the contrary are linked to theoretical aspects and are thus subjected to 'logical consistency'. Definition and determination of 'neurophilosophical terms' is therefore pre-structured so that the field of potentially possible ontological/epistemological assumptions is restricted. Meanwhile it still remains variable and open for 'definitorial shifting' and 'conceptual re-clarification'. Subsequently, 'neurophilosophical hypotheses' can no longer be regarded as purely 'a posteriori' judgments. 'Analytic' judgments are traditionally regarded as 'a priori' judgments. This refers to their determination on purely logical grounds. They remain consecutively pre-defined and pre-determined and thus fixed so that 'definitorial shifting' and 'conceptual re-clarification' remain impossible. 'Analytic' judgments refer predominantly to theories i.e. 'philosophical theories'. 'Synthetic' judgments, in contrast, are traditionally regarded as 'a posteriori' judgments since they are determined by the respective empirical context. 'Synthetic' judgments therefore refer predominantly to hypothesis i.e. 'neuroscientific hypothesis'. They consecutively remain open for modification by means of 'definitorial shifting' and 'conceptual re-clarification'. 'Neurophilosphical hypotheses' may thus be regarded as 'mixed' judgments as they include both 'a priori' and 'a posteriori' components. Depending on their balance, 'neurophilosophical hypotheses' may subsequently be characterized as either 'more or less a priori' or 'more or less a posteriori'. Accordingly, 'neurophilosophical judgments' may be characterized by the conjunction of 'a priori' and 'a posteriori' components. Due to the conjunction between 'a priori' and 'a posteriori' components, novel forms of judgment may be developed in 'neurophilosophical hypotheses'. Due to the necessity of 'empirical consistency', 'more or less analytic' judgments may show a strong 'a posteriori' component. Conversely, due to the necessity of 'logical consistency', 'more or less synthetic' judgments may show a strong 'a priori' component.

In addition to semantic and epistemic distinctions, the ontological distinction between necessary and contingent judgments is undermined in 'neurophilosophical judgments' as well. 'Neurophilosophical judgments' may subsequently be considered as 'more or less necessary' and 'more or less contingent'. Accordingly, 'neurophilosophical judgments' can be characterized by 'relativization' of epistemic, semantic and ontological distinctions. This 'relativization' leads to the possibility of dissociation between semantic, epistemic and ontological characterization (see also Nagel 2000: 434) in 'neurophilosophical judgments'. Usually the 'a priori' component is related to necessity and 'analyticity' in 'philosophical judgments' while the 'a posteriori' component is related to contingency and 'synthecity' in 'neuroscientific judgments'. This specific linkage between the epistemic, semantic and ontological characterizations is disrupted in 'neurophilosophical judgments' which, allow for novel, variable and flexible combinations among them.

1.4.5 'Standard arguments' against neurophilosophy

The 'Argument of logical circularity'

Neurophilosophy relies on the methodological strategy of 'epistemic primacy' (see 1.4.3) and therefore considers 'epistemological capacities' of the brain as a starting point for further epistemological and ontological investigation. From a purely philosophical point of view, one may argue that the neurophilosopher infers ontological assumptions from the 'epistemological capacities' of the brain which are already necessarily presupposed by the brain itself as its ontological presuppositions. The methodological strategy in neurophilosophy remains therefore circular and can thus be considered as an instance of 'ontological circularity' (see also 1.4.3). Neurophilosophy is logically inconsistent with regard to its methodological strategy, which should therefore be replaced by 'ontological primacy', as presupposed in philosophy (see 1.4.3). Accordingly, the 'argument of circularity' can be considered as an argument against the possibility i.e. validity of neurophilosophy as a methodological strategy distinct from philosophy.

The 'argument of circularity' assumes the identity between the brain, as investigated in neuroscience, and the brain, as considered in neurophilosophy. The brain, as investigated in neuroscience, must be regarded as a 'physical brain' (see 3.3.1), which as such presupposes particular ontological assumptions about 'reality and existence' i.e. 'physical ontology'. In addition to characterization of the brain as a 'physical brain', it may also be regarded as a 'mental brain' (see 3.3.1) (Northoff 2000b, 2001b). Similar to the 'physical brain', the 'mental brain' too presupposes certain ontological assumptions i.e. 'mental ontology'. However, both characterizations of the brain as 'physical brain' and 'mental brain' may be related to different 'epistemological capacities' i.e. Third- ad First-Person Perspective (see 3.3.1). Different ontological assumptions correspond to distinct 'epistemological capacities'. Instead of focusing on one particular ontological presupposition i.e. either 'physical ontology' or 'mental ontology', neurophilosophy rather aims at elucidation of correspondences between 'epistemological capacities' and ontological assumptions. Accordingly, the brain, as considered in neurophilosophy, does no longer presuppose particular ontological assumptions but rather a variety of different epistemological-ontological correspondences (see above). As such the ontological inferences, which are drawn from the 'epistemological capacities' of the brain in neurophilosophy, are not necessarily identical with those that are presupposed by the brain itself. 'Ontological circularity' is subsequently replaced by 'ontological iterativity' (see 1.4.3); the 'argument of logical circularity' should thus be reformulated as a 'strategy of logical iterativity'.

Even if one rejects the 'logical circularity', one may nevertheless characterize neurophilosophy as superfluous because its field of investigation may already be covered by philosophy. The 'argument of circularity' presupposes inclusion between natural and logical conditions and makes no differentiation between distinct subsets of logical conditions. The brain is characterized by natural conditions which must be considered as part of the larger field of logical conditions (see also 1.4.2). Since natural conditions are included within logical conditions, the former necessarily presuppose the latter while inference of the latter from the former remains impossible and thus 'circular'. Accordingly, neurophilosophical investigation of the natural conditions underlying the brain remains superfluous since they are already covered by philosophical investigation of logical conditions. There are two distinct subsets of logical conditions (i.e. L), the ones being identical with natural conditions (i.e. l1) and the ones being non-identical with natural conditions (i.e. l2) (see 1.4.2). Investigation of natural conditions consecutively allows for indirect inference on at least those logical conditions (i.e. l1) which are identical with natural conditions. Moreover, investigation of natural conditions allows for negative characterization of those logical conditions (i.e. l2) which are non-identical with natural conditions by describing what they are not. The brain, as characterized by natural conditions by itself, may therefore serve as a starting point for investigations of the differentiation between distinct subsets of logical conditions. Accordingly, a neurophilosophical investigation of the natural conditions of the brain is not superfluous since they are not covered completely by philosophical investigations of logical conditions.

The 'Argument of categorical fallacy'

From a philosophical point of view, one may argue that the neurophilosopher relies on false characterization i.e. categorization of the brain. The brain is characterized as a 'physical object' with natural conditions which are accessible to empirical i.e. neuroscientific investigations. The brain must be distinguished from a 'mental subject' i.e. a mind which accounts for logical conditions. As such the mind may be subjected to philosophical investigation. Since 'physical object' and 'mental subject' reflect different categories, the brain as a 'physical object' cannot be investigated in philosophy. The claim for the principal possibility of philosophical investigation of the brain presupposes therefore confusion between distinct categories i.e. between 'physical object' and 'mental subject' and consequently between natural and logical conditions (see also Keil & Schnaedelbach 2000). One cannot infer from the one category to the other without committing a 'categorical fallacy'. Accordingly, the ‘argument of categorical fallacy’ can be considered as an argument against the principal possibility of philosophical investigation of the brain and the consecutive development of a ‘philosophy of the brain’.

The ‘argument of categorical fallacy’ presupposes mutually exclusive distinction between natural and logical conditions with respect to brain and mind. Only if there is no overlap between natural and logical conditions, characterization of brain and mind as different categories can be maintained. However, there is some overlap between natural and logical conditions with respect to brain and mind. The brain as a ‘physical brain’, underlying natural conditions by itself, must be considered as a necessary natural condition for the possibility of generating logical conditions (see 3.3.4). We remain unable to perform philosophical reasoning and remain thus unable to account for logical conditions without our own brain. While logical conditions may remain independent from the brain by themselves, the brain must at least be regarded as a necessary natural condition for the possibility of their creation. The brain may then serve as a ‘bridge between natural and logical conditions’ and thus as a ‘window to the mind’. The distinction between natural and logical conditions with respect to brain and mind can therefore no longer be considered as mutually exclusive. If, however, the distinction between natural and logical conditions is not mutually exclusive, brain and mind can no longer be regarded as different categories. Accordingly, philosophical investigation of the brain i.e. a ‘philosophy of the brain’ does not presuppose confusion but rather linkage between different categories i.e. between ‘physical object’ and ‘mental object’. The ‘argument of categorical fallacy’ should thus be reformulated as a ‘strategy of categorical linkage’.

The ‘Argument of principal validity’

The possibility of ‘definitorial shifting’ and ‘conceptual re-clarification’ (see 1.4.3 and 1.4.4) in ontological/epistemological assumptions makes ‘neurophilosophical hypothesis’ rather contingent which undermines their necessity in ontological regard (see also 1.4.4). Moreover, by introducing ‘a posteriori’ components within purely ‘a priori’ arguments, consideration of empirical data renders ‘neurophilosophical hypothesis’ invalid in epistemic regard (see also 1.4.4). The ‘argument of principal validity’ can thus be considered as an argument against the principal possibility of ontological and epistemic validity of ‘neurophilosophical hypothesis’.

The ‘argument of validity’ equates introduction of contingency with complete elimination of necessity i.e. necessity and contingency are thus regarded as mutually exclusive. Introduction of traces of contingency eliminates necessity completely and renders ‘neurophilosophical hypotheses’ invalid. However, ‘neurophilosophical hypotheses’ cannot be characterized by ‘empirical consistency’ exclusively but, in addition, by ‘logical consistency’. ‘Empirical consistency’ reflects contingency while ‘logical consistency’ rather accounts for necessity. Since ‘neurophilosophical hypothesis’ requires ‘empirical and logical consistency’ (see 1.4.4), contingency and necessity may co-occur and co-exist so that they are no longer mutually exclusive. Introduction of traces of contingency does therefore not necessarily eliminate necessity completely – ‘neurophilosophical hypothesis’ cannot be regarded as necessarily invalid in ontological regard. Since the same remains true in the case of ‘a priori’ and ‘a posteriori’ (see 1.4.4), ‘neurophilosophical hypothesis’ cannot be regarded as necessarily invalid in epistemic regard either.

The ‘Argument of general irrelevance’

The development of ‘neurophilosophical hypotheses’ may be regarded as irrelevant and non-necessary for both philosophy and neuroscience. Since ‘neurophilosophical hypotheses’ are ‘crude and arbitrary mixtures’ between empirical hypotheses and theoretical assumptions, they remain unable to make significant contributions to either philosophy or neuroscience. If, however, ‘neurophilosophical hypothesis’ cannot contribute to either discipline, they must be regarded as irrelevant in general. Accordingly, the ‘argument of general irrelevance’ must be considered as an argument against the general relevance and necessity of neurophilosophy as distinguished from both neuroscience and philosophy. The philosophical characterization of ‘neurophilosophical hypothesis’ as ‘crude and arbitrary mixtures’ between empirical hypothesis and theoretical assumptions must be rejected and replaced by ‘fine-grained and systematic linkages’. ‘Neurophilosophical hypothesis’ (see Chapter 2) may indeed contribute to both philosophy (see 3.2.1. and 3.3.3) and neuroscience (see 3.1.2) so that they can no longer be considered as irrelevant in general.

First, empirical hypotheses and theoretical assumptions are not ‘mixed’ together but rather ‘linked’ to each other. ‘Mixture’ implies that both are thrown together while ‘linkage’ refers to selective coupling between those parts that both (i.e. empirical hypothesis and theoretical assumptions) have in common. ‘Mixture’ for example indicates that ontological/epistemological assumptions of philosophical theories are directly put together with empirical observations of neuroscientific hypothesis. ‘Linkage’, in contrast, remains possible only between particular ontological/epistemological assumptions of philosophical theories and specific ontological/epistemological ‘explications’ (see 1.4.2) of neuroscientific hypothesis. While ‘linkage’ between ontological/epistemological assumptions of philosophical theories and empirical observations of neuroscientific hypothesis remains impossible because of their principal differences which would be equated with ‘mixture’.

Secondly, the ‘linkage’ between empirical hypothesis and theoretical assumptions cannot be considered as ‘crude’ but rather as ‘fine-grained’. ‘Crude’ implies that neither differentiation between distinct types of conditions in general i.e. natural and logical conditions nor between distinct subsets of logical conditions in particular i.e. those being identical and non-identical with natural conditions is considered (see 1.4.2). However, the linkage between empirical hypothesis and theoretical assumptions considers their different conditions i.e. natural and logical conditions respectively which is reflected in the 'principle of asymmetry'. Furthermore, the differentiation between distinct subsets of logical conditions is considered which is reflected in the 'principle of bidirectionality'. Accordingly, the 'linkage' between empirical hypothesis and theoretical assumptions can be characterized as 'fine-grained' rather than 'crude'.

Thirdly, the 'linkage' between empirical hypothesis and theoretical assumptions cannot be considered as 'arbitrary' but rather as 'systematic'. 'Arbitrary' implies that there are no rules and strategies that serve as guidance for the generation of 'linkage'. There are however various principles i.e. the principles of transdisciplinary methodology (see 1.4.2) which establish concrete strategies for 'linkage' between empirical hypothesis i.e. natural conditions and theoretical assumptions i.e. logical conditions. This is reflected best in the 'principle of transdisciplinary circularity', which defines specific steps for their 'linkage' (see 1.4.2). Accordingly, the 'linkage' between empirical hypotheses and theoretical assumptions may be regarded as 'systematic' rather than 'arbitrary'.

The 'Argument of transitory relevance'
'Neurophilosophical hypothesis' may be regarded only as an intermediate stage from a neuroscientific point of view. As soon as the mind can be accounted for completely by the brain, all 'neurophilosophical hypothesis' can be replaced by 'empirical hypothesis' i.e. 'neuroscientific hypothesis'. 'Neurophilosophical hypothesis' may therefore be relevant only for the transitory period from philosophy to neuroscience. Neurophilosophy can be considered as a transitory stage in the process of replacement of philosophy by neuroscience. Accordingly, the 'argument of transitory relevance' can be considered as an argument against the principal relevance of neurophilosophy as distinguished from neuroscience.

The 'argument of transitory relevance' relies on a rather narrow definition of the 'brain'. The 'brain' is regarded as a 'physical brain' since otherwise it could not be accounted for completely by neuroscience (see 3.1.2 and 3.2.1). Moreover, the brain as a 'physical brain' can be characterized by natural conditions exclusively. This definition of the brain however neglects the possibility of generating logical conditions by the brain itself which as such have to be distinguished from natural conditions. Purely empirical and thus neuroscientific approaches to the brain cannot account for this linkage between natural and logical conditions within the brain (see 3.3.4) because they do not differentiate between natural and logical conditions. If, however, the linkage between natural and logical conditions is neglected, the brain itself cannot be accounted for completely. Accordingly, a purely neuroscientific account of the brain remains necessarily incomplete and thus insufficient. Logical conditions are not reflected in empirical hypotheses but rather in theoretical assumptions. If logical conditions need to be considered in investigation of the brain, the brain may subsequently be accounted for by a conjunction of empirical hypothesis and theoretical assumptions. It is this conjunction between empirical hypothesis and theoretical assumptions that is provided by ‘neurophilosophical hypothesis’. ‘Neurophilosophical hypothesis’ may subsequently be able to account for the linkage between natural and logical conditions within the brain itself. Accordingly, ‘neurophilosophical hypotheses’ cannot be replaced by empirical i.e. neuroscientific hypotheses and remain therefore not only transitorily but principally relevant for the investigation of the brain.

Chapter 2

Neuroepistemological account of the brain

'Epistemic–empirical relationship'

> 'There is no impassable gulf between those cognitive scientists who are philosophers and those who belong in the other disciplines, and there is no sharp line between the issues proper to the respective areas. A good deal of important philosophical work is done by scientists who are temporarily taking on one or more of the roles described above. Indeed, the best philosophy of cognitive science will be done standardly by those whose thinking is thoroughly grounded by familiarity with empirical work, just as the best empirical research will be that which is informed and shaped by philosophical perspective and rigor'.
>
> (van Gelder 1998b: 134)

In the following chapter, epistemic abilities/inabilities shall be directly related to the empirical function of the brain. Certain properties of the functional organization of the brain may account for specific epistemic abilities or inabilities: a so-called 'epistemic-empirical relationship' can be developed. These 'epistemic-empirical relationships' investigate the natural conditions for epistemic abilities and inabilities in the case of the human brain. It should be noted that in the first two sections (see 2.1 and 2.2), phenomenal characteristics as, for example, 'phenomenal time' and 'phenomenal space' are related to the empirical function of the brain. One may therefore speak of a 'phenomenal-empirical relationship' and 'neurophenomenology' (see also Northoff 2003a). In the last two sections (see 2.3 and 2.4), however it is the epistemic characteristics (e.g. the different perspectives) that are related to the empirical function of the brain. Accordingly, one may speak of an 'epistemic-empirical relationship' and 'neuroepistemology'. Since both 'phenomenal-empirical relationship' and 'neurophenomenology' are necessary conditions for the possibility of an 'epistemic-empirical relationship' and for the likelihood of 'neuroepistemology', we suggest a broader meaning of the latter terms, one that includes the former as well. It is this broader meaning of 'epistemic-empirical relationship' and 'neuroepistemology' that will be presupposed in the following. As a result, neuroepistemological hypotheses will be developed for the different epistemic abilities and inabilities.

In order to investigate the dependence of epistemic abilities and inabilities on particular features of empirical brain function, the properties of the functional organization of the brain will be varied in thought experiments. If epistemic abilities and inabilities remain the same, the respective empirical feature of the brain cannot be regarded as necessary. If, in contrast, epistemic abilities and inabilities change, the respective empirical feature of the brain can be regarded as necessary. The combination of 'epistemic-empirical relationship' and thought experiments may subsequently account for investigation of the kind of dependence either necessary or contingent between epistemic abilities/inabilities and empirical brain function. The crucial feature, characterizing 'epistemic-empirical relationship', is supposed to be 'embedment' which reflects the 'intrinsic' relationship between brain, body, and environment (see also 1.3 for exact definition). Depending on the focus within the 'intrinsic' relationship between brain, body, and environment, different forms of 'embedment' may be distinguished from each other.

First, 'spatial embedment' refers to the integration of the body within the spatial coordinates of the environment. This has the effect that the own body can be distinguished from other objects within the environment by means of 'phenomenal space' (see 2.1).

Secondly, temporal embedment' refers to the integration of the own body within the temporal coordinates of the environment. In this case the own body can be distinguished from other bodies within the environment by means of 'phenomenal time' (see 2.2).

Thirdly, 'mental embedment' refers to the integration of the brain within the own body and as a result, the brain can be distinguished from the body by means of mental states (see 2.3).

Fourthly, 'reflexive embedment' refers to the integration of mental states within the own brain. As a consequence the own brain and mental states can be distinguished from other's brains and mental states by means of cognitions reflecting reflexive processing (see 2.4).

The following limitations in the present development of 'epistemic-empirical relationship' shall be pointed out: (i) no complete, full, systematic and extensive account of empirical data since the focus is rather put on the elucidation of general principles of brain function; (ii) restriction of empirical data predominantly to human imaging studies while animal and molecular/cellular findings are rather neglected since the focus is put on the elucidation of the systemic and dynamic mechanisms of brain functions (see 3.1.2 for characterization of the brain as a 'dynamic brain') and their linkage to epistemic abilities/inabilities; (iii) the speculative and hypothetical character in the description of empirical mechanisms underlying epistemic abilities/inabilities since neuroepistemological data are rarely available; (iv) no exact logically-based inferences in thought experiments which should serve to generate potentially possible contingent (and non-natural) concepts rather than completely deducting all logically feasible possibilities; (v) no exhaustive account of the principles of brain functions since the 'theoretical principles underlying brain functions' are discussed in a subsequent chapter (see 3.1); (vi) no systematic and exhaustive account of philosophical questions since they are discussed in subsequent chapters in further detail (see 3.2 and 3.3); (vii) the appearance of both neuroscientific data and philosophical problems in rather unusual i.e. novel contexts that are not always in accordance with 'intra-disciplinary expectations' since the focus is put on 'inter-disciplinary relationships'.

2.1 'Spatial embedment': The body and the own body

'Spatial embedment' describes the integration of the body within the spatial coordinates of the environment. The 'internal' space within the body must be somehow related to the 'external' space of the environment. Distinct aspects and stages of 'spatial embedment' may be distinguished from each other.

First, the 'internal' space within the body may be phenomenally accounted for by 'phenomenal space'. This way the body can be distinguished from other objects within the environment; this represents 'bodily embedment' (see 2.1.1). Secondly, the 'internal' space within the body must be characterized individually as provided by the 'intra-subjective character' of 'phenomenal space'. This ensures that the body of a particular i.e. individual person can be distinguished from the bodies of other individuals which indicates 'individual embedment' (see 2.1.2). Thirdly, the 'internal' and individual space within the body must be experienced as different from the observation of the 'external' i.e. environmental space. This is provided by the 'phenomenal-qualitative character' of 'phenomenal space' which, in turn, specifies 'emotional embedment' (see 2.1.3).

2.1.1 'Bodily embedment': 'Phenomenal space'

The functional organisation of the brain: Body image

We are clearly capable to identify movements and specific parts of one's own and others bodies and we are able to perceive the body as a whole i.e. its 'general body structure' (Melzack 1989). This 'general body structure' must somehow be encoded by the brain since otherwise we would be unable to recognize and observe either the own or others bodies. This is called 'body schema' or 'body image' which can be defined in the following way:

> 'The final result, a mental construct that comprises the sense impressions, perceptions and ideas about the dynamic organisation of one's own body and its

> relation to that of other bodies, is variously termed body schema, body image and corporeal awareness' (Berlucchi & Aglioti 1997: 560).

How does the brain construct the body (image) to which it is related?

According to Melzack (Melzack 1992), the construction of the body image in the brain relies upon a large neural network in which somatosensory cortex, posterior parietal lobe, and insular cortex play crucial and different roles. The somatosensory cortex is apparently responsible for constructing the general shape of the body, relying on tactile and propioceptive stimuli. The posterior parietal cortex (comprised of superior parietal cortex, intraparietal sulcus, and adjacent rostral-most part of inferior parietal lobule), especially the right hemisphere, seems to provide the connection between the tactile-propioceptive body shape, as constructed in the somatosensory cortex, and the spatial coordinates. This linkage generates a spatial schema of the body i.e. the body image. Finally, the insular cortex provides the linkage with those parts of the limbic system (hypothalamus, etc.) that are involved in emotional and visceral functions. Consequently, the creation of body images is closely related to visceral and emotional functions of that individual person (see also 2.1.3).

There are some similarities in neural networks, which are essential for the 'proto-self', as suggested by Damasio (1999: 154–156; 2003), as well as for the ones subserving the body image, as presupposed by Melzack. In both approaches, the insular cortex, parietal cortex, and the visceral parts of the limbic system are claimed to be directly or indirectly involved. Accordingly, the body image may be considered as the bodily analogue of Damasio's 'proto-self'. However, unlike in the case of the body image, the generation of the 'proto-self' does not necessarily presuppose the primary somatosensory cortex. According to Damasio, the secondary somatosensory cortex may be the one that is rather crucial for the generation of the 'proto-self'. Furthermore, Damasio suggests the involvement of several brain stem nuclei that are responsible for controlling and regulating several physiological (e.g. frequency of ventilation) and vegetative (e.g. blood pressure) functions of the body.

The assumption that there is such a neural network that creates and constructs the body's image is supported by the consideration of lesion studies. Lesions in the somatosensory cortex induce deficits in the tactile and propioceptive spheres. They also lead to severe alterations of the body image which results in the inability to delineate the shape of the own body from the environment (see Berlucchi & Aglioti 1997; Metzinger 1997). Lesions in the parietal cortex do not impair the ability to delineate the shape of the body; especially the right parietal cortex seems to be linked with the image of the own body. The left parietal cortex may be related to the body image in general i.e. the ones from both, the own and other bodies. Finally, lesions or electrical stimulation in the insular can cause somatic hallucination, illusions of changes in body positions and feelings of being outside one's own body (Berlucchi & Aglioti 1997). These symptoms reveal the particular importance of the insular in regards to the generation of the body image.

Lesions in the different structures subsequently lead to alterations in the awareness of the own body. These alterations include negative as well as positive symptoms. Negative symptoms concern denial or non-recognition i.e. anosognosia of motor and/or sensory deficits. There may also be hemisomatoagnosia purporting as a neglect of one side of the own body. There may also be feelings of non-belonging, denial of ownership of a body part or hatred towards hemiparetic limbs i.e. misoplegia. The neglected or disowned body parts are excluded and expunged from the image of the body while their material existence is justified with confabulatory explanations. Positive symptoms include the possibility of supernumary limbs. In this case patients describe the existence of an additional limb like a third 'ghost arm' (Hari et al. 1998). It is interesting to note that one patient with right parietal cortical lesions who reported such a 'ghost arm' only showed suppression of somatosensory evoked potentials (i.e. SEP) in the secondary somatosensory cortex (SII). SII is an area that is close to the insula, but that does not exist in the primary somatosensory cortex (SI). This case lends further support to the assumption that the primary and secondary somatosensory cortex play very different roles in the creation of the body image.

Neuroepistemological implications: Body image and 'phenomenal space'

Functionally, the creation 'phenomenal space' may be subserved because neural activity orients itself on the differences between stimuli, which reflect 'biomechanical markers', rather than single stimuli, which indicate 'mechanical markers'. Neural activity in the neural network, that are essential for the generation of a body image, cannot be related to single and separate stimuli as independent from other stimuli i.e. their respective context. Accordingly, the various spatial coordinates are not coded independent from each other (in neural activity) for this would result in 'mechanical markers' and 'spatial heterogeneity'. Instead, the activity in this neural network is organized in orientation on the relation i.e. differences between the different stimuli and is thus dependent on the respective context. This relation i.e. difference between the different spatial coordinates is put into code in the neural activity which in turn gives rise to 'bio-mechanical markers' and 'spatial homogeneity' (see also Thelen & Smith 1994: 132–138). This is also reflected in the crucial role that tactile and propioceptive events play in regards to the body image. The construction of the body image is not primarily related to the absolute physical position of every single and separate limb i.e. 'mechanical markers' that are independent from the respective context. Because they are 'isolated' from one another, single and separated stimuli cannot account for tactile and propioceptive events. On the contrary, the body image reflects the relative position of a limb in relation to other limbs which accounts for angles and trajectories as 'bio-mechanical markers' (see also Jahanshahi & Frith 1998; Deecke 1996; Jeannerod 1997; Wolpert et al. 1998). Tactile and propioceptive events subsequently reflect the relation i.e. the difference between different stimuli rather than the single and isolated stimuli themselves. Due to these 'biomechanical markers', the space of the body is determined in relation to the respective context i.e. environment which includes other bodies as well. Accordingly, the 'phenomenal space' of the own body is determined by the spatial relationship between the own body and other bodies within the respective environmental context. The distinction between 'mechanical markers' and 'biomechanical markers' is also reflected in Locke's (1690, Book 2, Chapter XIII, 7–10) terms 'extension' and 'expansion'. 'Extension' describes the 'absolute length' of one particular body part by itself while 'expansion' accounts for the 'relative difference between different bodies'. Locke also points at the 'relativity' of space: 'single space' describes the 'relation of distance between two bodies'. Space and place are 'relative to particular bodies' and 'relative to a present purpose'.

Phenomenally, this 'spatial homogeneity' may be reflected in 'phenomenal space' as characterized by 'unity in space' and 'non-structural homogeneity'. Despite several distinct parts and organs, there is only one body. There must therefore be some kind of integration and linkage between the spatial coordinates of the different organs and body parts, e.g. they are apparently unified into one 'homogenous space', which reflects the 'unity in space' i.e. the body. Within our experience we remain unable to dissect our body into different parts, structures, or elements. We do not experience different organs, different structures, or different bodies but rather experience the body as a homogenous whole i.e. 'wholeness' that can be described as 'non-structural homogeneity' (Gadenne 1996: 26–28). 'Non-structural homogeneity' may thus be considered as the experiential analogue of 'unity in space'. While 'unity in space' refers to the body itself, 'non-structural homogeneity' describes our knowledge of the body which must be considered as complementary. As a result, we experience our body as a 'phenomenal body', as characterized by 'phenomenal space', rather than as a 'physical body', as characterized by 'physical space' which has already been noted by Schopenhauer: 'Thus as object, in other words as extended, filling space, and acting, I know my body only in the perception of my brain. This perception is brought about through the senses, and on their data the perceiving understanding carries out its function of passing from the effect to the case. In this way, by the eye seeing the body, or the hands touching it, the understanding constructs the spatial figure that presents itself in space as my body. (Schopenhauer 1966, Vol. II, 6). Due to 'homogenous space' and 'unity in space', we are able to experience 'infinity of space'. Space is experienced as 'boundless and infinite' because of its homogenous and united character. In contrast to the experience of the 'infinity of space' as the 'idea of the infinity of space', as Locke puts it (1690, book II, Chapter XVII, 3–9, 14–16), we have 'no idea of infinite space'. In order to have an 'idea of infinite space' i.e. a positive conception of it, we have to 'have a view of all those repeated ideas of space which an endless repetition can never totally represent to it'. To put it into our own terms: We need to observe the space as 'infinite and boundless' and thus we need to observe the 'phenomenal space' rather than experience it in order to have a positive conception of it. However, the observation of 'phenomenal space' remains impossible since we can only observe 'physical space' but not 'phenomenal space' which can only be experienced (see below). Locke's distinction between the 'idea of the infinity of space' and the 'idea of infinite space' can thus be supported by the distinction between 'biomechanical marker'/'phenomenal space' and 'mechanical marker'/'physical space'. The possibility to experience 'homogenous space' as well as 'unity in space' must thus be regarded as an 'intrinsic' characteristic of the functional organization of the brain, which reflects its orientation on 'biomechanical markers' rather than 'mechanical markers'. Accordingly, 'homogenous space' and 'unity in space' must be regarded as characteristics of the brain itself.'

'Phenomenal space' together with 'homogenous space' and 'unity in space' can therefore neither be inferred a posteriori i.e. from 'physical space' nor a priori i.e. from 'transcendental space'. Locke infers the possibility of 'phenomenal space', as characterized by the 'idea of the infinity of space', from 'physical space' as characterized by 'finite space' (1690, Book II, Chapter XVII, 3–9, 14–16). 'Phenomenal space' is thus a posteriori. He assumes that the 'idea of the infinity of space' is due to the 'repetition of ideas of simple space'. He therefore presupposes that this 'endless growing idea' is solely a matter of quantitative extension of 'finite space'. Considering the functional organisation of the brain, which is oriented on 'biomechanical markers' rather than 'mechanical markers', this must be regarded as false. Instead of being built on primarily 'finite space' and 'physical space', the 'idea of infinite space' and thus 'phenomenal space' is rather an 'intrinsic' characteristic of the organisation of the brain and spatial experience. Kant, in contrast, assumes that the 'transcendental ideality' of space is a necessary condition for the possibility of homogenous space i.e. 'phenomenal space' (Kant 1998) on which all spatial experiences depend. 'Phenomenal space' is thus a priori. Within the present context, the term 'transcendental space' may be re-interpreted and may therefore no longer refer to some kind of space within which the body and other things can be located. This presumption is disclosed in Merleau-Ponty's (1958: 284) comparison between container and content (see below). The term 'transcendental' may rather be 'naturalized' (see 3.3.3 for the definition of the term 'naturalism') and defined by the 'intrinsic' relationship between brain, body, and environment. As demonstrated above (see 2.1.1), this 'intrinsic' relationship between brain, body, and environment i.e. 'embedment' provides the 'unity in space' (see above). The 'form' of space i.e. the 'container' and the 'content' in space no longer need to be separated: 'To be a body, is to be tied to a certain world, as we have seen; our body is not primarily in space: it is of it' (Merleau-Ponty 1958: 171). Kant was therefore right when he assumed that 'unity in space' is possible and necessary. However, he was wrong by presuming that the 'unity in space' cannot be provided by the body itself, which leads to the assumption that 'transcendental space' and consequently the separation between 'form' and 'content' of space exist. Moreover, the term 'a priori' must be re-interpreted in a novel way within the context of space. It can no longer be defined as 'prior to and independent from all experience' (Kant 1998). Since 'phenomenal space' provides the necessary condition for the possibility of 'physical space' (see 2.1.1.2.2), 'a priori' may be defined as 'prior to physical conception of space'. In summary, Kant's conception of space may be re-interpreted within the framework of 'embedment' by inclusion of 'embedment' and 'phenomenal experience' in the definition of the terms 'transcendental' and 'a priori' respectively.

'Phenomenal space' and 'physical space'

Let us first imagine a case where spatial coding with regard to the own body would no longer be subserved by 'biomechanical markers' but rather 'mechanical markers'.

In that case, there would be a relation between neural activity and the absolute position of single body parts/limbs. Instead of one body image, we would probably have several images each related to distinct parts of the body. These different images could no longer be integrated and unified into one body image. Functionally, the own body would thus be coded in terms of 'mechanical markers' rather than 'biomechanical markers', which results in 'spatial heterogeneity'. Phenomenally, neither 'unity in space' nor 'non-structural homogeneity' but rather 'diversity in space' and 'structural heterogeneity' would exist. Accordingly, we would experience our own body in the same way we observe others' bodies and would no longer have a 'body image'. Nevertheless, even the observation of others' bodies could be impaired. We may also no longer be able to relate others' bodies to our own body and would therefore link different spatial coordinates with each other. One could therefore assume that patients with disturbances in their body image would also show deficits when observing others' bodies. This is indeed the case (Berlucchi & Agliotti 1997). A linkage between 'phenomenal and physical space' remains subsequently impossible. The thought experiment demonstrates the following: (i) the possibility of generating a 'body image' is necessarily dependent on the kind of coding of the spatial coordinates of the own body; (ii) the experience of 'non-structural homogeneity' is necessarily dependent on the possibility of the creation of a 'body image'; (iii) the possibility of linkage between 'phenomenal and physical space' is necessarily dependent on the experience of 'non-structural homogeneity' with respect to the own body.

Imagine a second case where, similar to the own body, the bodies of others could also be observed in terms of 'biomechanical markers'.

Functionally, a distinction between 'mechanical markers' and 'biomechanical markers' would no longer exist. Phenomenally, the 'phenomenal space' from the own body would be extended to the bodies of other individuals. 'Spatial homogeneity' and 'unity in space' would thus include both the own and other bodies. The own body could probably no longer be distinguished from other bodies because all bodies are spatially homogenized and unified. Only 'phenomenal space' but no 'physical space' would exist. The thought experiment demonstrates the following: (i) the possibility of generating a 'body image' is not necessarily dependent on the kind of coding of the spatial coordinates of other bodies; (ii) the restriction of 'non-structural homogeneity' to the own body is necessarily dependent on differential coding of the spatial coordinates of the own and other bodies; (iii) the distinction between the own and others bodies is necessarily dependent on the possibility of the distinction between 'phenomenal space' and 'physical space'.

Thirdly, imagine a case with a reversed design in regards to the own and other bodies.

Functionally, the bodies from other individuals would be coded in terms of 'biomechanical markers' whereas the neuronal activity that underlies the own body would rather reflect 'mechanical markers'. Phenomenally, while the own body would be observed in terms of 'diversity in space' and 'structural heterogeneity', others' bodies would be experienced in terms of 'unity in space' and 'non-structural homogeneity'. Accordingly, 'phenomenal space' would be related to other bodies while 'physical space' would be associated with the own body. We would have a 'body image' of another person but not for our own. We would probably remain unable to link the own and other bodies and thus 'phenomenal and physical space'. The thought experiment demonstrates the following: (i) the possibility of generating a 'body image' is not necessarily linked to the own body; (ii) the possibility of dissociation between 'phenomenal space' and 'physical space'; (iii) the possibility of dissociation between 'phenomenal/physical space' and own/other bodies.

In summary, the following conclusions can be drawn: (i) there is a relationship between the kind of coding of spatial coordinates and the kind of space; (ii) there is a relationship between differential kinds of spatial coding and the difference between the own and other bodies; (iii) there is a relationship between different kinds of space and the difference between the own and other bodies; (iv) there is no necessary linkage between the body image and the own body; (v) the possibility of a linkage between 'phenomenal and physical space' is necessarily dependent on 'phenomenal space' with respect to the own body.

The neuroepistemological hypothesis

Hypothesis: There is a relationship between the experience of 'phenomenal space' and neural coding of space in terms of 'biomechanical markers'.

Neuroscientific implications: (i) a relation between 'biomechanical markers' and neural activity that underlie the creation of the body image; (ii) a dependence of the body image i.e. its creation on tactile/propioceptive events, as related to the somatosensory cortex, and the transformation of the body shape into space, as related to the parietal cortex; (iii) a relation between the involvement of the insular/right parietal cortex and the attribution of the body (image) to the own person.

Epistemological implications: (i) dependence of the possibility of 'phenomenal space' on the creation of a body image; (ii) differential characterization of 'phenomenal and physical space' with regard to the integration of different spatial coordinates which reflect different spatial relationships between body and environment; (iii) dependence of the distinction between the own and other bodies on the distinction between 'phenomenal and physical space'.

2.1.2 'Individual embedment': 'Intra-subjective character' of 'phenomenal space'

Functional brain organisation: Phantom sensations and cortical plasticity
The most interesting disturbance of the body image is the phantom limb where 'people who have lost an arm or leg often perceive the limb as though it is still there' (Melzack 1992: 90). Several philosophers, including Descartes and Merleau-Ponty, recognized the possibility of phantom limbs which, due to the introduction of new imaging techniques, has recently invoked interest among neuroscientists as well. Following, we will briefly describe the phenomenon of phantoms as well as the pathophysiological mechanisms that are potentially essential for them.

Some authors (Ribbers et al. 1989: 137; Heinzel 1999) distinguish between the terms 'phantoms', 'phantom sensation', and 'phantom pain'. 'Phantom' refers to the 'awareness of non-existent or deafferentiated parts of the body with a specific shape, a specific weight, or a specific kinetic'. 'Phantom sensation' refers to all painless sensations of the phantom; this term can be used synonoumsly with 'phantom experiences'. 'Phantom pain' refers to all painful sensation of the phantom. Phantom sensations can occur after the amputation of the legs as well as almost all other parts of the body (breast, rectum, penis, etc). They are characterized by kinaesthetic sensations, kinetic sensations i.e. feelings of movements, and exteroceptive sensations i.e. feelings of external pressure, tactile stimuli or alterations of temperature (Jensen et al. 1984). The central characteristic of phantom sensations is the subjective experience of a feeling of certainty despite the objective counterevidence. This feeling of subjective certainty leads to the conviction of reality of the phantom: 'The most extraordinary feature of phantoms is their reality to the amputee. Their vivid sensory qualities and precise location in space – especially the first –

make the limbs so lifelike that a patient may try to step off a bed onto a phantom foot or lift a cup with a phantom hand. The phantom, in fact, may seem more substantial than an actual limb, particularly if it hurts' (Melzack 1992: 90). Most important, the subjective feeling of a phantom is stronger than the insight into the objective reality of the loss of that particular limb. This feature is demonstrated impressively in the following case reports. 'A sailor accidentally cut off his right index finger. For forty years afterwards he was plagued by an intrusive phantom of the finger rigidly extended, as it was when cut off. Whenever he moved his hand towards his face – for example to scratch his nose – he was afraid that his phantom finger would poke his eye out. He knew this to be impossible, but the feeling was irresistible' (Sacks 1985: 63–64). Another patient (P) without any cognitive deficits reported a phantom arm in his conversation with an interviewer (I) (Halligan et al. 1993: 159–166):

I: How many arms do people usually have?
P: Two.
I: And if someone lost an arm, they would have?
P: Just the one.
I: How many arms do you have?
P: Three.
I: How did that happen?
P: I had one amputated.
I: If you have two arms and one was amputated, how many arms would you have?
P: Two or three. I know it's a nonsense.

Another characteristic of phantom sensations consists in the fact that they can be influenced and modulated by a variety of internal and external stimuli. Physical stimuli such as temperature and weather for example, may modulate the feeling of the phantom limb: 'Thus before a spell of frost his toes felt crushed as if by a tight show. (..) Again, before rain he had the sensation as if his foot and toes were incompletely immersed in water which was being gently whirled around. (..) All these abnormal sensations were more obtrusive in the winter and so accurate that he had gained a local reputation as a weather prophet'. (Riddoch 1949: 199). In addition to physical stimuli psychological functions may modulate phantom sensations as well: Strong concentration ('.... when his mind was fully occupied he was unaware of his phantom...' (Riddoch 1949: 198)) or intense emotions ('..Emotions such as anger or excitement makes the patient forget the phantom' (Henderson & Smyth 1948: 98) may modulate the phantom sensation.

How can we account for the phantom phenomena?

Melzack (1990, 1992) presupposes a neural network or a so-called 'neuromatrix' – which consists of the somatosensory system, reticular afferents to the limbic system, and cortical regions. This 'neuromatrix' is important for self-recognition and the recognition of external objects and entities. It is largely pre-wired by genetics, generates a continuous pattern of activity i.e. the 'neurosignature', which can be modified by new sensory inputs Consequently, Melzack distinguishes between a genetically determined and thus unchangeable part within the neuromatrix (the 'phylomatrix') and an experience-dependent part (the 'ontomatrix') (Melzack 1989: 10). In the anatomical regions of the neuromatrix, neural processing is generated in parallel cycles. Melzack calls this 'cyclical processing' and claims that it provides feelings and actions that are related to the body image. Phantom phenomena may be caused primarily by the persisting activity of the components within the 'neuromatrix', and by the brain's interpretation of this activity, which is associated with the lost body part. It needs to be noted that the above-mentioned components have been deprived of their normal inputs.

How does this alteration in the brain's interpretation of activity take place: that is, what are the corresponding physiological mechanisms?

Recent research shows that the existence of phantoms is closely related to cortical plasticity, which reflects reorganisational processes in the somatosensory cortex (Ramachandran 1990, 1993; Ramachandran et al. 1995, 1996). If, for example, the right hand is amputated, the left hand has to perform all the functions of the right. The cortical area for the left hand is enlarged by these additional demands. Similar observations have been made in musicians. Their trained fingers, which are involved in playing the respective instruments, show much larger areas of representation in the somatosensory cortex than the other fingers (Elbert et al. 1995). Phantom sensations may subsequently be accounted for by similar mechanisms of cortical reorganisation. Representational areas for still existing limbs are overlapping with the ones of the amputated limbs. Neuronal impulses, as derived from still existing limbs can be associated with the amputated limb. One may therefore assume a confusion in recognition of the origin of neuronal impulses (Flohr et al. 1995; Knecht et al. 1996, 1998).

What are the mechanisms of cortical reorganisation?

Partial deafferentiation, which reflect a disruption of neuronal linkages in cases of amputation, may occur in a staged fashion (Berlucchi & Aglioti 1997). It may first involve the immediate expression of latent inputs, second the formation of new synapses, and third the stabilization or elimination of synapses in accordance with their functional usefulness. Afferences, being functionally inactive before an amputation, may be reactivated during partial deafferentiation. This may provide new functional linkages that had not been functionally relevant before the deafferentiation. The demasking of previously subthreshold synapses, as induced by the loss of gaba-ergic mediated local inhibition, as well as the modulation of NMDA-receptor mediated synaptic efficacy may play a crucial role in cortical reorganisation (Knecht & Ringelstein 1999). In general, cortical reorganisation may be modulated by several factors, which include age, training, and a variety of different neurochemical agents (see Knecht & Ringelstein 1999 for an overview). However, it remains unclear, whether the phantom pain itself may be considered as a consequence of cortical reorganisation or as the cause for the induction of reorganisational processes. The latter assumption is supported by the reversal of the cortical reorganisation in those subjects who are given a regional anaesthesia for their phantom pains (Birbaumer et al. 1997) or myoelectric prosthesis (Lotze et al. 1999). It is therefore suggested that phantom pain and pain in general may alter the synaptic threshold for the activation in the somatosensory cortical areas which subsequently leads to cortical reorganisational processes. Finally, it is important to note that these processes of cortical reorganisation can only be induced by a functionally meaningful condition i.e. behaviourally and functionally relevant events. Meaningless stimuli like passive high-repetitive sensory stimulation do not lead to cortical reorganization because they lack behavioural relevance for the respective individual (Knecht & Ringelstein 1999). Consequently, the criterion for the induction of cortical reorganisation (of the body image) does not consist in any kind of change irrespective of its behavioral relevance. Instead, it is the significance of events, as accounted for by functional and behavioral relevance for the respective individual person, that has to be considered as crucial:

> The meaning of a stimuli for the behaving organism's attention and intentions seems to be crucial for the overall dynamics of the organisation of sensory cortical maps, so that foreign inputs that become expressed in a deafferentiated portion of the somatosensory cortex should be maintained only if they can command attention and be useful for motor control.
>
> (Berlucchi & Aglioti 1997: 563)

Neuroepistemological implications: Body as spatial centre and 'intra-subjective character' of 'phenomenal space'

'Intra-subjective character' of 'phenomenal space'

Functionally, the coding of the spatial coordinates of the body not only depends on the differences between different stimuli (see 2.1.1) and thus on the environmental context as such. Instead, the stimuli, whose differences are coded for, are selected in orientation on the functional and behavioural relevance for the respective individual (see 2.1.2). The environmental context itself is thus selected and adapted to the individual functional and behavioural needs (more about 'selective-adaptive coupling' between brain/body and environment in Chapter 3). The 'biomechanical markers' (see 2.1.1) can subsequently be characterized as 'intra-individual markers', which account for the individual determination of neural activity. The individual determination of neural activity is unavoidably accompanied by the exclusion of context-dependent stimuli when related to other individuals. Common contexts or environments are reflected in similar neural activity in different individuals. However, this is only true if the behavioural relevance is more or less the same. Similar environmental contexts are therefore not necessarily related with the same neural activity in different individuals. Neural activity is thus determined rather by 'intra-individual markers' than 'inter-individual markers'.

Phenomenally, this orientation of neural activity on 'intra-individual markers' may be reflected in the private experience of our body image. We experience our body image as individual and as inaccessible to others i.e. private. Experiencing the own body image as individual necessarily excludes the possibility of being able to experience a different body image with respect to the own body. Moreover, the body images of other people are excluded in the experience of our own body image. Similarly, our own body image remains inaccessible to others. Body image and 'phenomenal space' (see 2.1.1) subsequently remain individual and private; there is an 'intra-subjective character' in the experience of our own body. The observation of others' bodies, in contrast, can neither be characterized by an 'intra-subjective character' nor a 'spatial centre' (see below). We remain unable to elucidate the individual, functional, and behavioural relevance in other individuals. Their bodies can subsequently not be observed as individual and private i.e. their observation lacks the 'intra-subjective character'. Accordingly, we can account for other bodies only in terms of 'inter-individual markers' which, phenomenally, may be reflected in the 'inter-subjective character' of observation. Moreover, due to the lack of the private and individual determination of other bodies, they cannot be regarded as 'spatial centres'. We consequently remain unable to attribute a 'reference (i.e. their body) for an experiential perspective' to another person. Since the body image is determined as individual and private, we experience our own body as the 'spatial centre'. It is the 'SPATIAL centre' because the body image can be characterized by 'unity in space' (see 2.1.1). It is the 'spatial CENTRE' because the exclusion of all other bodies and body images (see above) results in experiencing our own body as THE reference i.e. the centre of reference for experiencing not just the own but also other bodies. Our body subsequently serves as the 'reference for an experiential perspective' (Damasio 1999: 145) or as the 'invariant centre of experiential space' (Metzinger 2000a: 25) (see also 2.4.1 for further extension and discussion with respect to the First-Person Perspective).

Due to the experience of our own body as a 'spatial centre', the own body is distinguished from other bodies. While the own body can be characterized by 'unity in space', others' bodies do not show such a 'unity in space'. The own body can thus serve as THE reference so that the assumption of any kind of 'transcendental unity' of space, as for example presupposed by Kant, remains no longer necessary. Instead, the 'transcendental unity' of space is shifted to the 'intrinsic' relationship between the own body and its respective environment i.e. 'embedment' (see also

2.1.1). Kant's distinction between 'transcendental ideality' and 'empirical reality' of space (Kant 1998) must therefore be re-interpreted. 'Transcendental ideality' of space no longer involves the 'unity of space', which is given independently from any kind of experience. Instead, the 'transcendental ideality' of space refers to the 'intrinsic' integration of the own body within the environment by means of which the 'phenomenal experience' of 'unity in space' is provided (see also 2.1.1). 'Empirical reality' of space, on the other hand, refers to the observation of space as 'physical space' with 'diversity in space'. This necessarily presupposes 'phenomenal space' and 'unity in space'. Kant was subsequently right when he distinguished between two different kinds of space with one being a necessary condition for the possibility of the other but not vice versa. However, he was wrong when he detached and separated the 'unity of space' from the own body by specifying it as 'transcendental'. Due to the neglect of the distinction between the own and other bodies in terms of space, Kant could not relate the 'unity in space' to the own body.

Body as 'spatial centre' and the 'intra-subjective character' of 'phenomenal space'
First, imagine a case with neuronal organisation pursuant to context-independent stimuli i.e. pure physical stimuli without any meaning.

Functionally, the organisation of neural activity would be independent from the meaning of the context for the respective individual person. Similar stimuli would lead to a similar neural organisation in different individuals. Neural activity would thus no longer be determined by 'intra-individual markers' but rather by 'inter-individual markers' that are shared by different people. Phenomenally, due to the exclusion of 'non-intra-individual markers', creating the own body as a 'spatial centre' would be impossible. Accordingly, experience of space would no longer be individual nor private. Spatial experience would thus no longer be inaccessible to others i.e. its 'intra-subjective character' would be replaced by an 'inter-subjective character'. The difference between the own and others would probably be resolved since both would be observed solely in terms of 'inter-individual markers'. The thought experiment demonstrates the following: (i) the possibility of characterizing the own body as individual and private is necessarily dependent on the consideration of the behavioural relevance in neuronal coding; (ii) the characterization of the own body as the 'spatial centre' of awareness is necessarily dependent on the characterization of the own body as individual and private; (iii) the possibility of experiencing 'phenomenal space' as 'intra-subjective' is necessarily dependent on the characterization of the own body as the 'spatial centre' of awareness.

Imagine a second case where others' bodies are coded not only by 'inter-individual markers' but similar to the own body, by 'intra-individual markers'.

The observation of body parts and 'objective space' with regard to other bodies (see 2.1.1) would be replaced by the experience of body image and 'phenomenal space'. A distinction between the ownership of different bodies may be quite difficult since both the own and other bodies are spatially homogenized and individualized. The ‘spatial centre’ can thus no longer be related to the own body exclusively but includes other bodies as well. The distinction between the ‘intra-subjective’ and ‘inter-subjective character’ of experience is blurred since the latter is no longer present. The thought experiment demonstrates the following: (i) the possibility to distinguish between the own and other bodies is necessarily dependent on the distinction between ‘intra-individual’ and ‘inter-individual markers‘; (ii) the characterization of the own body as the ‘spatial centre’ is necessarily dependent on the possibility to distinguish between the own and other bodies; (iii) the possibility to distinguish between the ‘intra-subjective’ and ‘inter-subjective character’ is necessarily dependent on the characterization of the own body as the ‘spatial centre’.

Imagine a third case with a reversed design in regard to the own and other bodies.

Functionally, while the neural activity that underlies other bodies would be characterized by ‘intra-individual markers’, the neural activity that is essential for the own body would probably be accounted for by ‘inter-individual markers’. Phenomenally, the other bodies may be regarded as the ‘spatial centre’ for the own experience in this case. The own physical body, however, would no longer be experienced as the own body. Instead, the bodies of others may be associated with the own experience. Accordingly, the ‘intra-subjective character’ of spatial experience would no longer be related to the own body but rather to other bodies. The ‘inter-subjective character’, on the other hand, would probably be related with the own physical body. One may therefore speak of a dissociation between ‘physical body’ and ‘phenomenal body’. The thought experiment demonstrates the following: (i) neural coding of spatial coordinates in terms of ‘intra-individual markers’ is not necessarily linked with the own body; (ii) the characterization of the body as the ‘spatial centre’ of awareness is not necessarily associated with the own body; (iii) the possibility of dissociation between ‘phenomenal body’ and ‘physical body’ is necessarily dependent on a non-necessary relationship between ‘spatial centre’ and own body.

In summary, the following conclusions can be drawn: (i) the possibility of neural organisation in orientation on ‘intra-individual markers’ is necessarily dependent on the relationship between different stimuli which in turn account for the context-dependence of neural activity; (ii) the possibility of privacy and individuality of spatial experience is necessarily dependent on the neuronal organisation in orientation on ‘intra-individual markers‘; (iii) the possibility to distinguish between ‘phenomenal and physical space’ is necessarily dependent on the distinction between ‘intra- and inter-individual markers‘; (iv) the possibility to distinguish between the own and other ‘spatial centres’ is necessarily dependent on the distinction between ‘phenomenal and physical space‘; (v) the possibility to distinguish between 'intra- and 'inter-subjective characters' is necessarily dependent on the distinction between the own and others' 'spatial centres'.

Neuroepistemological hypothesis
Hypothesis: There is a relationship between the 'intra-subjective character' of spatial sensation and neural coding of space in terms of 'intra-individual markers'.

Neuroscientific implications: (i) the neural activity, that is essential for the generation of the body image, can be characterized by 'intra-individual markers' and individual context-dependence; (ii) the neural activity, that is essential for the creation of the body image, is organized in orientation on behaviourally relevant events rather than behaviourally irrelevant events for the respective individual; (iii) the individual determination of neural activity that underlies the generation of both body image and space.

Epistemological implications: (i) characterization of the body as private and individual accounts for an 'intra-subjective character' in the experience of the own body; (ii) characterization of the own body as the 'spatial centre' serves as the reference for the awareness of our own and other bodies; (iii) dependence of the possibility of the distinction between the own and other bodies on the distinction between 'intra- and inter-subjective characters' in experience and observation respectively.

2.1.3 'Emotional embedment': 'Phenomenal-qualitative character' of 'phenomenal space'

Functional brain organisation: Viscero-emotional function and body image
The generation of the body image is closely related to the emotional and visceral function via the insular, which provides close linkage with the limbic system (see 2.1.1). The limbic system includes medial (i.e. hippocampus, parahippocampus, etc) and anterior (amygdala) structures of the temporal lobe as well as basal prefrontal cortical regions (i.e. orbitofrontal cortex). Especially the orbitofrontal cortex is of crucial importance for the integration of somatic and emotional functions (see 2.3.2 for further discussion about emotions). Two distinct neural networks can be distinguished within the orbitofrontal cortex: an orbital network and a medial network (Price et al. 1996, 1998, 2003, see also Morecraft et al. 1992, 1998). The orbital network includes posterior and lateral parts of the orbitofrontal cortex which are densely connected among each other. The orbital network receives afferences i.e. input from the medial and dorsal parts of the basal nucleus of the amygdala, which provides the linkage with emotional processing. Other inputs from the ento- and perirhinal cortex reflect medial temporal lobe structures. In addition, the or-

bital network receives several inputs i.e. afferences from almost all olfactory and gustatory regions as well as from visceral afferents that are implicated in control of vegetative functions and thus of the homeostatic regulation of internal bodily organs. Most important in the present context is that the orbitofrontal cortex receives direct and strong afferences from the somatosensory (SI and SII) and posterior parietal (area 7b, anterior intraparietal sulcus) cortex (Bates & Goldmann-Rakic 1993). On the basis of this connectivity pattern, it is assumed that the orbital network serves as a substrate for the integration of sensory-spatial, visceral and emotional functions with regard to the body (Price 1999). Consequently, the body image, as generated in somatosensory and posterior parietal cortex (see 2.1.1.1), seems to be directly connected with the emotional functions that are processed in the orbitofrontal cortex. In contrast to the orbital network, the medial network includes the medial orbitofrontal cortex as well as areas on the medial prefrontal cortical surface. The medial network receives afferences from the ventrolateral parts of the basal nucleus of the amygdala, the hippocampal and parahippocampal formation, and the hypothalamus. Consequently, the medial network is involved in both emotional and visceral processing. Since the medial prefrontal cortex participates in the generation of movements and action (via anterior cingulate i.e. area 24c and supplementary motor area i.e. area 6), the medial network relates the two functions i.e. visceral-emotional function with motor function.

Both orbital and medial network are closely connected with each other which allows information to flow from viscerosensory to visceromotor systems. The importance of the anatomical and connectional distinction between medial and orbital network is further underlined by results obtained in imaging studies. A reciprocal pattern of neural activity has been observed in the medial as well as in the lateral orbitofrontal cortex. Activation in the medial orbitofrontal cortex is accompanied by deactivation in the lateral orbitofrontal cortex during negative emotional processing (Northoff et al. 2000, 2002; Mayberg et al. 1999) Cognitive processing (language, attention, working memory), on the other hand, induces an inverse pattern that consists of deactivation in the medial and activation in the lateral orbitofrontal cortex (Drevets & Raichle 1998; Northoff et al. 2000a, 2002, 2003c). This reciprocal pattern may be, at least partially, mediated by gaba-ergic neurotransmission since GABA-A receptor agonists (i.e. potentiators), such as lorazepam lead to the reversal of activation and deactivation in the medial and lateral orbitofrontal cortex (Northoff et al. 2002). Additionally, the orbitofrontal cortical function (OFC) has to be distinguished from the dorsolateral prefrontal cortical function (DLPFC) (Sarazin et al. 1998; Dias et al. 1996, 1997). While the OFC is involved in behavioural-emotional linkage, the DLPFC subserves cognitive functions in order to control action and behaviour (see also 2.4.3.1). The importance of the distinction between OFC and DLPFC is further underlined by the possibility of a 'double dissociation' between both regions with regard to neuropsychological functions (Sarazin et al. 1998; Dias et al. 1996, 1997).

Considering the particular function of the orbitofrontal cortex, Damasio (1995, 1999, 2003) developed his hypothesis of 'somatic markers'. His hypothesis relies on the linkage between sensory, motor, and emotional function in the orbitofrontal cortex which, according to him, must be considered as crucial for the generation of a phenomenal experience. First, Damasio distinguishes between 'emoticons' and 'feelings'. Emotions are outwardly directed and publicly observable responses. 'Feelings' on the other hand are rather inwardly directed and are therefore private mental experiences (Damasio 1999: 36, 42). He furthermore distinguishes between three consecutive stages, a state of emotions, a state of feelings, and a state of feelings that is made conscious as a kind of knowing the own feelings (Damasio 1999: 37). Secondly, relying on the anatomical and connectional characteristics of the orbitofrontal cortex, he closely links emotions with somatic states of the body: '... the results of emotions are primarily represented in the brain in the form of transient changes in the activity pattern of somatosensory structures, I designated the emotional changes under the umbrella term 'somatic state'. Note that by somatic I refer to musculoskeletal, visceral, and internal milieu components of the soma and not just to the musculoskeletal aspect' (Damasio 1995: 243). Emotional states serve as 'somatic markers' for bodily states so that both bodily and emotional functions are matched with regard to each other. Thirdly, a particular activity pattern in the orbitofrontal cortex can 'trigger the reactivation of the somatosensory pattern that describes the appropriate somatic state' (Damasio 1995: 243). Due to the matching between emotional and somatic functions, both can reciprocally trigger each other. Fourthly, the reactivation of a specific match between emotional and somatic states can occur via a 'body loop'. The reactivation via 'body loop' would result in actual changes within the body itself - through the transmission of signals to the subcortical and the brain stem nuclei. Reactivation can also occur via an 'as if loop' in which the reactivation signals are conveyed directly to the somatosensory and posterior parietal cortical areas while subcortical and brain stem nuclei and thus the body itself are bypassed (Damasio 1995, 1999). Fifthly, since emotional states serve as markers for somatic states, the somatosensory pattern is marked as good or bad by the corresponding emotional state (Damasio 1995: 243). The process of emotional evaluation of somatic states may either be conscious (i.e. overt) or unconscious (i.e. covert). Sixthly, specific matches between somatic and emotional states influence cognitive processes like working memory, attention, and logical reasoning by either facilitating or inhibiting them (Damasio 1995, 1999) (see 2.4.3 for more extensive discussion about emotional-cognitive interaction). Seventhly, due to the link between emotional and somatic states, there are neither pure sensory i.e. perceptual nor pure motor states because all of them are accompanied by correlative changes in emotional and visceral states (Damasio

1999: 146–148). Eighthly, patients with lesions in the orbitofrontal cortex show lack of emotional control with affective instability. These symptoms are accompanied by lack of control of somatic i.e. bodily states. From a psychodynamic point of view, these patients show a regression of psychological abilities to bodily functions by unconsciously equating emotional with somatic functions (Solms 1998a: 923–924, 934–935; Northoff et al. 2003).

The functional importance of the orbitofrontal cortex for the visceral and emotional evaluation of somatic i.e. bodily states is further underlined by the consideration of developmental and neuropsychiatric observations. According to Shore (1996), the function of the orbitofrontal cortex is crucial for 'affective and social imprinting in the first two years of life' because it provides the 'affective core of the self'. By relating emotional states with somatic i.e. bodily states, the orbitofrontal cortex apparently accounts for the development of a socio-emotional content for the respective individual person (Shore 1996). This is paradigmatically reflected in the neuropsychiatric illness of catatonia (see Northoff 2003b). Catatonia is a psychomotor syndrome that can be characterized by the co-occurrence of emotional, behavioural, and motor disturbances (Northoff 2003b; Northoff et al. 1999, 2000, 2003). These patients are often entirely immobilized, showing bizarre postures. Moreover, they are completely mute and extremely anxious. Subjectively, most patients report that they were 'immobilized by anxiety' (Northoff 2003b; Northoff et al. 1998). Therefore, some authors consider catatonia as a human analogue to the 'immobilization reflex' in animals. Interestingly, recent imaging studies in fMRI and MEG revealed severe alterations in the orbitofrontal cortical function with an inverse pattern of neural activity in catatonia (see Northoff et al. 2003). During negative emotional processing, the patients showed a reversed pattern that consisted of deactivation in the medial and activation in the lateral orbitofrontal cortex. Moreover, functional connectivity between orbitofrontal and premotor cortical structures was shown to be altered in catatonia which probably accounted for the disturbance in the emotional-motor transformation in these patients. In addition to orbitofrontal cortical alterations, catatonic patients can be characterized by a decrease in the regional cerebral blood flow and gaba-ergic binding in the right posterior parietal cortex which may account for their motor deficits i.e. posturing (Northoff et al. 1999, 2000).

Neuroepistemological implications: Emotions and the 'phenomenal-qualitative character' of 'phenomenal space'

'Phenomenal-qualitative character' of 'phenomenal space'

Functionally, the body image cannot only be described by spatial and individual properties but in addition, by viscero-emotional functions. Viscero-emotional functions characterize the respective state of the body and could therefore be regarded as 'somatic markers' (see 2.1.3 and Damasio 1999) or 'emotional markers'. Accordingly, the body image may be characterized by 'bio-mechanical markers' as 'spatial markers' (see 2.1.1), 'intra-individual markers' as 'private markers' (see 2.1.2) and 'emotional markers' as 'somatic markers'. These three kinds of markers build upon each other. 'Intra-individual markers' are only possible on the basis of 'bio-mechanical markers'. If there were 'mechanical markers' instead, an individual selection of the differences between stimuli would no longer be possible, which would make 'intra-individual markers' as such impossible (see 2.1.2). Moreover, 'emotional markers' necessarily presuppose 'intra-individual markers'. Emotions, as defined by 'feelings' (see 2.3.2), can be accounted for by an 'intra-subjective character' in experiences. The 'intra-subjective character' in the experience of emotions, however, is only possible if the own body is determined as individual and private (see 2.1.2). Otherwise, in case of a non-individual and non-private determination of the body, emotions as such must necessarily remain impossible. This is, for example, the case when observing other bodies whose observation can only be accounted for by an 'inter-subjective character' (see 2.1.2). Accordingly, we experience no emotions with respect to other bodies i.e. we have no access to their body state which indicates 'emotional markers' as 'somatic markers'.

Phenomenally, this conjunction between 'bio-mechanical markers', 'intra-individual markers', and 'emotional markers' may be reflected in the 'phenomenal-qualitative character' of the experience of 'phenomenal space'. While the term 'phenomenal' circumscribes 'pure experience' without any other cognitive ingredients like reflection or recognition, the term 'qualitative' points out the character of experience as a 'feeling' i.e. 'raw feeling' (see Metzinger 1995: 22–24). The linkage between 'bio-mechanical and emotional markers' may account for this 'raw feeling'. We feel our own body; this feeling may be stronger than any cognitive insight as it is, for example, the case in phantom limbs (see 2.1.2). The 'raw feeling' itself is subsequently not mediated by any cognitions. Otherwise, this 'raw feeling' would not persist even in the case of strong cognitive counter-evidence like, for instance, in patients with phantoms (see 2.1.2). The 'raw feeling' therefore reflects 'pure experience' without any cognitive ingredients. Moreover, due to the linkage between 'intra-individual and emotional markers', the 'raw feeling' remains 'private' and 'intra-individual' which restricts the experience of this 'raw feeling' to the own body. In contrast, we remain unable to experience this 'raw feeling' in the case of other bodies i.e. the experience of the 'raw feeling' cannot be shared with others. Since the experience of the 'raw feeling' is necessarily restricted to our own body, it can be accounted for by an 'intra-subjective character' (see 2.1.2).

The 'raw feeling' itself can be described by 'phenomenal certainty' and 'lucidity'. 'Phenomenal certainty' refers to a feeling of certainty as a kind of 'pre-reflexive self-confidence' that can persist even in the case of strong counter-evidence. For example, patients with supernumary limbs show persistent feelings of an additional limb even though they know this to be impossible (see 2.1.2). The feeling of 'phenomenal certainty' in this case reflects the linkage between the 'intra-subjective character' when experiencing the own body and 'emotional markers'. The 'intra-subjective character' of the experience becomes therefore emotionally coloured and loaded. Since emotions as 'somatic markers' reflect the own body state (see above), one is inclined to infer that one cannot be wrong about the own body i.e. one must be certain about the own body. Phenomenally, this inference may be reflected in 'phenomenal certainty' with regard to the own body. The observation of other bodies, in contrast, is not emotionally coloured and loaded because we have no access to their respective body state. We remain emotionally indifferent to other bodies and do not infer that we cannot be wrong about other bodies i.e. we are not certain about other bodies. Phenomenally, the lack of this inference may be reflected in the absence of 'phenomenal certainty' with regard to other bodies. 'Lucidity' refers to the 'direct giveness of contents as part of the world' (see Metzinger 1995: 22–24). Due to the lack of cognitive mediation (see above), we experience our own body as directly given by means of the 'raw feeling'. We feel our body (see above) and we infer from this that we have direct and immediate access to our own body. In contrast, other bodies are not directly given; we do not feel them and have neither immediate nor direct access to them. Instead of feeling them, other bodies can be accounted for only by cognitive mediation i.e. so-called 'social cognition' (see 2.4.3), which provides us with indirect and mediated access.

Spatio-emotional linkage and 'phenomenal-qualitative character' of 'phenomenal space'

Imagine first a case with a direct linkage between 'spatial markers' and 'emotional markers'.

Functionally, a direct connection between posterior parietal cortex and lateral orbitofrontal cortex would no longer exist (see 2.1.3). Phenomenally, spatial experience would still be 'private' and 'intra-individual' since it relies on 'intra-individual markers' (see 2.1.2). However, spatial experience of the own body would no longer be characterized by 'raw feeling', lucidity', and 'phenomenal certainty' which reflects its 'phenomenal-qualitative character'. Accordingly, there would no longer be any phenomenal difference between the experience of the own body and the one of other bodies with respect to emotional involvement. The thought experiment demonstrates the following: (i) the 'phenomenal-qualitative character' of spatial experience is necessarily dependent on the conjunction between 'spatial, intra-individual, and emotional markers'; (ii) there is a possibility of dissociation between 'individuality/privacy' and 'phenomenal-qualitative character' in the experience of the own body; (iii) the possibility of the phenomenal distinction between the own and other bodies is necessarily dependent on the spatio-emotional linkage with respect to the own body.

Imagine a second case, one without a difference between 'spatial markers' and 'emotional markers' i.e. both being subsequently identical.

Functionally, posterior parietal and orbitofrontal cortex could no longer be distinguished from each other i.e. they would be identical and should functionally be considered as one homogenous region. Phenomenally, the distinction between emotional and spatial experience would no longer subsist. Spatial experience would no longer be emotionally coloured, as it is actually the case (see also 2.1.3). Instead, spatial and emotional experiences would be identical. Conversely, emotional experience would be necessarily spatial. Accordingly, one may assume spatio-emotional synaethesia. The 'phenomenal-qualitative character' of spatial experience would be extended to other bodies as well (see also 2.1.2). We would probably be able to 'feel' the others' body. 'Raw feeling', 'lucidity', and 'phenomenal certainty' in connection with the others' body that so far was restricted to our own body would be possible. The phenomenal distinction between the own and other bodies could subsequently become almost impossible. The thought experiment demonstrates the following: (i) the restriction of the 'phenomenal-qualitative character' of spatial experience to the own body is necessarily dependent on the linkage between 'intra-individual markers' and 'emotional markers'; (ii) the 'phenomenal-qualitative character' of spatial experience is not necessarily related to the own body; (iii) the possibility of the phenomenal distinction between the own and others bodies is necessarily related to the restriction of the 'phenomenal-qualitative character' in the experience of the own body.

A third case with a reversed design concerning the relationship between spatial and emotional function could also be imagined.

Functionally, one would expect unilateral control of either posterior parietal cortex or orbitofrontal cortex by the respective other region. Unilateral connectivity would thus replace reciprocal connectivity as well as bilateral dependency between both regions. Phenomenally, while the experience of the others' body shows a 'phenomenal-qualitative character', the own body is rather observed in physical terms. While there would be 'lucidity' and 'phenomenal certainty' when experiencing other bodies, the own body would remain phenomenally inaccessible. We experience the others' body while observing our own body. The thought experiment demonstrates the following: (i) the linkage of the own body with the 'phenomenal-qualitative character' of spatial experience is necessarily dependent on the direction of the spatio-emotional linkage; (ii) phenomenal access to the own body is necessarily dependent on the linkage of the own body with the 'phenomenal-qualitative character' of spatial experience; (iii) the possibility of dissociation between the 'phenomenal-qualitative character' and the own body.

In summary, the following conclusions can be drawn: (i) the relation between emotions and space depends on the kind of connectivity that exists between orbitofrontal and posterior parietal cortex; (ii) the individual and private character of spatial experience is not necessarily dependent on the 'phenomenal-qualitative character' since both can dissociate from each other; (iii) emotional experience of the own body is not a necessary condition for the possibility of spatial experience of it since both can dissociate from each other; (iv) spatio-emotional linkage is a necessary condition for the possibility of 'phenomenal certainty' and 'pre-reflexive self-confidence' with regard to the body image; (v) spatio-emotional linkage is a necessary condition for the possibility of 'phenomenal-qualitative character' of spatial experience; (vi) the possibility of dissociation between 'phenomenal-qualitative character' and the own body exists.

Neuroepistemological hypothesis

Hypothesis: There is a relationship between the 'phenomenal-qualitative character' in the spatial experience of the own body and neural coding of space in terms of 'emotional markers'.

Neuroscientific implications: (i) bilateral connectivity between lateral orbitofrontal and posterior parietal cortex; (ii) synchronization of neuronal activity between amygdala and orbitofrontal cortex; (iii) integration between medial and orbital network in the orbitofrontal cortex which provides the linkage between sensory, motor, and emotional functions.

Epistemological implications: (i) characterization of the 'phenomenal-qualitative character' of 'phenomenal space' by involving emotions that account for the 'raw feeling'; (ii) the linkage between the 'intra-subjective character' of 'phenomenal space' and 'raw feeling' as a necessary condition for the possibility of 'phenomenal certainty' and 'pre-reflexive self-confidence'; (iii) the possibility to distinguish between the own and other bodies depends on the experience of a 'raw feeling' with respect to the own body.

2.2 'Temporal embedment': The own body and other bodies

'Temporal embedment' describes the integration of the body within the temporal coordinates of the environment. The 'internal' temporal processes within the body must be somehow linked to the 'external' temporal processes within the environment. Analogous to 'spatial embedment' (see 2.1), distinct aspects and stages of 'temporal embedment' can be distinguished from each other. First, temporal processing within the 'internal' body is phenomenally accounted for by 'phenomenal time'. The individual body can therefore be linked to (and, at the same time, distinguished from) temporal sequences within the environment, which indicates 'environmental embedment' (see 2.2.1). Secondly, temporal processing within the 'internal' body must be detected and recognized as such. This is provided by 'phenomenal judgment', which reflects 'intra-subjective embedment' (see 2.2.2). Thirdly, temporal processing within the 'internal' body can be linked to and integrated in the observation of temporal sequences within the environment. 'Phenomenal time' is linked to 'physical time'. We can therefore make 'physical judgments' on the basis of 'phenomenal judgments'; this reflects 'inter-subjective embedment' (see 2.2.3).

2.2.1 'Environmental embedment': 'Phenomenal time'

Functional brain organisation: Sensorimotor integration

Rizzolatti et al. (1998) proposed a new concept for the organisation of the cortical motor system by making the following assumptions: (i) The motor cortex is shaped by a mosaic of anatomically and functionally distinct areas, each containing an independent representation of one particular body movement. Based on the respective cortical afferents and descending projections, each motor area plays a specific role in motor control. The classical view i.e. that there are only two motor areas in the cortex is wrong. Instead, there are multiple motor areas, which correspond to different movements respectively. (ii) Analogous to the motor cortex, the somatosensory cortex is also shaped by multiple areas, each being involved in the analysis of particular aspects of sensory information. (iii) The fronto-parietal connections account for multiple segregated anatomical circuits (PE-F1, VIP-F4, AIP-F5ab, PF-F5c, PEc-F2, PE-F3/6) that characterize basic functional units, which are devoted to specific sensorimotor integration (Rizzolatti et al. 1998). There is strong empirical support for sensorimotor integration. For example, a study, that investigated the association between auditory and visual stimuli in PET, revealed a sensory-motor component, which included primary and secondary sensory and motor cortical areas (McIntosh et al. 1998). The interdependence between sensory and motor function has also been demonstrated. Tactile sensations, accompanied by movements lead to the same enhanced activation (i.e. somatosensory evoked fields as measured with MEG) in the ipsi- and contralateral secondary somatosensory cortices (SII) as the tactile sensations that are not accompanied by movements (Forss & Jousmäki 1998). Unilateral deficits in tactile awareness, as observed in patients with right posterior temporal-parietal cortical lesions, can be improved by corresponding movements (Vaishnavi et al. 1999). Reaching and grasping movements, that necessarily require visual-motor transformation, have been shown to activate both premotor and posterior parietal cortex (Iacoboni 1999; Desmurget et al. 1999). In addition to fronto-parietal circuits, various types of feedforward and feedback loops may account for a reciprocal integration between sensory and motor function. These loops include 'exafference', 'reafference' and 'efference copies' (see Hurley 1998: 436–438 who relies implicitly on the work by von Holst). 'Exafference' reflects a 'feedforward' input whose source is the external environment e.g. the movement of external objects. In contrast to 'exafference', both 'reafference' and 'efference copy' may be regarded as feedback loops. 'Reafference' reflects afferent input, which is derived from sensory changes as induced by the own movement. It includes visual and propioceptive inputs that are caused by limb movement as well as other inputs from the environment insofar as they are affected by the movement itself. Reafferent signals induce changes in the somatosensory cortex by modulating the respective somatosensory evoked potentials that follow the movement potential (Bötzel et al. 1997). Either 'efference copy' or 'corollary discharge' can be regarded as a 'feedback loop' of the output, which reflects an 'efference' inside the central nervous system. Central efferent or motor output signals are projected to other processing areas of the brain including sensory areas. Sensory areas may then receive both kinds of signals i.e. from 'efference copy' and 'reafference' from the same movement. As a result 'internal' motor signals and 'external' sensory signals can be directly compared with each other which, neuroanatomically, may be subserved by the posterior parietal cortex.

A functional interdependence between sensory and motor system has been conceptualised in a model introduced by Miall and Wolpert (1996). The causal representation of the motor apparatus i.e. the movement can be described as a 'Forward dynamic model'. The sensory changes, which reflect 're- and exafferences', account for a so-called 'Forward output model'. The 'efference copy', on the other hand, which reflects the representation of those events that induced or caused the respective motor state i.e. the movement, are described as an 'inverse model' (Miall & Wolpert 1996; Wolpert et al. 1998).

Based on these models, actual and predicted state can be compared with each other. Reciprocal comparison between actual and predicted state may provide the functional basis for mutual adjustments between motor and sensory function. This 'comparator function' is assumed to be related to the neural function in the (right) posterior parietal cortex and the cerebellum. While the posterior parietal cortex may provide the 'spatial frame of reference' (see 2.1.1 and 2.1.2), the prefrontal cortex i.e. the dorsolateral prefrontal cortex (DLPFC) may rather account for temporal integration (Onoe et al. 2001; Harrington et al. 1998; Fuster et al. 2001; Quintana & Fuster 1999). Sensorimotor integration in the fronto-parietal circuits may therefore account for temporal and spatiotemporal integration. The different temporal coordinates of the sensory and motor function are adjusted to each other and linked with the respective spatial coordinates. One may subsequently regard sensorimotor integration as spatiotemporal integration (Vallar 1999; Castillo 1999; Desmurget et al. 1999; Mattingley et al. 1998; Snyder et al. 1997; Driver & Mattingley 1998). However, the exact neural and functional mechanisms of prefronto-parietal coordination that account for spatiotemporal integration, remain unclear.

Neuroepistemological implications: Sensorimotor integration and 'phenomenal time'

'Phenomenal time'

Functionally, integration between sensory and motor function requires integration between different temporal coordinates. The different sensory functions may occur at different points of time. Moreover, sensory functions in general may operate on a completely different time scale than motor functions. Integration between sensory and motor function subsequently requires integration between different temporal coordinates. This is provided by the various feedforward and feedback loops (see 2.2.1) which bridge the temporal gap between sensory and motor function by directly relating their different points of temporal occurrence. The mutual temporal adjustment between sensory and motor function is provided by 'exafference', 'reafference' and 'efference copy' (see 2.2.1). While 'exafference' and 'reafference' may allow for the integration of earlier i.e. past sensorimotor events within the present movement, 'efference copy' may account for the anticipation of future motorsensory events within the present movement. Since both, sensory and motor function, are inseparably intertwined, one can no longer speak of single and separated sensory and motor stimuli. Instead, the difference between sensory and motor stimuli is accounted for, which results in the orientation of neural activity on events (see also 2.3.1 as well as 3.1.2 for the difference between stimuli and events). These events may either be sensorimotor or motorsensory in nature. In the case of sensorimotor events, the sensory function predominates in the present while at the same time, past and future motor implications are integrated. In the case of motorsensory events, the motor function predominates in the present while past and future sensory implications are integrated. These 'feedforward and feedback' loops 'relate, compare, integrate, and reconcile simultaneous (and sequential) responses in different modalities' so that 'a temporal window of unity wide enough to allow for feedback for motor functions' (Hurely 1998: 204) is created. Sensorimotor integration therefore leads to temporal homogenisation that includes past (sensorimotor) and anticipates future (motorsensory) events i.e. there is 'temporal homogeneity' (see also Quintana & Fuster 1999 for empirical support). Accordingly, the temporal succession of sensory and motor stimuli is processed in relation rather than isolated and independent from each other. Instead of the 'absolute time points' of sensory and motor stimuli, the 'relative temporal distance' between sensory and motor stimuli is processed and coded. As introduced by Locke (1690, Book II, Chapter XIV, 7–8, 10–11), the distinction between 'absolute time point' and ‘relative temporal distance’ parallels with the distinction between ‘succession’ and ‘duration’. ‘Succession describes the temporal sequence of parts while ‘duration’ can be accounted for by the ‘distance between parts of succession’ so that the parts remain ‘inseparable’.

Phenomenally, ‘temporal homogeneity’ may be reflected in ‘phenomenal time’ as characterized by ‘presence’, ‘protention’, and ‘retention’ (Metzinger 1995: 31; Gadenne 1996 17–19; Lloyd 2002; this characterization of time as ‘phenomenal time’ can be traced back to Husserl). Due to sensorimotor integration, sensory and motor stimuli can no longer be distinguished from each other. As a result, their different points of temporal occurrence can no longer be distinguished from each other either. Past, present, and future sensory and motor stimuli are subsequently integrated into each other within events that account for ‘unity in time’. When we experience these events, the ‘unity in time’ is reflected as temporally homogenous i.e. ‘temporal homogeneity’. Although different aspects of the event may reflect different temporal coordinates, we nevertheless experience only one temporally homogenous event. The event is experienced as ‘present’ without any distinction between earlier and later i.e. between past and future aspects. While the integration of earlier i.e. past aspects within the ‘present’ event can be called ‘retention’ the anticipation of future aspects within the ‘present’ event may be described as ‘protention’. Experiencing events as ‘present’ thus reflects ‘temporal homogeneity’, which may be regarded as the phenomenal correlate of the ‘unity in time’. This ‘unity in time’ is experienced as eternity. Although we know that our own body is not eternal, we nevertheless experience ourselves in our mental states as eternal and independent from time. This is nicely reflected in the following quote from Spinoza (1985, Part V, prop. 23, school): ‘It is impossible, nevertheless, that we should recollect that we existed before the body, because there are no traces of any such existence in the body, and also because eternity cannot be defined by time, or have any relationship to it. Nevertheless we feel and know by experience that we are eternal. . . . Although, therefore, we do not recollect that we existed before the body, we feel that our mind, in so far as it involves the essence of the body under the form of eternity, is eternal, and that this existence of the mind cannot be limited by time nor manifested through duration’.

In contrast to the experience of the own body, we observe sensorimotor functions in other bodies as separate and thus as temporally heterogenous. While we remain unable to clearly distinguish between sensory and motor function when experiencing our own body, we are well able to do so when it comes to other peoples’ bodies. The temporally different sensory and motor stimuli are no longer integrated within the experience of one temporally homogenous event. Instead, we observe that distinct i.e. sensory and motor stimuli, reflect different ‘momentary time slices’ (Hurely 1998: 30–32). Due to this ‘diversity in time’, we remain able to distinguish between different points of temporal occurrence i.e. between past, present, and future. The observation of others' bodies is subsequently characterized by 'temporal atomism', 'temporal heterogeneity', (Hurely 1998: 30–32) and 'physical time' (Sandkuehler 1999: 1343–1345, 1804). While we experience ourselves as 'infinite and eternal', we experience other individuals as 'non-eternal and finite'. However, in contrast to the experience of the 'infinity of time' as the 'idea of the infinity of time', as Locke puts it (1690, Book II, Chapter XVII, 3–9), we have 'no idea of infinite time'. In order to have an 'idea of infinite time' i.e. a positive conception of it, we have to 'have a view of all those repeated ideas of time which an endless repetition can never totally represent to it'. To put it into our terms: We need to observe the time as 'infinite and eternal' and thus 'phenomenal time' rather than experiencing it to have a positive conception of it. Nevertheless, the observation of 'phenomenal time' remains impossible since we can only observe 'physical time' but not 'phenomenal time'.

Locke's distinction between the 'idea of the infinity of time' and the 'idea of infinite time' can be supported by the distinction between 'sensorimotor integration/'phenomenal time' and 'sensorimotor segregation'/'physical time'. The possibility of experiencing 'homogenous time' and 'unity in time' must thus be regarded as an 'intrinsic' characteristic of the functional organisation of the brain. This reflects its orientation on 'sensorimotor integration' rather than 'sensorimotor segregation'. Accordingly, 'homogenous time' and 'unity in time' must be regarded as characteristics of the brain itself. 'Phenomenal time' with 'homogenous time' and 'unity in time' can therefore neither be inferred a posteriori i.e. from 'physical time' nor a priori i.e. from 'transcendental time'. Locke infers the possibility of 'phenomenal time', as characterized by the 'idea of the infinity of time', from 'physical time' as 'finite time' (1690, Book II, Chapter XVII, 3–9) – 'phenomenal time' is thus a posteriori. He assumes that the 'idea of the infinity of time' is an 'endless growing idea' and that it is thus solely a matter of quantitative extension of 'finite time'. Considering the functional organisation of the brain, which is oriented on 'sensorimotor integration' rather than 'sensorimotor segregation', this must be regarded as false. Instead of being primarily built upon 'finite time' and 'physical time', the 'idea of infinite time' and thus 'phenomenal time' is rather built upon an 'intrinsic' characteristic of the organisation of the brain and a temporal experience itself. Kant, in contrast, assumes that the 'transcendental ideality' of time is a necessary condition for the possibility of homogenous time i.e. 'phenomenal time' (Kant 1998) on which all temporal experience depends – 'phenomenal time' is thus a priori. Within the present context, the term 'transcendental time' may be reinterpreted. 'Transcendental time' may no longer refer to some kind of time within which body and other things can be located as it is expressed in Merleau-Ponty's (1958: 284) comparison between container and content. Instead, the term 'transcendental' may rather be 'naturalized' (see 3.3.3 for definition of the term 'naturalism') and accounted for by the 'intrinsic' relationship between brain, body, and environment. As demonstrated above, this 'intrinsic' relationship between brain, body, and environment i.e. 'embedment' provides the 'unity in time' (see above). 'Form' of time i.e. the 'container' and the 'content' in time no longer need to be separated. Kant was subsequently right when assuming that 'unity in time' is possible and necessary. However, he was wrong by assuming that the 'unity in time' cannot be provided by the body itself which leads to the assumption of 'transcendental time' with the consecutive separation between 'form' and 'content' of time. Moreover, the term 'a priori' must be re-interpreted in a novel way within the context of time. It can no longer be defined as 'prior to and independent from all experience' (Kant 1998). Since 'phenomenal time' provides the necessary condition for the possibility of 'physical time', 'a priori' may be defined as 'prior to physical conception of time'. In summary, Kant's conception of time may be re-interpreted within the framework of 'embedment' with a consecutive inclusion of 'embedment' and 'phenomenal experience' in the definition of the terms 'transcendental' and 'a priori' respectively.

The relationship between 'phenomenal time' and 'physical time'

Imagine first a case without an integration between sensory and motor function.

Functionally, 'afferences', 'exafferences' 'and efference copies' in the above mentioned sense would no longer exist because sensorimotor integration would be superfluous. Furthermore, prefronto-parietal circuits would no longer be necessary so that sensory and motor areas would function more or less independently from each other. 'Temporal markers' for both sensory and motor function would be independent from each other. The different temporal coordinates of sensory and motor function would not be integrated within each other, which results in the absence of 'unity in time' and in the presence of 'temporal heterogeneity'. Neither past sensory-motor aspects nor future motor-sensory aspects could be integrated within the present event. Phenomenally, experience of 'phenomenal time' with respect to the own body would no longer exist but rather experience of 'physical time'. Accordingly, neither 'presence' nor 'retention' and 'protention' would be possible. Consequently, we would experience our own body temporally in the same way as we observe other bodies i.e. in terms of 'momentary time slices'; this ensues 'temporal atomism' and 'physical time'. Both the own and other bodies would thus be indistinguishable from each other in temporal regards. The thought experiment demonstrates the following: (i) the possibility of temporal integration i.e. 'temporal homogeneity' is necessarily dependent on sensorimotor integration by means of feedforward and feedback loops; (ii) the possibility of 'phenomenal time' is necessarily dependent on the possibility of 'temporal homogeneity'; (iii) the possibility of a temporal distinction between the own and other bodies is necessarily dependent on the distinction between ‘phenomenal time’ and ‘physical time’.

Secondly, imagine a case that includes the observation of other bodies in terms of ‘sensorimotor integration’.

Functionally, sensory and motor function would be subserved by exactly the same neuroanatomical areas so that both could no longer be distinguished from each other. Phenomenally, the experience of ‘phenomenal time’ would be extended to other bodies as well. Similar to the own body, there would be a ‘presence’ with ‘protention’ and ‘retention’ with respect to the other body. Accordingly, there would only be ‘phenomenal time’ but no ‘physical time’ which makes the temporal distinction between the own and other bodies impossible. The thought experiment demonstrates the following: (i) the possibility to restrict ‘temporal homogeneity’ to the own body is necessarily dependent on the distinction between sensory and motor function; (ii) the possibility to distinguish between ‘phenomenal time’ and ‘physical time’ is necessarily dependent on the restriction of ‘temporal homogeneity’ to the own body; (iii) the possibility of distinguishing between the own and other bodies is necessarily dependent on the distinction between ‘phenomenal time’ and ‘physical time’.

Thirdly imagine a case with a reversed design in regards to the own and other bodies.

Functionally, sensory and motor observations of other bodies would be integrated within each other while the sensorimotor functions of the own body would remain separate. Phenomenally, ‘phenomenal time’ would be experienced with respect to the other body while we would observe our own body in the same way (in temporal regard) as we usually observe other bodies. ‘Phenomenal time’ with ‘presence’ and ‘unity in time’ would thus be related to the other body while the own body would be characterized by ‘momentary time slices’, ‘temporal atomism’, and ‘physical time’. Accordingly, there would be dissociation between the ‘phenomenal body’ and the ‘physical body’ in temporal regards. The thought experiment demonstrates the following: (i) ‘temporal homogeneity’ is not necessarily related to sensori-motor integration of the own body; (ii) the experience of ‘phenomenal time’ is not necessarily related to the own body’s ‘temporal homogeneity’; (iii) the possibility to dissociate between ‘phenomenal body’ and ‘physical body’ in temporal regards.

In summary, the following conclusions can be drawn: (i) relationship between the processing of temporal coordinates and the kind of sensorimotor organisation; (ii) dependence of ‘temporal homogeneity’ on ‘sensorimotor integration; (iii) dependence of ‘phenomenal time’ on ‘temporal homogeneity’; (iv) dependence of the distinction between ‘phenomenal time’ and ‘physical time’ on different forms of sensorimotor organisation; (v) dependence of the possibility to distinguish between the own and other bodies on a distinction between ‘phenomenal time’ and 'physical time'; (vi) no necessary relationship between 'phenomenal time' and the own body; (vii) possibility to dissociate between 'phenomenal body' and 'physical body' in temporal regards.

Neuroepistemological hypothesis
Hypothesis: There is a relationship between the experience of 'phenomenal time' and sensorimotor integration.

Neuroscientific implications: (i) relation between sensorimotor integration and coordination of neural activity in prefronto-parietal circuits; (ii) dependence of sensorimotor integration on 'feedforward and feedback loops' including 'afferences', 'exafferences', and 'efference copies'; (iii) crucial role of the dorsolateral prefrontal cortex in temporal integration between sensory and motor function.

Epistemological implications: (i) dependence of the possibility of 'phenomenal time' on sensorimotor integration; (ii) differential characterization of 'phenomenal time' and 'physical time' with regard to the integration between different i.e. past, present, and future time points that reflect the different temporal relationships between body and environment; (iii) dependence of the possibility of a distinction between the own and other bodies on the distinction between 'phenomenal time' and 'physical time'.

2.2.2 'Intra-subjective embedment': 'Phenomenal judgment'

Functional brain organisation: 'Action judgments' and 'agency judgments'
The integration between sensory and motor functions (see 2.2.1) does neither imply detection of action as such nor attribution to a particular person. According to Jeannerod (1997, 2001, 2003), both detection and attribution of action are subserved by three distinct stages. The first stage consists of an automatic level that only involves nonconscious processing of those features of movements that are relevant to action. Automatic, non-conscious, and implicit processing is subserved by a 'fast system' (or 'How-system'), which is more or less independent from conscious processing (see below) (Jeannerod 2001; Prinz 2000). This 'fast system' is based on the mutual interdependence and integration between sensory and motor functions (see 2.2.1). It therefore provides fast and appropriate motor responses in a particular sensory i.e. environmental context. The movement itself cannot be consciously perceived and we are therefore unable to identify it as such. Jeannerod speaks of a so-called 'pragmatic representation' of the movement in the 'fast system'. The visuomotor transformation, as characterized by sensorimotor integration, can be considered as an example for the 'fast system'. Visuomotor transformation involves parietal areas that surround the intraparietal sulcus as well as the premotor cortical areas e.g. the supplementary motor area (Jeannerod 1997, 2001, 2003). Neuro-

chemically, the 'fast system' seems to be modulated by dopaminergic transmission. Patients with Parkinson's disease, suffering from nigrostriatal dopaminergic deficiency, show deficits in the 'fast system' whereas their 'slow system' seems to be preserved.

The second stage consists of a conscious explicit representation of the movement. This second stage is only necessary in the following cases: (i) failure of automatic processing as, for example, during the learning acquisition of novel movements; (ii) necessity of mental simulation of movements and action as, for example, during mental imagery (see also 2.4.1). Since in both cases, automatic processing remains absent, it has to be substituted for by a cognitive function. However, in contrast to automatic and non-conscious processing, involving a cognitive function requires time, which results in slow, conscious, and non-automatic processing i.e. a 'slow system' (or 'What-system'). Within conscious awareness, the meaning of action is revealed and one could speak of 'semantic representation' (Jeannerod 1999; Georgieff & Jeannerod 1998). 'Goal-orientation', as represented in 'pragmatic representation' within the 'fast system' (see above), is integrated within the 'semantic representation' of the 'slow system'. It therefore becomes available to conscious awareness. 'Semantic representation' in the 'slow system' may subsequently reflect a 'recursive structure in the sense that goals which account for automatic execution of individual movements are embedded into a broader goal which accounts for unfolding of the whole action' (Jeannerod 2001). Empirically, the assumption of a 'slow system' is supported by the classical experiments of Libet et al. (1982, 1983, 1985, 1993). He observed conscious awareness of movements and the urge to move after a temporal delay of only 300–500ms (see also Jeannerod 1997; Castiello et al. 1991). Although the experiments by Libet are constrained by several methodological shortcomings (see Prinz 2000; Keller & Heckhausen 1990; Walter 1998: 299–308), several independent studies yielded more or less similar results. The assumption of a 'slow system' that accounts for conscious awareness, may thus build upon empirical evidence (see Jeannerod 1997; Prinz 2000). Similar to the 'fast system' i.e. the primary motor cortex, the premotor cortex as well as the supplementary motor area, and the parietal areas are involved in the 'slow system' and thus in the generation of conscious representation of movements. In addition to these 'core areas', other areas are also involved in the 'slow system'. Conscious representation presupposes the process of 'explicit internal monitoring' for which the dorsolateral prefrontal cortex (i.e. DLPFC) is of crucial importance (Fink et al. 1999; Grafton et al. 1995). For example, patients with lesions in DLPFC are unable to switch from the automatic and non-conscious level of processing to the non-automatic and conscious level of processing. Behaviorally, the inability to switch is reflected in the continuation of making errors and perseverative-repetitive movements (Jeannerod 2001, 2003). In addition to the DLPFC, the ventrolateral prefrontal cortex may be crucially involved in 'explicit internal monitoring'. It may provide storage and retrieval of actual information (see Petrides 1995). Accordingly, patients with lesions in this region show severe deficits in the 'slow system'. They lack conscious awareness of their actions, which results in anosognosia of posturing and in the inability to inhibit inappropriate behaviour i.e. movements (Northoff 2003b; Shore 1996; Solms 1998a, b). Furthermore, the attention to movements is required for 'internal monitoring' and thus for conscious representation. Attention to movements involves the anterior cingulate, the anterior supplementary motor area, and the right and left posterior parietal cortex (see Jueptner et al. 1997; Gitelmann et al. 1996; Fink et al. 1999). Neurochemically, the 'slow system' seems to be somehow related to gaba-ergic neurotransmission. Patients with motor diseases, that are characterized by primary defects in gaba-ergic i.e. inhibitory neurotransmission e.g. Huntington's disease and catatonia, show a lack in their conscious awareness of their motor deficits (Snowdon et al. 1998; Northoff et al. 1998, 2000b, 2002). Especially catatonia can be considered as a paradigmatic example for an isolated deficit in the 'slow system'. While catatonic patients show severe deficits in their conscious awareness of movements and thus in the 'slow system' (see 2.1.3), their 'fast system', as demonstrated in ball experiments (Northoff et al. 1995b), seems to remain intact (Northoff 2003b). Moreover, these patients respond well to gaba-ergic substances like lorazepam so that one may assume a deficit in gaba-ergic transmission.

The third stage consists in the conscious attribution of an action to its proper agent. The 'action judgement', as generated in the second stage in the 'slow system' is supplemented by an 'agency judgment' as a 'Who-system' that attributes the action to one particular person (Georgieff & Jeannerod 1998; Jeannerod 1999, 2001). Daprati et al. (1997) designed a study where subjects had to discriminate their own hand from an alien hand on a screen, thus requiring 'agency judgments'. Since healthy subjects were well able to distinguish between their own and other hands, it is concluded that 'agency judgments' are based upon internal and self-generated action-related signals (Daprati et al. 1997; Jeannerod 2001). The prefrontal cortex and especially the right posterior inferior parietal cortex seem to be involved in the generation of 'agency judgment'. Interestingly, schizophrenic patients with hallucinations and delusions fail to make correct 'agency judgments': they misattributed the alien hand to themselves (Daprati et al. 1997) i.e. they tended to over-attribute actions that were produced by others, to themselves. Consequently, the effects of the actions of others are apparently (mis)interpreted through the intentions of the own self. The reverse pattern of misattribution occurs when subjects misattribute their own intentions or actions to external agents. Psychopathologically, this can be described by delusions of alien control or the passivity phenomena as characterized by external thought insertion and other i.e. so-called Schneider's First-Rank symptoms. Spence et al. (1997) performed a PET study on schizophrenic patients with delusions of alien control i.e. patients who felt their movements controlled by external agents. While performing a motor task, patients reported vivid experiences of alien control and showed concurrent hyperactivation in both premotor and right inferior parietal cortex. Since the frontal cortex suppresses and inhibits activities in association cortices such as the parietal cortex (see Jahanshahi & Frith 1998), hyperactivity in the right inferior parietal cortex may result from lack of prefrontal cortical inhibition. Misattributing the own movements to external agents may thus be due to a deficit in cortico-cortical inhibition with subsequent parietal cortical overexcitation. It may be assumed that externally generated (sensory) signals can no longer be suppressed sufficiently which may result in an inability to correctly distinguish between internally- and externally generated signals (see also Blakemore et al. 1998, 2000; Luu et al. 2000). Consequently, particularly the right posterior inferior parietal cortex, by maintaining a kinaesthetic model of the own ongoing movements, seems to be involved in the generation of 'agency judgments' (Sirigu et al. 1999; Binkowski et al. 1999).

Neuroepistemological implications: 'Agency/action judgments' and 'phenomenal judgments'

'Phenomenal judgments'

Functionally, execution ('automatic response system') as well as judgment of action ('action judgment system') can be distinguished from each other in terms of temporal processing. While execution of action can be characterized by a 'fast system', judgment of action is rather associated with a 'slow system'. In contrast to the principal temporal differences, there are apparently no major spatial differences between execution and judgment of action. Both are subserved by so-called 'core areas', which are complemented by further areas in the 'action judgment system' (see 2.2.2). If (more or less) the same areas are involved, the question for their functional differentiation with respect to execution and judgment of action arises. Considering the principal temporal differences, one may be inclined to assume different kinds of temporal processing upon the same areas; this in turn, indicates different functional processes i.e. execution and judgment of action respectively. The transition from fast to slow processing in these 'core areas' may lead to the transformation from 'pragmatic representations' into 'semantic representations' (see 2.2.2). An executed action that reflects 'pragmatic representation' can therefore be re-processed slowly by means of which it is transformed into a judgment with 'semantic representation'. In particular, the 'goal-orientation' of the executed action may be reprocessed while the execution itself remains neglected in slow reprocessing. The 'goal-orientation' itself becomes subsequently available for judgments without accompanying execution. Functional differentiation between execution and judgment of actions relies predominantly on different kinds of temporal processing that are either fast or slow. While fast processing in the 'core areas' may indicate the execution of the 'goal-orientation' of a particular action, slow re-processing of the 'goal-orientation' in the same areas may rather code for judgment of the executed action. While neural differentiation between execution and judgment seems to be based on temporal distinction, judgment and attribution may rather be distinguished from each other by means of neural inhibition and excitation. However, since the exact neural mechanisms, that are essential for the differentiation between 'agency judgment' and 'action judgment', remain unclear one cannot exclude the possibility of a combination of both mechanisms.

Phenomenally, the difference between execution and judgment of action may be reflected in the difference between lack of awareness of the executed movement itself and conscious awareness of the intention to move (see also Jeannerod 1997). We can only make 'phenomenal judgments' about our intention of movements but not about their execution. Execution of action is subserved by 'pragmatic representation' within a 'fast system', which as such is not accessible to conscious awareness. 'Goal-orientation' of the executed is re-processed within the 'slow system' (see above), which results in 'semantic representation' and accessibility to conscious awareness. In contrast to 'goal-orientation', the executed movement itself is apparently not re-processed within the 'slow system'. It is therefore not accessible to conscious awareness. This functional dissociation between 'goal-orientation' and executed movement may be reflected in the phenomenal difference between lack of awareness of executed movements and conscious awareness of the 'goal-orientation' of the executed movement. We can subsequently only make judgments about 'goal-orientation' but not about execution. Since 'goal-orientation' is accessible in our experience i.e. to conscious awareness, one may call these judgments 'phenomenal judgments' (see 2.4.2 and 3.2.2 as well as Chalmers 1996). Due to dissociation between 'goal-orientation' and executed movement, 'temporal homogeneity ' in the experience of actions is disarranged in 'phenomenal judgment'. 'Goal-orientation' is experienced as an event whose temporal window is no longer wide enough to include past and future executed movements. The intention to move is vividly 'present' while the executed movement is no longer 'present' in the judgment. Apparently, there must be some 'unity in time' since otherwise the intentions could not be 'present'. There is however no longer 'temporal homogeneity' because past and future executed movements are not available in judgment – 'retention' and 'protention' remain impossible (see 2.2.1). Accordingly, 'phenomenal judgment' may be characterized by the co-occurrence of 'unity in time' and 'temporal heterogeneity'.

In contrast to the intentions of our own movements, the intentions of other peoples' movements are not directly available in 'phenomenal judgment' (see also 2.4.2). Phenomenally, we can become consciously aware of the intentions of our own movements but have no direct access to others' intentions (there are, however, indirect methods, see 2.2.3). The intentions of others' movements are not 'present' so that there is no longer 'unity in time'. While 'phenomenal judgment' can be characterized by 'unity in time' and 'temporal heterogeneity' (see above), observation and judgment of others' actions i.e. 'physical judgment' can rather be described by 'diversity in time' and 'temporal heterogeneity' (see 2.2.3 and 2.4.3 for further details).

'Phenomenal judgments' and 'physical judgments'
Imagine first the case of neuroanatomical and functional separation between 'fast and slow system'.

Functionally, the 'slow system' could no longer be considered as a 'recursive structure' that provides a broader context for the 'fast system'. Instead, 'fast and slow system' would be entirely separated from each other in both regards i.e. neuroanatomically and functionally. Any type of linkage between processing and re-processing and thus between original and simulated 'goal-orientation' would no longer exist. If, however, this linkage is disrupted, 'action judgment' can no longer be considered as a judgment about the executed action. Accordingly, 'action judgment' as such would remain impossible. Phenomenally, the impossibility of 'action judgments' may be reflected in the absence of any 'phenomenal judgment'. Access to the intentions and 'goal-orientation' of the own actions would no longer exist so that they could not be vividly experienced as such. Conscious awareness of the intention/'goal-orientation' of our own action would also no longer subsist. Accordingly, there is neither 'unity in time' nor 'presence'. Instead, the intentions of our own movements are experienced and judged in exactly the same way as the ones from other individuals. The distinction between the own and others' intention/'goal-orientation' remains thus impossible. The thought experiment demonstrates the following: (i) the possibility to judge the intentions/'goal-orientations' of our own actions is necessarily dependent on the neuroanatomical and functional linkage between 'fast and slow system'; (ii) the possibility of 'phenomenal judgment' is necessarily dependent on access to the intentions/'goal-orientation' of our own actions; (iii) the possibility of distinguishing between the own and others' intentions is necessarily dependent on 'phenomenal judgment'.

Secondly, imagine a case without the temporal distinction between 'fast and slow system'.

Functionally, automatic and non-conscious processing could no longer be temporally distinguished from non-automatic and conscious processing. The execution of actions and 'action/agency judgments' would occur at the same time i.e. they would be temporally simultaneous. 'Action judgments' would probably not only refer to the intention/'goal-orientation' but in addition, to the executed action i.e. the movement itself. Accordingly, execution and judgment of actions could neither be distinguished in temporal regards nor in terms of contents. Phenomenally, the difference between 'phenomenal experience' and 'phenomenal judgment' would no longer exist. Due to the availability of executed actions i.e. movement itself 'phenomenal judgment' would be characterized by 'phenomenal time' (see 2.2.1). 'Temporal heterogeneity' in 'phenomenal judgments' would also no longer subsist but rather 'temporal homogeneity', which includes 'protention' and 'retention'. One would thus be consciously aware not only of the intentions but also of the executed action/movement. If one is consciously aware of the own executed action/movement, the distinction between the own and others' actions may be blurred. Although the others' intentions/'goal-orientation' remain inaccessible, we can nevertheless observe their executed actions/movements. The possibility of being consciously aware of our own executed actions/movements may also include the executed actions/movements from other individuals. This makes the distinction between the own and others' actions rather difficult. The thought experiment demonstrates the following: (i) the possibility of judging actions as distinguished from executing actions is necessarily dependent on the functional differentiation between their underlying neural processes; (ii) the possibility to distinguish between 'phenomenal experiences' and 'phenomenal judgments' is necessarily dependent on the distinction between the execution and the judgment of an action; (iii) the possibility distinguish between our own and others' actions is necessarily dependent on the distinction between 'phenomenal experience' and 'phenomenal judgment'.

Thirdly, imagine a case of reverse temporal characterization of the neural systems that are essential for execution and judgment of actions.

Functionally, while the 'automatic response system', which subserves the execution of actions, would be characterized by slow processing, it would be fast processing that depicts the 'action judgment system'. While 'action judgments' would still be possible the execution of actions would almost certainly no longer be automatic. Due to temporal reversal, the 'action judgment' would precede the execution of actions so that we would be consciously aware of its exact intention/'goal-orientation' even before the actual execution. Phenomenally, 'phenomenal judgment' would predominate. Due to the predominance of 'phenomenal judgment', 'phenomenal experience' in the original sense, as an experience without any kind of cognitive mediation i.e. judgment, would probably become impossible. We would be consciously aware of every intention/'goal-orientation' of each one of our actions and movements before we could even start to execute them. Execution of our own actions could subsequently be dramatically slowed which would make it impossible to react appropriately within the respective environmental context. We may therefore no longer be able to link our own actions with the actions of others since we could not react fast, appropriately, and phenomenally unconscious. The thought experiment demonstrates the following: (i) the possibility of progressing from the execution to the judgment of actions is necessarily dependent on the temporal transition from fast to slow neural processing; (ii) the possibility of predominance of 'phenomenal experiences', as compared to 'phenomenal judgment', is necessarily dependent on the progression from the execution to the judgment of actions; (iii) the linkage between our own and others' actions is necessarily dependent on the predominance of 'phenomenal experience'.

In summary, the following conclusions can be drawn: (i) the linkage between execution and judgment of action is a necessary condition for the availability of intention/'goal-orientation' in 'phenomenal judgment'; (ii) the distinction between intention/'goal-orientation' and executed action/movement is a necessary condition for the distinction between 'phenomenal experience' and 'phenomenal judgment'; (iii) the temporal distinction between fast and slow system is a necessary condition for the distinction between 'phenomenal experience' and 'phenomenal judgment'; (iv) the sequential temporal transition from fast to slow neural processing is a necessary condition for predominance of 'phenomenal experience' as compared to 'phenomenal judgment'; (v) the distinction between 'phenomenal experience' and 'phenomenal judgment' is a necessary condition for the possibility to distinguish between our own and others' actions.

Neuroepistemological hypothesis

Hypothesis: There is a relationship between 'phenomenal judgments' and slow neuronal re-processing of 'goal-orientation'.

Neuroscientific implications: (i) the relationship between the processing of 'goal-orientation' and fast prefronto-parietal cortical integration; (ii) the relationship between re-processing of 'goal-orientation' and slow prefronto-parietal cortical integration; (iii) the relationship between prefronto-parietal cortical inhibition/excitation and discrimination of internally and externally generated signals.

Epistemological implications: (i) 'phenomenal judgment' is characterized by the judgment about intention/'goal-orientation' while the executed movement itself remains inaccessible; (ii) differential temporal characterization of 'phenomenal judgment' and 'physical judgment' with regard to 'unity in time'; (iii) dependence of the possibility to distinguish between our own and other bodies on the distinction between 'phenomenal and physical judgment'.

2.2.3 'Inter-subjective embedment': 'Physical judgment'

Functional brain organisation: Observation of action

The observation of the movements and actions of other individuals implies two distinct functions: a visual function, which is necessary to observe and a visual-motor function, which is necessary to recognize a visual action pattern. In humans, the observation of other peoples' actions and movements induces activation in the middle and inferior temporal (Brodman areas 21, 19–37) and parahippocampal regions (Rizzolatti et al. 1996; Decety et al. 1997). These regions may include a neuronal population that subserve the selective neuronal processing of visual recognition of others' movements and actions. The visual function, necessary for observation of movements, has been investigated in monkeys. A neuronal population has been identified in the superior temporal sulcus, which seems to be specialized for the recognition of body postures and movements (Jeannerod 1999). Activation in these neurons is selective for limb, body, or hand movements when they are produced by another monkey. These neurons however remain silent if these movements are the consequence of the animal's own action. When investigating the visuo-motor function in monkeys, Rizzolatti et al. (1996, 2001) identified a specific group of neurons in the premotor cortex, the so-called F5 region. These neurons were activated during the observation of meaningful hand movements as generated by other individuals. Since this particular subset of neurons in F5 is only activated during the observation of actions they are also called 'mirror neurons' (see Rizzolatti et al. 1996; Jeannerod 1999). On the contrary, other neurons in the same region were only activated during the execution of own movements. Accordingly, there apparently is congruence between the observed and the executed actions within the same region i.e. F5 although both are subserved by distinct groups of neurons respectively: 'When the monkey observes a motor action that belongs (or resembles) its movement repertoire, this action is automatically retrieved. The retrieved action is not necessarily executed. It is only represented in the motor system. We speculated that this observation/execution mechanism plays a role in understanding the meaning of motor events' (Rizzolatti et al. 1996: 132). The existence of such an 'observation/execution matching system' attributed to F5 in the premotor cortex is also supported by imaging studies in humans. The observation of actions induces activation in the inferior frontal gyrus (i.e. area 45 according to Brodman), which is supposed to be the human analogue of F5 in monkeys (Rizzolatti et al. 1996; Grafton et al. 1996; Decety et al. 1997). During the observation of movements, the motor cortex can be distinguished by an increased excitability that shows an increase in motor evoked potentials (Fadiga et al. 1995) as well as suppression of 15- to 25-Hz activity (Hari et al. 1998). Subsequently, the motor cortex seems to be activated during the observation of movements as well. Nevertheless, this activation in the motor cortex shows a lower degree of intensity, different spatial extensions and an earlier/delayed temporal onset.

The involvement of the inferior frontal gyrus (i.e. area 45) raises the question about the relationship between language and observation of meaningful actions. This region represents a sector of the Broca's area (including area 44 and 45) that is closely associated with language (see 3.2.3 as well as Jeannerod 1999). If a subsector of the Broca's area becomes activated during the observation of movements, one may assume a close relation between 'mirror functions' and 'speech functions'

(Rizzolatti et al. 1996). Accordingly, Rizzolatti et al. (1996) speculates that speech functions reflect a functional specialization of the human Broca's area: 'It may derive from an ancient mechanism related to production and understanding of motor acts. From this mechanism evolved, possibly in relation with the development of a more complex social life, first the capacity to make and interpret facial communicative gestures and, then, the capacity to emit and understand 'verbal gestures'. It is likely that the sophisticated capacity of movement analysis shown by 'mirror cells' is at the basis of the evolutionary prevalence of the lateral motor system on the medial one, related to emotion, in becoming the main communication channel in higher primates and man' (Rizzolatti et al. 1996) (see also 3.2.3).

In addition to the temporal and inferior prefrontal cortical areas, activation in the parietal cortical areas (area 7, 39, 40) has also been considered during the observation of movements and actions (Rizzolatti et al. 1996; Grafton et al. 1996; Decety et al. 1997; Castelli et al. 2000). This agrees with the assumption that neurons in F5 are part of a cortico-cortical i.e. fronto-parietal circuit that subserves sensory-motor integration (see 2.2.1 and Rizzolatti et al. 1998, 2001). Due to the close sensory-motor connections, one would expect neurons in F5 to show both sensory and motor properties; this is indeed the case. Neurons in F5 are activated during the presentation of 3D objects but only when no other overt movements are present; this reflects their sensory properties. Moreover, they are activated during the execution or observation of meaningful i.e. goal-oriented movements; this indicates their motor properties. It remains important to note that only meaningful i.e. goal-oriented movements induce activation of neurons in F5 (Rizzolatti et al. 1996) or area 45 in the inferior prefrontal cortex in humans (Decety et al. 1997). No activation can be observed in these areas during meaningless movements (see Grafton et al. 1995; Decety et al. 1997).

Neuroepistemological implications: Observation of action and 'physical judgments'

'Physical judgments'

Functionally, we have no direct access to others' 'goal-orientation'. However, the relationship between the observed movements of other individuals and the potentially corresponding 'goal-orientation' from our own actions may provide indirect access to the intention/'goal-orientation' of others' actions (see also 2.4.3). This linkage between the movements of others and our own 'goal-orientations' seems to be subserved by the 'observation/execution matching system'. The observed movements are 'matched' with the 'goal-orientation' of our own action. The 'goal-orientation' of our own action is re-processed and as such available for 'phenomenal judgment'. This, however, is not the case when observing others' actions.

We can only observe their executed movements but have no direct access to their 'goal-orientations'. These may be inferred indirectly from the observed executed movements. Indirect inference may be provided by the selection of potentially corresponding 'goal-orientations' from our own actions that could 'match' with the observed executed movement.

Phenomenally, others' actions are no longer accessible to conscious awareness, which makes 'phenomenal judgment' impossible: meaning that we can only make 'physical judgments' about other peoples' actions. 'Phenomenal judgment' only concerns the own phenomenal states thus referring to 'intra-subjective states' exclusively. 'Physical judgment', in contrast, concerns the observation of others' actions thus referring to 'inter-subjective states'. Accordingly, the observation of action and 'physical judgment' may provide the foundation for 'inter-subjective communication' as associated with thought and language (see 3.2.3 for more information): 'We hold that human language ... evolved from a basic mechanisms that was not originally related to communication: the capacity to recognize actions' (Rizzolatti & Arbib 1998: 193). 'Goal-orientation' from other peoples' actions is not available to us because we can only observe their executed movements. Subsequently, we have no conscious awareness of someone else's 'goal-orientation' which makes any 'phenomenal judgment' impossible. Instead of judging 'goal-orientation' as events in our own actions, we can only observe single and separated stimuli in the actions of others, which reflect their executed movements. Since events are replaced by stimuli, one may speak of 'physical judgment' in the case of the observation of others' actions rather than 'phenomenal judgment'. Instead of having access to 'bio-mechanical markers', like we do in our own action, we can only observe 'mechanical markers' in others' actions. The experience of events with respect to our own actions is thus replaced by the observation of stimuli in others' actions. Since stimuli reflect physical properties, the judgment about these stimuli may be called 'physical judgment'.

Due to the lack of access to others' 'goal-orientation', there is no longer any 'unity in time' and 'temporal homogeneity' when observing the actions of others. The executed movements are observed at different points of time i.e. as 'momentary time slices', which results in 'temporal atomism' and 'physical time'. On the contrary, any kind of temporal integration either functional or phenomenal remains absent. Functionally, this is reflected by the absence of integration between past and future stimuli within a present event so that 'unity in time' is replaced by 'diversity in time'. Phenomenally, this is reflected by our inability to either 'retrodict' or 'predict' others' actions i.e. there is neither 'presence' nor 'protention' and 'retention', which results in 'temporal heterogeneity'. The distinction between 'phenomenal time' and 'physical time' is furthermore reflected in Kant's distinction between 'transcendental ideality' and 'empirical reality ' of time. Kant's distinction between 'transcendental ideality' and 'empirical reality' of time (Kant 1998) must however be re-interpreted within the present context. 'Transcendental ideality' of time no longer concerns the 'unity of time' as independently given from any kind of experience. Instead, 'transcendental ideality' of time refers to the 'intrinsic' integration of the own body within the environment by means of which 'phenomenal experience' of 'unity in time' is provided. 'Empirical reality' of time, on the contrary, refers to the conception i.e. judgment of time as 'physical time' with 'diversity in time' which necessarily presupposes 'phenomenal time' and 'unity in time'. Kant was subsequently right when he distinguished between two different forms of time with one being a necessary condition for the possibility of the other but not vice versa. However, he was wrong in detaching and separating the 'unity of time' from the own body by identifying it as 'transcendental'. Due to the neglect of the distinction between the own and other bodies in terms of time Kant could not relate the 'unity in time' to the own body.

The observation of action and 'physical judgments'

First, imagine a case without the possibility of a relationship between our own intention/'goal-orientation' and the observed executed actions/movements of others.

Functionally, execution and observation of movements would no longer be subserved by the same underlying system i.e. the motor system. Both systems would thus show principal differences in their respective underlying spatiotemporal pattern. The observed executed actions/movements could no longer be linked with the corresponding 'goal-orientation' of our own action. Subsequently there would no longer be any kind of matching between execution and observation. Phenomenally, 'physical judgment' would still be possible. However, due to the lack of 'matching', 'physical judgment' could no longer be related to 'phenomenal judgment'. We would have no idea of the intentions and goals of others' actions, and would remain unable to make any kind of inference. Since we remain unable to infer the others' intentions/'goal-orientation', the other person could no longer be considered a subject but rather as an object analogous to a mere 'physical fact'. Thus, 'inter-subjective communication', involving different subjects with different intentions/'goal-orientation', would probably remain impossible. 'Inter-subjective communication' would be replaced by 'inter-objective communication'. The thought experiment demonstrates the following: (i) matching between the own intentions/'goal-orientations' and others' movements is necessarily dependent on spatiotemporal similarity/overlap between neural systems that subserve the execution and observation of actions; (ii) the possibility of linking 'phenomenal and physical judgment' is necessarily dependent on 'matching' the own intentions/'goal-orientations' and others' movements; (iii) the possibility of 'inter-subjective communication', as distinguished from 'inter-objective communication', is necessarily dependent on the linkage between 'phenomenal and physical judgment'.

Secondly, imagine a case with no distinction between execution and observation.

Functionally, execution and observation of actions would be subserved by exactly the same i.e. identical neural system with no differences at all in regard to intensity, degree, temporal onset, and spatial extent of activation. While the observed executed action/movement could be linked directly with the correct 'goal-orientation' which would make the process of 'matching' superfluous, a distinction between the own and others' 'goal-orientation' would be rather difficult. Our own 'goal-orientation' would be extended to others and vice versa. The border between our own and others' 'goal-orientations'/actions would be almost completely blurred. This would make the distinction between our own and others' action superfluous. Phenomenally, 'physical judgment' would no longer be possible because 'physical judgment' would be replaced by 'phenomenal judgment'. The 'phenomenal judgment' would no longer concern 'intra-subjective states' exclusively but would include 'inter-subjective states' as well. Accordingly, the distinction between 'intra-subjective states' and 'inter-subjective states' would be blurred. 'Intra-subjective communication' would thus be identical to 'inter-subjective communication' and vice versa. The thought experiment demonstrates the following: (i) the possibility to distinguish between the own and others' intentions/'goal-orientations' is necessarily dependent on the neural differentiation between execution and observation of actions; (ii) the possibility to distinguish between 'phenomenal and physical judgment' is necessarily dependent on the distinction between the own and others' intentions/'goal-orientation'; (iii) the possibility of 'inter-subjective communication', as distinguished from 'intra-subjective communication', is necessarily dependent on the distinction between 'phenomenal and physical judgment'.

Thirdly, imagine a case with a reversed design concerning execution and observation of actions.

Functionally, while executed and observed movements would still be subserved by the same underlying system i.e. the motor system their differences in degree of intensity, spatial extent, and temporal onset of activation would be reversed. For example, the observation of movements would be accompanied by a higher degree of excitability in the motor cortex than the execution of movements. Furthermore, instead of the observation of movements, the execution of movements would lead to activation in the 'mirror neurons' and the Broca's area. Finally, the observation of movements would be characterized by an earlier temporal onset than the execution of movements. Executing our own actions/movements would necessarily require a linkage with intention/'goal-orientation' from the observed i.e. others' actions/movements. Otherwise, in the case without observation of intentions/'goal-orientations', the execution of our own actions/movements would remain impossible. Phenomenally, a relation between 'phenomenal and physical judgment' would be reversed with respect to contents and states. 'Phenomenal judgment' would no longer concern the intention/'goal-orientation' of the own person but rather the ones from other persons. 'Phenomenal judgment' would thus refer to 'inter-subjective states'. 'Physical judgment' would no longer concern the physical observation of others executed actions/movements but rather the ones from the own person. 'Physical judgment' would thus refer to 'intra-subjective states'. Observations of actions and language would still provide 'communication' although no longer 'inter-subjective communication' but 'intra-subjective communication'. Accordingly, we could directly experience and feel the others' actions but would have to communicate with others in order to get indirect access to our own intention/'goal-orientation'. The thought experiment demonstrates the following: (i) attribution of intentions/'goal-orientation' to the own or another person is necessarily dependent on the direction of integration between the neural systems underlying execution and observation of actions; (ii) distinction of contents and states in 'phenomenal and physical judgment' is necessarily dependent on the attribution of intentions/'goal-orientation' to the own or another person; (iii) the possibility to distinguish between 'inter-subjective communication' and 'intra-subjective communication' is necessarily dependent on the distinction of contents and states in 'phenomenal and physical judgment'.

In summary, the following conclusions can be drawn: (i) the co-occurrence of linkage and distinction between neural systems, underlying execution and observation of action, is a necessary condition for the possibility of linkage and distinction between our own and others intentions/'goal-orientation'; (ii) distinction between observation and execution of actions is a necessary condition for the possibility of distinguishing between 'phenomenal judgments' and 'physical judgments'; (iii) characterization of 'physical and phenomenal judgment' is closely related with attribution of intentions/'goal-orientation' to the own and/or other person; (iv) the distinction between 'phenomenal and physical judgment' is a necessary condition for the possibility of 'intra- and inter-subjective communication'.

Neuroepistemological hypothesis

Hypothesis: There is a relationship between 'physical judgments' and the neural network that accounts for the 'observation/execution matching system'.

Neuroscientific implications: (i) distinction between executed and observed movements by degree of intensity, spatial extent and temporal onset of activation within the same underlying neural system i.e. the motor system; (ii) linkage between observed movements from others' action and 'goal-orientation' from the own action within area 45 which is essential for the 'execution/observation matching system'; (iii) overlap in neuroanatomical areas that subserve the observation of actions and the generation of language.

Epistemological implications: (i) the characterization of 'physical judgment' by the judgments about movements that are executed by others while their intentions/'goal-orientation' remain inaccessible; (ii) temporal characterization of 'physical judgments' by 'diversity in time' and 'temporal heterogeneity' i.e. 'physical time'; (iii) dependence of the possibility of 'inter-subjective communication' on 'physical judgment'.

2.3 'Mental embedment': The brain and the own body

Until now, we described 'spatial and temporal embedment' by means of which the body was integrated within the spatial and temporal coordinates of the environment (see 2.1 and 2.2). However, the integration of the brain within the own body remains unclear. If the brain becomes integrated within the body, it is necessarily integrated within the environment as well. Accordingly, the integration within the body may account for the integration of the brain within the environment. It is suggested that, analogous to the integration of the body within the environment (see 2.1 and 2.2), the integration of the brain within the body requires a particular functional organisation. The principles of this functional organisation and their implementation and realization within the human brain will be described in the following. Within the framework of this functional organisation of the brain, mental states can be distinguished from neuronal states in functional, phenomenal, and epistemic respect. Accordingly, the integration of the brain within the body may be characterized by 'mental embedment'. It should be noted that this particular functional organisation of the brain, which accounts for, mental embedment' relies on the same principles that provide 'spatial and temporal embedment' (see 2.1 and 2.2). The same principles are more elaborated and extended within the present context of 'mental embedment' (and 'reflexive embedment'; see 2.4).

'Mental embedment' includes three distinct stages. 'External' sensory afferent neural activities (i.e. external senses like vision, hearing etc) of the brain are integrated within the body by means of 'goal-oriented embedment'; this results in 'autoepistemic limitation' and mental states (see 2.3.1). On the contrary, the 'internal' sensory afferent neural activities (i.e. autonomous and vegetative nervous system) of the brain are integrated within the body by means of 'state-oriented embedment'; this results in feelings and qualia (see 2.3.2). The brain activities that are related to motor efferences may be integrated within the body by means of 'act-oriented embedment'; this results in intentionality and mental causation (see 2.3.3). It should be noted, that 'mental embedment' necessarily presupposes and builds upon 'spatial and temporal embedment'. This remains true with respect to the principles of the functional organisation of the brain (see above) as well as to the phenomenal and epistemic abilities. Space and time may therefore be regarded as the sources and necessary conditions for the possibility of cognitive and emotional abilities. They reflect higher phenomenal and epistemic abilities and inabilities and also include mental states.

2.3.1 'Goal-oriented embedment': 'Autoepistemic limitation' and mental states

Functional brain organisation: 'Embedded coding' of sensory and motor functions

The relationship between sensory and motor functions may be characterized by either separation or 'isomorphism'. In the case of separation, both may be subserved by a different code, which would result in 'separate coding'. In the case of 'isomorphism' however, both may be subserved by the same code, which would result in 'common coding'. In the case of 'separate coding', external objects and events induce sensory stimulations on the afferent side generating a 'sensory code' (see Prinz 1992: 2). On the effector side, a 'motor code' is generated, which induces a pattern of excitation in the peripheral effector organs (i.e. muscles). Both 'sensory and motor code' are subserved by different systems i.e. sensory and motor pathways with their contents remaining incommensurate (see Prinz 1992: 2–3 as well as Hommel et al. 2001). The translation between the incommensurate contents from 'sensory code' and 'motor code' is necessary for integration. Accordingly, the direct interaction between sensory and motor function remains impossible. Both may interact only indirectly i.e. via translation, which can be called 'instrumental dependence' (see Prinz 1992). An alternative to 'separate coding' is 'common coding' or 'shared coding' (see Prinz 1992: 4–8; Hommel et al. 2001; Hurely 1998: 417–419). In the case of 'common coding', sensory and motor contents are no longer incommensurate. They are rather common or they are isomorphic features that are subserved by a common representational scheme and identical pathways in the brain. In this system, motor components are directly involved in the 'sensory code' and sensory components are essential for the 'motor code'. The translation between 'sensory and motor code' is thus no longer needed. Moreover, direct interaction between sensory and motor function remains possible; this may be described as 'non-instrumental dependence'.

The assumption of 'isomorphism' between sensory and motor contents remains rather implausible from an empirical point of view. If sensory and motor contents were isomorphic, they would be mere copies of each other. If they were mere copies of each other, a distinction between them should be rather difficult.

This, however, is not the case. Sensory and motor contents can be clearly distinguished from each other. This is, for example, reflected in the difference between sensory impressions and movements.

The assumption of 'non-instrumental dependence', on the other hand, remains empirically plausible. There is direct interaction between sensory and motor functions, which indicates that no translation is needed. There are many empirical examples for direct interaction between sensory and motor function (see Hommel et al. 2001; Hurely 1998: 342; Prinz 1992: 4), two of them shall be described briefly in the following.

First, due to sensorimotor synchronization, subjects are able to synchronize their movements with a regular auditory pattern (see Hommel et al. 2001; Prinz 1992: 10–12). Everybody knows that a regular beat of music will be involuntarily accompanied by movements. If there were only 'instrumental dependence' without 'non-instrumental dependence', information related to the 'sensory code' would have to be transferred from the ear to the cortical areas in the brain. Furthermore, information that is related to the 'motor code' would have to be transferred from the cortical brain areas back to the body in order to effectuate certain muscles. In the case of 'instrumental dependence', the reaction time should thus take as long as the nerve conductance from sensory stimulations in the peripheral afference i.e. the ear over the central cortical areas to the motor effectuation in the periphereal muscle. However, reaction times, as elucidated in various experiments (see Hommel et al. 2001; Prinz 1992 for an overview), are much faster than those based on inferences from nerve conductance. Since the reaction times are much faster, some kind of 'non-instrumental dependence' between sensory and motor functions must be assumed, which allows for fast sensorimotor synchronisation. The term 'sensorimotor synchronization' should subsequently be replaced by the term 'perceptual synchronization'. It is not the 'physical beat', reflecting the peripheral sensory stimuli, but rather the 'kinaesthetic beat', reflecting the perception of the beat itself, according to which the motor function gets synchronized (see Prinz 1992: 11–12). Unlike the 'physical beat', the 'kinaesthetic beat' reflects the functional relevance of the beat for the individual person (see also 2.1.2). Accordingly, motor functions are conversant with the meaning of the beat for the respective person rather than the physical properties of the sensory stimuli.

Secondly, the example of the 'Simon effect' (see Hommel et al. 2001; Prinz 1992): there are two stimuli, A and B, and there are two response keys, e.g. left and right hand. When stimulus A is presented, the subject should press the left-hand key whereas the presentation of stimulus B should lead to pushing the right-hand key. Stimulus A and B may be presented either on the left or right side. The reaction times are shorter in the case of positional correspondence between stimulus side and response key side (A presented on the left and B on the right) whereas they are longer in the case of positional non-correspondence (A is presented on the right side and B on the left). What are the functional mechanisms for shorter reaction times in the case of positional correspondence? Mechanisms could be either 'proximal', reflecting the correspondence between stimuli position and the anatomical structures that are involved in the generation of the response or they could be 'distal' mechanisms, reflecting the correspondence between stimulus position and the spatial location at which the response event is executed. The same experiment may be repeated with crossed hands. While in the case of 'proximal' i.e. anatomical correspondence, reaction times should be completely reversed, they should remain unchanged in the case of 'distal' i.e. spatial correspondence. Several studies demonstrated that reaction times remain unchanged in case of crossed hands. The critical determinant of the experiments can therefore not consist in the degree to which 'sensory and motor code' share the same 'proximal' i.e. anatomical structure. Instead, the degree to which stimulus and response event share the same 'distal' i.e. spatial location in the respective environmental context seems to be crucial for determining the reaction time. 'Distal' determination, which replaces 'proximal' determination, does thus allow for 'non-instrumental dependence' between sensory and motor function, which makes any kind of translation superfluous.

'Common coding' must be considered as empirically rather implausible since there is apparently no 'isomorphism' between sensory and motor contents (see above) On the contrary, 'non-instrumental dependence' does seem plausible from an empirical point of view. Accordingly, an empirically plausible form of coding allows for 'non-instrumental dependence' while at the same time avoiding 'isomorphism'. In addition to strong forms of 'common coding', as described above, both Hurely (1998: 417–418) and Prinz (1992: 5) suggest a weaker form of 'common coding'. As in 'separate coding' (see above) 'sensory and motor code' are separate with their contents remaining incommensurate. 'Isomorphism' does therefore not exist. However, unlike in 'separate coding', the 'sensory and motor code' is complemented by an additional code: the 'event and action code'. This 'event and action code' no longer refers to single sensory and motor stimuli. The term 'event code' describes 'ongoing and observable environmental events' while the term 'action code' refers to 'intended and to-be-effectuated environmental events' (see Prinz 1992: 6). The difference between 'sensory and motor code' and 'event and action code' consists in their relation to the environment. 'Sensory and motor code' reflect the stimulation of sensory and motor afferences/efferences, which as such must be distinguished from the environmental context. In contrast, the 'event and action code' characterize events and actions within the respective environmental context. Since 'event and action code' share the same reference i.e. the respective environmental context, their representational schemes and contents are not incommensurate. Accordingly, no translation is needed, which allows for the direct interaction and thus 'non-instrumental dependence' (see above). However, this weaker form of 'common coding' faces the problem of linkage and translation between the two codes i.e. 'sensory and motor code' and 'event and action code'. 'Sensory and motor code' are characterized by 'proximal reference', which reflects single stimuli as subserved by anatomical structures with afferent and efferent organs and the related cortical areas. In contrast, 'event and action code' can be characterized by 'distal reference', which reflects the spatiotemporal location of events within the respective environmental context. Both codes are not compatible with each other because they can be distinguished by means of distinct referents i.e. stimuli and events. The problem of incompatibility between the two codes may be solved through the suppression of, for example, the 'sensory and motor code'. The 'sensory and motor code' may be suppressed by the 'event and action code' i.e. through superposition of the latter on the former. The suppression of the 'sensory and motor code' leads to a so-called 'proximal neglect' (Prinz 1992; Hommel et al. 2001), which indicates a principal but neglected presence. 'Distal reference' can therefore be accompanied by 'proximal neglect', which makes a translation between the two kinds of codes superfluous.

In addition to 'proximal neglect' and 'distal reference', the weaker form of 'common coding' may be characterized by 'goal-orientation'. 'Goal-orientation' can be defined by the functional relevance of environmental events for each respective individual (see also 2.1.2 and 2.2.2). 'Distal reference' on the other hand refers to events within the environment in general (see above). 'Goal-orientation' describes the individual relevance of particular events. 'Goal-orientation', 'distal reference', and 'proximal neglect' should thus be implemented and realized in the human brain (see below). The functional organization of the brain is therefore oriented on and directed towards 'observable and to-be effectuated events within the environment'. This provides for the 'intrinsic' integration of the brain within the environment (see also 1.3). The weaker form of 'common coding' may subsequently be described as a form of 'embedded coding', which is supposed to be characteristic and constitutive for the brain as a brain (see 1.2 and 3.1.2). Functionally, 'embedded coding' can be defined by the integration and linkage of 'sensory and motor code' within the respective environmental context via 'event and action code'. Integration and linkage imply 'embedment' as distinguished from both 'isolation' and 'isomorphism'. In the case of 'isolation', 'sensory and motor code' are not integrated and linked within the respective environmental context. Accordingly, one may describe this form as 'isolated coding'; this is reflected in 'separate coding' (see above). In the case of 'isomorphism', 'sensory and motor code' are no longer distinguished from environmental events i.e. both are isomorphic. Accordingly, one may describe this form as 'environmented coding', which is reflected in the strong form of 'common coding' (see above).

'Goal-orientation' is supposed to be subserved by fronto-parietal networks that account for the sensory-motor integration (see 2.2). More specifically, if the prefrontal cortex participates in the generation of 'goal-orientation', it should not only receive afferents from the sensory systems but from the motor system as well. In addition, it should send efferences not only to the motor system but also to the sensory systems. Absence of reciprocal afferences/efferences would make the generation of 'goal-orientation' impossible. The prefrontal cortex receives afferences not only from the sensory systems but also from the motor system. Furthermore, prefrontal efferences are not only sent to the motor system but in addition to the sensory systems (Koetter et al. 2000; Stephan et al. 2000). Furthermore, an analogous connectivity pattern has been demonstrated for the parietal cortex (Snyder et al. 2000). The reciprocal connectivity patterns of afferences and efferences in prefrontal and parietal cortex may therefore be regarded as a necessary condition for the realization of 'goal-orientation' (see also West & Alain 2000; Brown & Pluck 2000). In addition, this connectivity pattern may be considered as a necessary condition for the possibility of the superposition of 'event and action codes' on 'sensory and motor codes'. This in turn accounts for the co-occurrence of 'proximal neglect' and 'distal reference'. Via reciprocal afferences and efferences, both prefrontal and parietal cortical regions may directly modulate primary and peripheral sensory and motor regions/organs. Neural activity in primary/peripheral sensory and motor regions/organs may therefore be oriented on the respective environmental context and thus on 'goal-orientation' rather than on the physical properties of single sensory/motor stimuli. Since it provides direct interaction between central cortical areas and primary/peripheral sensory/motor regions/organs, this modulation could be called 'vertical modulation' (Northoff 2003b; Hurely 1998: 406–407; Juarrero 1999: 197–199). This includes both 'top-down modulation' and 'bottom-up modulation' (see Chapter 3.1 for more extensive discussion of these mechanisms). There is strong empirical evidence for 'vertical modulation' (see Northoff 2003b); two examples shall be described in the following.

First, there is strong evidence for 'top-down modulation' between the prefrontal and visual cortex. For example, it can be demonstrated (see Gilbert et al. 2000; Hopfinger et al. 2000; Macaluso et al. 2000; Shulman et al. 1997; Smith et al. 2000; Somers et al. 1999) that activation in the primary visual cortex (i.e. V1) is context-dependent and thus dependent on the respective environmental situation. Activation in the so-called receptive fields does not only depend on local stimuli inside the respective receptive field but, in addition, on stimuli that are outside the receptive field. The 'contextual influence' is neurally modulated by long-range horizontal i.e. lateral connections that are formed by the axons of cortical pyramidal cells, which link cells with widely separated receptive fields. These horizontal connections allow for global response properties of local receptive fields. Events outside the receptive fields are thus indirectly represented within the receptive field itself. These horizontal connections intrinsic to V1 are modulated by feedback connections from the prefrontal cortical areas, which may either facilitate or block the generation of neural activity. Consequently, 'top-down modulation' of neural activity in V1 i.e. in particular receptive fields exists. However, this modulation of neural activity in V1 is not direct but rather indirect that is to say via the modulation of horizontal connections i.e. of 'contextual influence'. The effects of 'top-down modulation' are thus not oriented on the sensory stimuli themselves but rather on the respective environmental event, which can be characterized as the crucial determinant for the modulation and generation of visual input.

Secondly, there is strong evidence for 'bottom-up modulation' between the peripheral motor organs and the prefrontal-parietal cortex. As already demonstrated (see 2.2.1), movements may be accompanied by the generation of an 'inverse model' and a 'forward output model', which reflect the respective environmental event before and after the execution of movements (see also Jahanshahi & Frith 1998; Frith 2000). Both models, as derived from peripheral sensory and motor organs, may modulate cortical activity in the prefrontal cortex by means of 'exafferences', 'reafferences' and 'efference copies' (see 2.2.1 for further details). Effects of 'bottom-up modulation' are thus not predominantly oriented on single motor stimuli but rather on the respective environmental event on which the movements are executed. We demonstrated that generating 'goal-orientation' might be subserved by prefrontal-parietal circuits that account for sensori-motor integration. Furthermore, we showed the realization of 'distal reference' by means of reciprocal afferences/efferences, which allow for 'vertical modulation' between the prefrontal-parietal cortex and the primary/peripheral sensory/motor regions/organs. The exact empirical realization of 'proximal neglect', however, remains unclear. The interactions between both kinds of codes should be one-way, if the superposition of the 'event and action code' on the 'sensory and motor code' exists. While the former can be superpositioned on the latter, some kind of modulation should make the superposition in the reverse direction impossible. This kind of modulation may be accounted for by 'unilateral feedback loops' between the central prefronto-parietal cortical regions and the subcortical/peripheral sensory/motor regions. There is some empirical evidence for such 'unilateral feedback loops'. One example will be described briefly below. Due to the fact that these 'unilateral feedback loops' avoid the 'isolation' of neural activity from the respective environmental event, they may account for 'horizontal modulation' between brain (sensory/motor function) and environment (see Hurely 1998: 406–407; Juarrero 1999: 197–199; Northoff 2003b). However, neither exact mechanisms nor functional implications of 'horizontal modulation' are known yet. Edelman and Tononi (2000; 180, see also Figure 8.1. on p. 96) point out a characteristic feature of the cortical motor organisation with regard to feedback loops (or 're-entrant circuits' as they call them; see 2.4.3 for further details). The pyramidal neurons in layer V of the posterior supplementary motor area and the motor cortex are directly or indirectly related to motor effectors via long-range axons that travel through the spinal cord. These neurons are directly connected to the neurons in layer VI in the anterior supplementary area and other prefrontal cortical areas that are predominantly related to the thalamocortical loop as one main feedback loop (or 'reentrant circuit'). However, the interaction between neurons in layer V and those in layer VI is one-way. It is important to note that the interactions are one way only e.g. from layer VI to layer V but not vice versa. The thalamo-cortical loop as one main feedback loop may modulate the neural activity in the cortical motor areas but the latter could not modulate the former.

Neuroepistemological implications: 'Embedded coding' and mental states

Generation of 'autoepistemic limitation' and mental states

What is 'autoepistemic limitation'?

'Embedded coding' can be characterized by 'distal reference', 'proximal neglect', and 'goal-orientation' (see 2.3.1). These functional characteristics shall be related to the phenomenal and epistemic abilities and inabilities concerning the experience of mental states and the recognition of neuronal states.

Functionally, the term 'autoepistemic limitation' implies that a system with states X has no access to these states as states X. Instead, these states are only accessible as states Y which may reflect 'proximal neglect'. That is why the system remains unable to recognize the true nature and origin of its own states. This differs from cognitive/connectionist systems, which in contrast are well able to detect and recognize the nature of their own states (see 3.1.2 for further details).

Phenomenally, both 'distal reference' and 'proximal neglect' are reflected in perception and action. Due to 'proximal neglect', we remain unable to perceive neuronal activity in the sensory afferences that reflect the 'sensory code'. We are however able to perceive 'observable events within the environment' that reflect the 'event code'. For example, we do not perceive the stimuli in our sensory afferences, as induced by the butter on the table, but rather the butter itself as an event located within the environment. This difference between 'events' and 'stimuli' is also reflected in the distinction between 'primary and secondary qualities'. 'Stimuli' reflect 'primary qualities' while 'events' account rather for 'secondary qualities'. Since our perceptions account for 'events' rather than 'stimuli' we have no direct access to the latter. Historically, this has been already pointed out by Locke who describes the impossibility of perceiving 'primary qualities': 'The reason why the one (i.e. 'secondary qualities') are ordinarily taken for real qualities, and the other (i.e. 'primary qualities') only for bare powers, seems to be, because the ideas we have of distinct colours, sounds, etc., containing nothing at all in them of bulk, figure, or motion, we are not apt to think them the effects of these primary qualities: which appear not, to our senses, to operate in their production, and with which they have not any apparent congruity or conceivable connexion' (Locke 1696, Book II, Chapter VIII, 25). Furthermore, our reaction to the butter on the table is not determined by the induction of stimulations in certain muscles (i.e. 'motor code'). It is the butter itself i.e. as the 'to-be effectuated event within the environment' that guides and determines the motor reaction and further action (i.e. 'action code'). Sensory and motor stimuli are thus replaced by 'observable and to-be effectuated events within the environment' in our perceptions and actions (see also Northoff 2000b). Thus Hume is wrong when he claims that our senses 'convey to us nothing us but a single perception (i.e. stimulus), and never give us the least intimation of any thing beyond' (Hume 1978: 189). This 'thing beyond' is however not an 'object' with an 'independent and continued existence', as for example body or mind as 'external or internal objects' (see also 3.3.3), which Hume correctly rejects. Instead this 'thing beyond' in our perceptions is an 'event' which as such has to be distinguished from 'objects' (see 3.3.2 and 3.3.3). Hume overlooks that the 'thing beyond' in our perceptions may also concern something else than 'objects' and he consecutively defines perceptions rather by 'stimuli' (or 'single perceptions' or 'impressions' in his terms) than 'events'. While Hume does not capture the difference between 'stimuli' and 'events', he nevertheless points out an essential characteristic of 'events' in a nice way i.e. their 'projection' onto the environment where they are 'located' as 'observable and to-be effectuated events' (see above). Though 'events' reflect the relation of 'stimuli' to the body of the perceiving person, they are nevertheless associated with 'external objects': 'Our own body evidently belongs to us; and as several impressions appear exterior to the body, we suppose them also exterior to ourselves. The paper, on which I write at present, is beyond my hand. The table is beyond the paper. The walls of my chamber are beyond the table. And in casting my eye towards the window, I perceive a great extent of fields and buildings beyond my chamber. From all this it may be infer'd, that no other faculty is required besides the senses, to convince us of the external existence of body.' (Hume 1978: 190). Moreover, Hume points out that this tendency to 'locate' the contents of perceptions i.e. 'events' in the 'external world' is due to 'projection' from our 'internal world' onto the 'external world': ' 'Tis a common observation, that the mind has a great propensity to spread itself on external objects, and to conjoin with them any internal impressions, which they occasion, and which always make their appearance at the same time that these objects discover themselves to the senses.' (Hume 1978: 167).

Epistemically, we remain unable to directly detect and recognize our own neuronal states as neuronal states because we do not experience sensory and motor stimuli as such (see Figure 10). This inability to directly detect and recognize our own neuronal states as neuronal states can be called 'autoepistemic limitation' (see below as well as Northoff 2001a). More generally, we have no direct epistemic access to our brain states as brain states (in First-Person Perspective) so that our own brain as such remains hidden for us; this more general sense shall be called

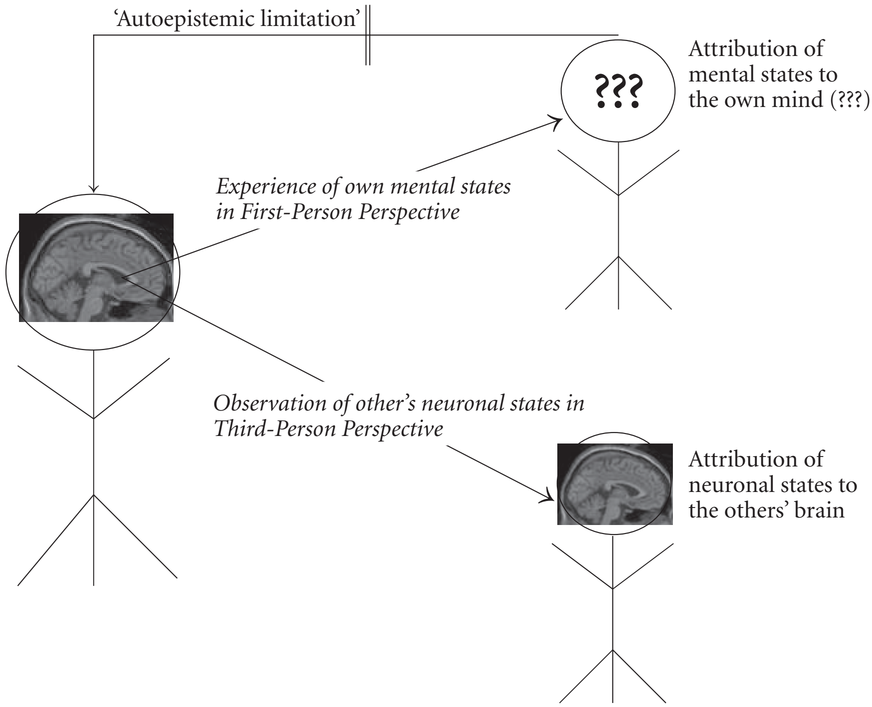


Figure 10. Epistemic difference between own and others' states in first- and third-person perspective

'autoepistemic limitation' in the following. 'Autoepistemic limitation' in this sense implies the epistemic distinction between the own and the other person with respect to mental states and brain states: The own person can be experienced only in terms of mental states in First-Person Perspective while the other person is observed in terms of brain states in Third-Person Perspective (see also Figure 10). This epistemic distinction between the own and other persons with regard to the brain has already been pointed out by Schopenhauer: 'Here my thesis is this: that which in self-consciousness (i.e. experience in First-Person perspective in our terms), and hence subjectively, is the intellect (i.e. mental states in our terms), presents itself in the consciousness of other things (i.e. observation in Third-Person Perspective in our terms), and hence objectively, as the brain (i.e. brain states in our terms); ...'(Schopenhauer 1966, Vol. II, 245).

'Autoepistemic limitation' shall be illustrated by the following example. A psychiatrist (PS) and a philosopher (PH) meet at a conference on consciousness. The psychiatrist works in the field of functional brain imaging while the philosopher is a specialist when it comes to the problem of self-recognition and self-consciousness.

Both discuss the epistemic implications of functional brain imaging regarding the recognition of one's own and others' brains.

PS: I can investigate brains in the scanner.
PH: Can you investigate all brains in the scanner?
PS: Yes, all brains.
PH: How about your own brain? Can you investigate your own brain in the scanner as well?
PS: Off course. I have been in the scanner too.
PH: Who is investigating your brain while you are in the scanner?
PS: The radiologist, a friend of mine.
PH: So you can't investigate your own brain while you are in the scanner by yourself.
PS: That is probably true.
PH: However, how can you then know that you have a brain if you can't investigate it by your own?
PS: Off course, I have a brain. Otherwise I would neither be able to experience my environment nor to observe and investigate other's brains.
PH: Yes, that might be right. But how do you know that it is your brain that accounts for the experience of the environment and observation/investigation of others brains?
PS: You mean I can neither experience nor observe/investigate my own brain as a brain?
PH: Yes. I do not deny that your abilities to experience and observe/investigate may be traced back to your own brain. I only deny that you have direct access to your own brain as a brain in either experience or observation/investigation.
PS: This, however, leaves the possibility of me having indirect access to my own brain via my experience of mental states open.
PH: Yes. While you may have no 'direct self-reference' to your own brain, you may nevertheless be able to have at least some kind of 'indirect self-reference'.

One might argue that we are able to access our own brain in the Third-Person Perspective with the help of some technical devices. For example, I can observe my own brain while I am in the scanner by means of so-called on-line 'neuromonitoring'. Similar to others' brains, we are thus able to access our own brain though indirectly through technical devices allowing for 'neuromonitoring'. In this case we observe our own brain as another brain in Third-Person Perspective. In contrast, we nevertheless remain unable to directly access our own brain as a brain in First-Person Perspective: For example, we have no access to our own brain as a brain in 'phenomenal experience' in First-Person Perspective, i.e. we remain unable to experience our own brain as a brain. Unlike others' brains, our own brain remains therefore a phenomenon for us. Instead of our own brain states, we rather experience mental states in First-Person Perspective. This is what is called here 'autoepistemic limitation' (see also Figure 11). Interestingly, Spinoza expresses a more or less similar idea in his ethics (1985) (Part II, prop. 19–29) when he states that 'the human mind does not know the human body itself, nor does it know that the body exists, except through ideas of affections by which the body is affected'. What is here called the 'human mind' may, in the present context, be called the First-Person Perspective, which does not know the body as a body ('the human body itself') i.e. the brain as a brain ('the human mind does not know the human body itself'). Moreover, the 'human mind does not involve an adequate knowledge of the parts composing the body' (see Part II, prop. 24). This may be understood in the present context as the lack of experience and knowledge of the own brain in First-Person Perspective. Instead of experiencing and knowing our own brain and body as such, the First-Person Perspective experiences events i.e. the 'human mind perceives these affections, and consequently the human body itself actually existing' (see Part II, prop. 19). 'Affections' in the present context may therefore be translated into 'events'. Brain and body are characterized by 'affections' which reflect events within the relationship between brain, body, and environment. 'The human mind, therefore, perceives the human body' (see Part II, prop. 19) through 'affections'; this is also true for the First-Person Perspective which allows for experience of the own brain via the 'events' in mental states. This 'indirect self-reference' of the brain to itself via 'events' in mental states (see also 3.3.4) is reflected in the following quote from Spinoza (see also 3.3.2 for further discussion of Spinoza): 'The mind does not know itself except in so far as it perceives the ideas of these affections of the body' (see Part II, prop. 23). Similar to Spinoza, Kant (1998) noticed too that we are able to 'recognize our own subject only as a phenomenon and not as it is in itself' as a noumenon. Applied to the current context: We can experience our own brain only in terms of mental states i.e. as a 'phenomenon' while we remain unable to experience our own brain as a brain i.e. 'as it is in itself'. Unlike Kant, Schopenhauer directly relates this epistemic deficit to the brain itself i.e. the own brain as the 'subject of recognition': 'But in so far as the brain knows, it is not itself known, but it is the knower, the subject of all knowledge. . . . . . . On the other hand, what knows, what has that representation, is the brain; yet this brain does not know itself, but becomes conscious of itself only as intellect, in other words as knower, and thus only subjectively.' (Schopenhauer 1966, Vol. II, 259). Moreover, Schopenhauer also describes the reverse side of this epistemic inability, the epistemic ability of the brain to project its processes 'outside the brain' which, in the present terms, reflects its orientation on the 'observable and to-be effectuated events within environment': 'Thus, in the two phenomena here compared, what occurs in the brain is apprehended as outside the brain; in the case of perception, by means of the understanding extending its feelers into the external world; in the case of a sensation in the limbs, by means of the nerves. (Schopenhauer 1966, Vol. II, 25). A more recent author, C. McGinn (1989, 1999), also speaks of an epistemic limitation in introspection and observation; both remain unable to account for 'property p', which is essential for the generation of mental states out of brain states. Introspection allows for access to mental states but has no access to brain states – it remains therefore 'closed' with respect to the 'property p': 'P has to lie outside the field of the introspectable, and it is not implicitly contained in the concepts we bring to bear in our first-person ascriptions. Thus the faculty of introspection as concept forming capacity is cognitively closed with respect to P...' (McGinn 1989: 355). What McGinn calls 'introspection' may be called 'phenomenal judgment' in the present context (see 2.2.2 and 2.4.2).

What are mental states?

We characterized 'autoepistemic limitation' as the epistemic inability of the brain to directly detect and recognize its own brain states as brain states (see above). Instead, the own brain states are experienced as mental states; this shall be characterized in further detail in the following (see also 3.1.2 and 3.3.2 for further details).

Functionally, mental states may be characterized by 'event and action code' as distinguished from the 'sensory and motor code'. Mental states are only possible in the case of 'event and action code'; they remain impossible in the case of 'sensory and motor code' (see 2.3.1). Because of the orientation of the functional organization of the brain on 'observable and to-be effectuated events within the environment', mental states can neither be located within the brain ('ain't in the head either'; Juarrero 1999: 197) nor within the environment. They can rather be located within the 'intrinsic' relationship between brain, body, and environment.

Phenomenally, mental states may be characterized by experience and recognition of events i.e. 'observable and to-be effectuated events within the environment', as distinguished from mere stimuli i.e. sensory and motor stimuli (see 3.1.2 for further explication). While 'events' describe and include the actual context i.e. the time ('When'), place ('Where') and kind of occurrence ('How') of changes in the environment (see 3.1.3 for further details), 'facts', which rely on stimuli, are stripped of this actual context i.e. they rather exclude it (see 2.4.3 and 3.3.2). 'Events', as experienced in mental states, are therefore meaningful while 'facts' i.e. stimuli remain meaningless. Moreover, 'events' are necessarily 'intrinsically' integrated within the environment while 'facts' i.e. stimuli remain 'isolated' from the environment. Mental states can subsequently be characterized by 'events' and meaning. This distinguishes mental states from neuronal i.e. physical states (see 3.1.2. for definition) which refer to stimuli and are observed as 'facts' that are devoid of any meaning by themselves (see 2.4.3).

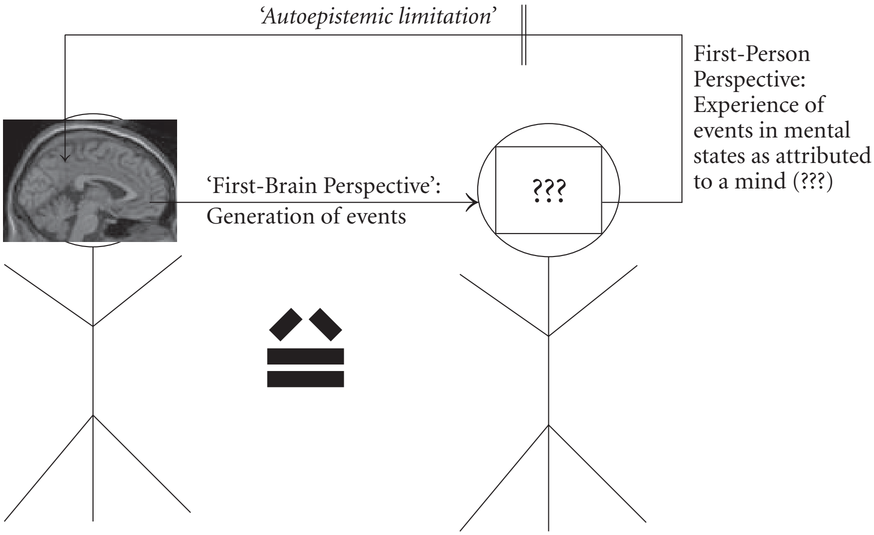


Figure 11. 'Autoepistemic limitation': No direct epistemic access to the own brain states as brain states in the first-person perspective

Epistemically, mental states may be characterized as the epistemic analogue of 'autoepistemic limitation' (see Figure 11). The experience of mental states reflects an epistemic ability while 'autoepistemic limitation', refers to an epistemic inability. Both epistemic ability and inability are necessarily tied together and must be considered as inseparable from each other. Accordingly, the possibility of mental states is necessarily tied to the presence of 'autoepistemic limitation': If there were no 'autoepistemic limitation', mental states would no longer be possible. In this case, we would be able to take the perspective of the brain itself as a 'systems or brain point of view' (see also Chalmers 1996: 203; Clark 1997, epilogue; Lakoff & Johnson 1999: 20; Northoff 1999: 211–212). Epistemically, such a 'systems or brain points of view' might be accounted for by a so-called 'First-Brain Perspective' (see 3.1.2 and 3.2.1 as well as Northoff 1999: 211–212; Northoff 2001b: 321) or 'First-Body Perspective' (see Hornsby 1986). However, due to 'autoepistemic limitation', we have no direct epistemic access to the 'First-Brain Perspective'. Therefore, perception and action of 'observable and to-be effectuated events within the environment' cannot be directly related to neuronal states and thus the own brain. Instead, they are rather attributed to the own person and its perspective i.e. the 'First-Person Perspective' (see 2.4.1 and 3.2.1), i.e. the First-Person Perspective subsequently replaces the 'First-Brain Perspective'. To put it into metaphoric terms: The First-Person Perspective fills the epistemic gap caused by 'autoepistemic limitation'. The difference between both perspectives is reflected in different 'What is it like' questions: Presupposing direct epistemic access to the 'First-Brain Perspective', we should ask 'What is it like to be in a particular neuronal state?' or 'What is it like to be a particular brain/body?' In contrast, when relying on a 'First-Person Perspective', we rather ask 'What is it like to be in a particular mental state?' or 'What is it like to be a particular person?'

Ontologically, mental states necessarily presuppose the 'embedment' of the brain within body and environment as it is reflected in 'embedded coding'. If, for example, the brain were 'isolated' from the environment, as it is the case in 'isolated coding' (see above), 'autoepistemic limitation' and thus mental states would remain impossible. Moreover, 'isolation' of mental states from the neuronal states of the brain itself, remains incompatible as well. This is, for example, the case in the assumption of a mind (see 3.3.1), Similar to the brain in the case of 'isolated coding', such a mind must necessarily be 'isolated' from the environment since otherwise its assumption is superfluous (see also 3.3.3). 'Isolation' from the environment, however, makes any kind of 'embedded coding' with consecutive 'autoepistemic limitation' and mental states impossible. Accordingly, the possibility of mental states necessarily presupposes 'embedment', which makes any 'isolation' of either brain or mind from the environment impossible.

'Embedded coding' and 'autoepistemic limitation'
Imagine a first case of 'isolated coding' as characterized by 'proximal reference' and 'distal absence' (see above).

'Top-down and bottom-up modulation', which as 'vertical feedback loops' could account for 'distal reference' would no longer exist. Unilateral connectivity, which as 'horizontal feedback loops' could account for 'proximal neglect' would also no longer exist. Sensory and motor functions would be coded separately, as characterized by 'separate coding' and feedback loops would be unnecessary. In this case, the neuronal organisation would no longer be oriented on 'observable and to-be effectuated events within the environment' but rather on single stimuli reflecting the stimulation in sensory afferences and motor efferences. 'Goal orientation' would thus be replaced by 'stimulus orientation'. 'Autoepistemic limitation' would no longer exist. The experience of 'observable and to-be effectuated events within the environment' would be replaced by direct detection and recognition of stimuli i.e. stimulation in sensory and motor organs of the own brain/body. Epistemically, this design would allow for a 'systems i.e. brain point of view'. Subsequently, epistemic access to the 'First-Brain Perspective' would be possible while the possibility of a 'First-Person Perspective' would no longer be given. Accordingly, the occurrence of mental states remains impossible in the case of 'isolated coding'. The thought experiment demonstrates the following: (i) the possibility of epistemic occurrences of mental states is necessarily dependent on the kind of coding i.e. in particular on 'embedded coding'; (ii) the possibility of 'autoepistemic limitation' is necessarily dependent on the functional integration between sensory and motor function; (iii) the possibility of the 'First-Person Perspective' is necessarily dependent on the functional integration between brain/body and environment.

Imagine a second case with a strong form of 'common coding' i.e. 'environmental coding' as characterized by 'proximal absence' and 'distal reference' (see above).

There would be 'isomorphism' between sensory and motor function and the two could therefore no longer be distinguished from each other. Anatomical structures underlying sensory and motor function would be identical which would make unilateral connections as 'horizontal feedback loops' superfluous. 'Vertical feedback loops' that account for 'top-down and bottom-up modulation', would remain for the implementation of 'distal reference'. One may inquire after the difference between 'proximal neglect', characterizing 'embedded coding', and 'proximal absence', characterizing 'environmented coding'. While 'proximal absence' may account for the absence of any kind of distinction between 'sensory and motor code' and 'event and action code', 'proximal neglect' maintains this distinction between both codes but, at the same time, suppresses the former through superposition of the latter on the former. Epistemically, the case of 'proximal absence' would be characterized by 'autoepistemic limitation' in an extended way. Similar to 'embedded coding', direct detection and recognition of the own brain states as brain states remains impossible. However, it would be impossible to recognize this epistemic inability i.e. 'autoepistemic limitation'. Not only our own neuronal states would remain hidden for us but, in addition, the 'autoepistemic limitation' itself could no longer be recognized as such. Accordingly, the distinction between 'First-Brain Perspective' and 'First-Person Perspective' as well as between neuronal and mental states would remain impossible. The thought experiment demonstrates the following: (i) the possibility of the phenomenal and epistemic distinction between neuronal and mental states is necessarily dependent on the kind of coding i.e. in particular on 'embedded coding'; (ii) the possibility to recognize 'autoepistemic limitation' as an epistemic inability is necessarily dependent on some kind of distinction between sensory and motor function; (iii) the possibility to distinguish between 'First-Brain Perspective' and 'First-Person Perspective' is necessarily dependent on the possibility to recognize 'autoepistemic limitation' by itself.

Imagine a third case with a design reversed to the actual one so that one could speak of 'reversed embedded coding', which is characterized by 'proximal reference' and 'distal neglect'.

'Unilateral connectivity' with 'horizontal feedback loops' would probably be reversed. 'Reversed embedded coding' would therefore be characterized by the superposition of the 'sensory and motor code' on the 'event and action code' where any interaction would remain one-way but in a reversed way. Analogously, 'top-down and bottom-up modulation' would also be reversed. The 'sensory code' would no longer be top-down modulated by 'goal-orientation' but would instead (top-down) modulate 'goal-orientation'. 'Goal-orientation' would no longer be bottom-up modulated by the 'motor code' but the 'motor code' would be bottom-up modulated by 'goal-orientation'. Epistemically, 'autoepistemic limitation' with respect to the own neuronal states would not exist. Moreover, the experience of mental states in the First-Person Perspective would also no longer exist since it would be replaced by experience of neuronal states i.e. brain states in the 'First-Brain Perspective'. There thus seems to be no phenomenal difference between 'distal absence' and 'distal neglect'. However, functionally the difference may consist in the absence or presence of any kind of 'goal-orientation'. 'Goal-orientation' may be absent in the case of 'distal absence', as it is the case in 'isolated coding' (see above). In contrast, 'goal-orientation' may be present in 'distal neglect' but, due to the absence of 'normal' top-down –and bottom-up modulation, functionally suppressed. Epistemically, the presence of 'goal-orientation' has to be regarded as a necessary condition for the possibility of mental states (see above). Accordingly, the absence of 'goal-orientation', as it is the case in 'distal absence', may be characterized by the impossibility of even raising the idea of the possibility of mental states. The idea of the possibility of mental states would thus remain unattainable. Similarly 'distal neglect' would also be characterized by the absence of mental states but unlike in 'distal absence', the idea that mental states are possible would still remain feasible. The thought experiment demonstrates the following: (i) the possibility of epistemic co-occurrence of neuronal and mental states is necessarily dependent on 'embedded coding' since it remains impossible in 'reversed embedded coding'; (ii) the possibility of the idea of possible mental states is necessarily dependent on the presence of 'event and action code' even if it remains neglected i.e. suppressed; (iii) the possibility of phenomenal distinction between neuronal and mental states is necessarily dependent on the presence of 'event and action code' even if it remains neglected i.e. suppressed.

In summary the following conclusions can be drawn: (i) the dependence of the possibility of 'autoepistemic limitation' on the kind of coding; (ii) the dependence of the possibility of mental states on the kind of coding; (iii) the possibility to distinguish between 'First-Brain Perspective' and 'First-Person Perspective' depends on the kind of coding; (iv) the possibility of the phenomenal distinction between neuronal and mental states depends on 'embedded coding'; (vi) the possibility of the idea of possible mental states depends on the presence of 'event and action code'.

Neuroepistemological hypothesis

Hypothesis: There is a relationship between 'autoepistemic limitation'/mental states and the organization of neuronal states in terms of events i.e. 'embedded coding'.

Neuroscientific implications: (i) a relationship between prefronto-parietal cortical circuits and 'goal-orientation' exists; (ii) 'vertical modulation' accounts for top-down modulation of primary sensory areas by prefronto-parietal circuits as well as bottom-up modulation of prefronto-parietal circuits by primary motor areas; (iii) 'horizontal modulation ' accounts for unilateral connectivity and one-way interaction between prefronto-parietal circuits and primary motor/sensory areas.

Epistemological implications: (i) mental states are characterized by events and meaning, while neuronal states are characterized by meaningless stimuli; (ii) there is a necessary relationship between mental states, which reflect an epistemic ability and 'autoepistemic limitation', which in turn reflects an epistemic inability; (iii) a necessary relationship between mental states and 'embedment' exists implying that the possibility of mental states and 'autoepistemic limitation' remains incompatible with 'isolation' of the brain/mind from the environment.

2.3.2 'State-oriented embedment': Feelings and qualia

Functional brain organisation: The neuroanatomical correlates of emotions
Until now, we only considered events within the environment and neglected the events within our own brain and body. Events within brain and body may indicate the actual state i.e. 'state-orientation'.

What is the exact functional relationship between 'state-orientation' and 'goal-orientation'?

'Internal' sensory signals, as induced by bodily events, and 'external' sensory signals, as triggered by environmental events, may be accounted for by different pathways; this reflects 'separate coding'. In this case, their contents would be incommensurate, translation would be needed, and 'non-instrumental dependence' between bodily and environmental stimuli would remain impossible (see 2.3.1). Alternatively, 'internal' and 'external' sensory signals may be accounted for by identical pathways, which as a result would be copies of each other i.e. 'isomorphic'; this reflects 'common coding'. In this case, their contents would be commensurate, translation would no longer be needed, and 'non-instrumental dependence would be possible. We are well able to distinguish between 'internal' (hormonal system, autonomous nervous system) and 'external' (sense systems: touch, smell, gustatory, visual, auditory) sensory signals i.e. between bodily and environmental events. Accordingly, both cannot be copies of each other, which makes the assumption of 'isomorphism' empirically implausible. The assumption of a 'non-instrumental dependence' between bodily and environmental events, however, remains plausible since there is direct interaction between the two. Therefore, a weaker form of 'common coding' i.e. 'embedded coding', which allows for 'non-instrumental dependence' while avoiding 'isomorphism', can be assumed (see also

2.3.1). Analogous to the ‘event and action’ code’, one may assume a ‘bodily and environmental code’ that complements the ‘internal/external sensory code’. Since both bodily and environmental events refer to the same code, ‘non-instrumental dependence’ is possible. However, because there are two kinds of codes (i.e. ‘internal/external sensory code’ and ‘bodily/environmental code’), mere copying and thus ‘isomorphism’ is excluded. Functionally, ‘embedded coding’ may be characterized by ‘proximal neglect’ (i.e. suppression of ‘sensory code‘), ‘distal reference’ (i.e. orientation on ‘observable events‘), and ‘state-orientation’ (i.e. reflection of events/state as distinguished from mere stimuli). ‘Embedded coding’ presupposes a linkage between bodily and environmental events and thus between ‘internal’ and ‘external’ sensory afferences. Emotions may be regarded as the paradigmatic example where both bodily and environmental events converge onto each other (LeDoux 1996; Panksepp 1998). Emotions reflect integration and linkage between environmental and bodily events: ‘Emotions are aroused in us by various external events ... and were designed to respond to various types of real-world events’ (Panksepp 1998: 47–50). Accordingly, emotions may be accounted for by neuroanatomical substrates that are essential for the ‘internal’ and ‘external’ sensory afferences. While regions like the brain stem and the hypothalamus provide ‘internal’ sensory afferences, regions like the amygdala and the orbitofrontal cortex provide substrates for the convergence of both ‘internal’ and ‘external’ sensory afferences. The brain stem nuclei (raphe nucleus, locus coeruleus, reticular formation, nuclei vagii, etc) not only register and regulate body states but also map body signals onto neural functions. These nuclei account for the registration and regulation of autonomic functions i.e. the vegetative nervous system. Accordingly, they regulate the internal milieu of the body with regard to neural functions. The hypothalamus is involved in registering the level of circulating nutrients such as hormones, glucose, ions, water, pH, etc. thus registering humoral functions.

According to Damasio (1999: 79–80, 2003), one may speak of a ‘body loop’ that registers neural and humoral signals from the internal milieu of the body and maps them onto the neuronal organisation of the brain. This ‘body loop’ itself is finally mapped onto somatosensory structures i.e. the secondary somatosensory cortex, the insular and the medial parietal cortex which subserve the functional integration between ’internal’ and ‘external’ sensory codes. Accordingly, patients with lesions in these regions exhibit severe emotional deficits (see Adolphs et al. 2000). In addition to the ‘body loop’, Damasio (1999: 79–80) assumes an ‘as if body loop’. This loop properly bypasses the body and internally simulates changes in the body via direct modulation of the body’s sensory maps in the somatosensory and parietal cortex. The ‘as if body loop’ can be superpositioned on the ‘body loop’. Within the framework of ‘embedded coding’, the ‘body loop’ may reflect ’state-orientation’ of the body. The ‘body loop’ may be described as a ‘body control loop’, which adjusts the brain to the body via ’bottom-up modulation’. The ‘as if body loop’, on the other hand, may account for 'state-orientation' of the brain and may thus be regarded as a 'brain control loop' which adjusts the body to the brain through 'top-down modulation'.

Regions like the amygdala and the orbitofrontal cortex provide integration and linkage between 'state-orientation' and 'goal-orientation'. The amygdala can be characterized by a convergence between 'internal' and 'external' sensory afferences. It therefore provides integration and linkage between bodily and environmental events (see O'Doherty et al. 2000; Francis et al. 1999; Rolls 1999, 2000a, b) and recognizes them as being crucial for the formation of 'state-orientation'. Moreover, the amygdala has sensory efferences by means of which it can modulate neural activity in both 'internal' and 'external' sensory areas (LeDoux 1996: 284–287, 2002). Accordingly, the amygdala, which accounts for 'state-orientation', can top-down modulate i.e. suppress neural activity that does not correspond to the respective state. This is the case for single sensory stimuli, which are not related to the respective event. The possibility of 'top-down modulation' may subsequently account for the co-occurrence of 'distal reference' and 'proximal neglect' from a functional point of view. The 'state-orientation' is then further processed to the orbitofrontal cortex, which shows both 'internal/external sensory' afferences and direct access to motor efferences. The orbitofrontal cortex may therefore be considered as crucial for the integration of 'state-orientation' within 'goal-orientation' (see also 2.3.3). However, the connectivity between amygdala and orbito/prefrontal cortex is predominantly one-sided since it is much stronger from the former region to the latter than vice versa (see Le Doux 1996: 287). Functionally, while 'state-orientation' can be integrated within 'goal-orientation' a 'reversed integration' i.e. integration of 'goal-orientation' within 'state-orientation' seems rather unlikely on the basis of this connectivity pattern.

Neuroepistemological implications: Emotions and qualia

Generation of 'feelings' and qualia

What are 'feelings'?

'Feelings' may be determined by the perception of the own bodily events in relation to the respective environmental context, which may remain either unconscious (Panksepp 1998) or conscious (Rolls 1999, 2000b; LeDoux 1996; Damasio 1999; Charland 1996, 1997) (see below). 'Feelings' in general may therefore be regarded as a subset of perceptions that reflect either bodily (see 2.3.2) or environmental (see above) events.

Functionally, 'feelings' reflect 'state-orientation' and 'homeostasis of the organisms'. They have an 'adaptive, central integrative function as opposed to input and output', and are important in 'controlling vigor and patterning of actions important for survival' (Panksepp 1998: 47–48): 'In more simple subjective terms, we might say that these systems generate an animal's egocentric sense of well-being with regard to the most important natural dimensions of life. They offer solutions to such survival problems as: How do I obtain goods? How do I keep goods? How do I remain intact? How do I make sure I have social contacts and supports? Such major survival questions, which all mammals face, have been answered during the long course of neural evolution by the emergence of intrinsic emotional tendencies within the brain' (Panksepp 1998: 48).

Phenomenally, 'feelings' can be considered an example of a mental state. They reflect events i.e. bodily events while they do not refer to stimuli. If, for example, they refer to stimuli, 'feelings' as such would remain impossible. Moreover, 'feelings', being 'intra-subjective', 'individual' and 'private' (see 2.1.3) show the phenomenal characteristics of mental states (see 2.3.1). Subsequently, 'feelings' may be regarded as a paradigmatic example of mental states.

Epistemically, 'feelings' reflect 'autoepistemic limitation' of the own brain states and body states (see 2.3.1). Due to 'autoepistemic limitation', we remain unable to detect and recognize events in our own body as bodily events. Instead, we rather perceive and experience them as 'feelings' i.e. as mental states. If there was no 'autoepistemic limitation', we would, for example, be able to directly detect and recognize our hormones and activities in our own autonomous nervous system. This would make 'feelings' superfluous (see also 2.3.1). Due to the experience of bodily events in terms of 'feelings', we relate them to our own person and its First-Person Perspective rather than to our own brain and its 'First-Brain Perspective' (see 2.3.1).

What is the relationship between 'feelings' and emotions?

The relationship between 'feelings' and emotions remains unclear. Some authors, like Panksepp, argue for a basic and primary role of 'feelings' in emotions which, in addition to the subjective component the 'feeling', include objective components like motor and vegetative features (Damasio 1999, 2003). According to Panksepp (1998: 340–341), 'feelings' must be considered as an 'existential state reflecting the organisms state' that is fundamental for emotions. Others, like LeDoux, Damasio and Rolls, do not deny the existence of 'feelings' as such but their basic, fundamental, and primary character. LeDoux (1996: 267) regards emotions as 'preprogrammed and automatic control of bodily responses' that do not necessarily require subjective experiences i.e. 'feelings'. According to LeDoux, 'feelings' arise only, if emotions are represented within the working memory and 'feelings' may therefore reflect 'consciousness of emotions' (LeDoux 1996: 282, 296–302). Analogously, Rolls (1999, 2000b) considers 'feelings' as a secondary representation of emotions in consciousness. Similar to LeDoux, Damasio denies the basic and constitutive character of 'feelings' for emotions. There is 'no central feeling before the respective emotion occurs – expression (emotion) precedes feeling' (Damasio

1999: 283–284). However, unlike LeDoux and Rolls, Damasio does not necessarily link 'feelings' to consciousness because they can remain either unconscious ('having of feelings') or become conscious ('knowing of feelings') (Damasio 1999: 284). Since 'feelings' are closely related to experiences in FPP, they are often considered 'pre-cognitive' or 'perceptual'. Emotions on the contrary, may rather be characterized by 'propositional contents' and thus as 'cognitive' (see, for example, Charland 1996). If 'pre-cognitive' indicates a necessary dependence of 'propositional contents' on 'feelings', it could reflect the basic and fundamental character of 'feelings' for emotions. If however 'pre-cognitive' means that 'feelings' are subsumed under 'propositional contents', the basic and fundamental character of 'feelings' for emotions would no longer be given. When relying on the term 'pre-cognitive' in the first sense, one may characterize 'propositional contents' as 'hot' cognitions as defined by guidance of cognitions by 'feelings' reflecting so-called 'preferenda'. Empirically, the assumption of such 'hot' cognitions is supported by the example of decision-making (see 2.3.3 for exact details). Cutting the linkage between 'feelings' and cognitive operations leads to wrong decisions and one could then speak of so-called 'cold' cognitions. One may also characterize 'feelings' as 'post-cognitive'. Cognitive processes like working memory may lead to second-order representations of emotions by means of working memory and consciousness which then may induce 'feelings' (see Damasio, LeDoux and Rolls above). The characterization of 'feelings' as 'post-cognitive', however, remains incompatible with the crucial role of 'feelings' especially in decision-making and their possible occurrence as unconscious 'feelings'.

Functionally, 'feelings' and emotions may be considered as two distinct events, which are necessarily interdependent. While 'feelings' are regarded as bodily events in relation to environmental events emotions rather reflect environmental events in relation to bodily events.

Phenomenally, 'feelings' and emotions may reflect distinct perceptual contents: 'feelings' may reflect the perception of bodily events while emotions may rather be related to the perception of environmental events.

Epistemically, 'feelings' are necessarily tied to the First-Person Perspective while emotions, due to the inclusion of observable motor and vegetative features, could be considered in Third-Person Perspective as well. Since the First-Person Perspective is a necessary condition for the possibility of a Third-Person Perspective (see 2.1 and 2.2 as well as 2.4.3 and 3.2.3), emotions may remain impossible without feelings. Accordingly, feelings, being the intrinsic nucleus of emotions must be considered as basic, fundamental and 'pre-cognitive'. The concept, introduced by Panksepp, is subsequently preferred over the ones that are suggested by Damasio, LeDoux and Rolls (see above).

What are qualia?

Qualia can be determined by the experience of perceptions in the First-Person Perspective. Perceptual contents of qualia may reflect either environmental events in relation to our own bodily events or our own bodily events in relation to environmental events. In the following, different functional, phenomenal, epistemic and ontological conditions for the possibility of qualia are discussed. Each condition is necessary but not sufficient by itself for the possibility of qualia. Only the conjunction between the different conditions can be considered as sufficient for the possibility of qualia. We will restrict the discussion to natural conditions and will only briefly raise the issue of logical conditions at the very end in the context of inverted and absent qualia (for the distinction between natural and logical conditions see 1.4.1).

Functionally, the co-occurrence of 'distal reference' and 'proximal neglect' makes the perception of bodily and environmental changes in terms of events (as distinguished from stimuli) necessary. Due to 'distal references', we recognize changes in both our own body and our environment in terms of 'events'. Due to 'proximal neglect', we do not recognize changes in both body and environment in terms of stimuli i.e. 'sensory code'. Accordingly, 'proximal neglect' and 'distal reference' can be regarded as necessary functional conditions for the possibility of qualia. Due to co-occurrence of 'proximal neglect' and 'distal reference', the distinction between 'primary and secondary qualities' as presented by Locke (1690, Book II, Chapter VIII, 9–10, 13–14) remains impossible. Physical, spatial, and temporal characteristics of the own body account for Locke's characterization of 'primary qualities' by 'solidity, extension, figure, motion, rest, and number'. These physical characteristics cannot be separated from the 'secondary qualities' i.e. qualia or the sensations they induce in us. Instead, the organisation of our brain suggests that the 'secondary qualities' are the 'primary qualities' (though not in the sense of Locke). Moreover, 'secondary qualities' in the sense of Locke can neither be characterized as 'imputed' and 'non-real' nor are they sufficiently dependent on 'primary qualities'. Instead, 'secondary qualities' i.e. qualia although not 'real' in the physical sense (see below) must be considered as 'real' in the phenomenal sense. Physical characteristics and thus 'primary qualities' in the sense of Locke are a necessary condition for the possibility of 'secondary qualities' i.e. qualia. The functional organisation, on the contrary, may be regarded as a sufficient condition for the occurrence of 'secondary qualities' i.e. qualia.

Phenomenally, qualia can be characterized by phenomenal-qualitative properties (Northoff 2003a). The own body shows phenomenal-qualitative properties (see 2.1.3 for further details). The perception of events within the body subsequently shows analogous properties – this is reflected in the characterization of qualia by phenomenal-qualitative properties. The connection of qualia with the body implies the crucial role of 'feelings' in qualia. 'Feelings' reflect bodily events in relation to environmental events. Since qualia necessarily presuppose a linkage to the phenomenal-qualitative properties of the body, they are also necessarily tied to 'feelings', which reflect events within the body. Accordingly, the phenomenal-qualitative properties of the body and 'feelings' as bodily events may be regarded as necessary phenomenal conditions for the possibility of qualia. However, qualia do not only reflect the experience of bodily events in relation to environmental events but in addition, environmental events in relation to bodily events. Since feelings reflect only the former but not the latter, they cannot be considered as a sufficient condition for the occurrence of qualia.

Epistemically, qualia are necessarily linked to 'autoepistemic limitation' and the First-Person Perspective. Qualia as mental states refer to the experience of events. The possibility to experience events reflects the perception of environmental events. This, however, makes the perception of the own brain states as brain states impossible. If there were no 'autoepistemic limitation', there would be neither mental states nor qualia. Direct detection and recognition of the own brain states as brain states would, however, be possible. Due to the experience of brain states in terms of events, we attribute the respective mental states to our own person and its First-Person Perspective rather than to our brain and its 'First-Brain Perspective'. If there were no First-Person Perspective, the experience of events and thus qualia would remain impossible. Accordingly, 'autoepistemic limitation' as well as First-Person Perspective can be considered as necessary epistemic conditions for the possibility of qualia.

Ontologically, qualia are closely related to 'embedment'. The possibility to perceive bodily and environmental changes in terms of events is necessarily linked to a particular way of the functional organization of the brain i.e. 'embedded coding' (see 2.3.1 and 3.1.2). In contrast to 'separate coding' and 'common coding', 'embedded coding' provides the 'intrinsic' integration between brain, body, and environment as reflected in 'embodiment' and 'embeddedness'. 'Embodiment', which reflects the 'intrinsic' integration of the brain within the body (see 1.3 as well as 3.3.2), is a necessary condition for the possibility of First-Person Perspective (see 2.4.1) and thus for experience as such. 'Embeddedness', which reflects the 'intrinsic' integration of the brain/body within the environment (see 1.3 as well as 3.3.2), is a necessary condition for the experience of events, as distinguished from mere stimuli. Since qualia can be defined by the experience of bodily/environmental events (see above), 'embodiment' and 'embededdness' may be regarded as necessary ontological conditions for the possibility of qualia as 'embedded qualia'. While 'isolated qualia' that no longer show 'embodiment' and 'embeddedness', remain logically possible they, at the same time, remain naturally impossible. 'Isolated qualia' are presupposed in both 'inverted- and absent qualia argument'. The same neuronal-functional organisation may either be accompanied by different kinds of qualia i.e. inverted qualia as, for example, the colour green instead of red or there may be no qualia at all, as it is presupposed in the 'absent qualia argument'. In both cases, brain, body, and environment can no longer be integrated within each other since otherwise either inversion or absence remains impossible. Accordingly, both arguments presuppose ontological 'disembodiment' and 'disembeddedness' and thus 'isolated qualia'. It becomes clear, that this conception of qualia is not compatible with the functional organisation of the brain as characterized by 'embedded coding'. Neither absent nor inverted qualia can therefore be considered as naturally possible i.e. they cannot occur in the actual world. However, this does not exclude their logical possibility (see 1.4.1). Although absent and inverted qualia remain impossible in the actual world i.e. naturally impossible, they may nevertheless be possible in a world different from ours i.e. logically possible. This world however, must show both 'disembodiment' and 'disembeddedness' as necessary conditions for the possibility of 'isolated qualia' and thus for absent or inverted qualia.

'Feelings' and qualia

First, imagine the case of 'isolated coding' i.e. 'separate coding' in which 'state-orientation' is replaced by 'stimulus orientation' (see 2.3.1).

Functionally, convergence of 'internal' and 'external' sensory afferences with the amygdala would not exist (see 2.3.2). Since 'sensory coding' replaces 'event coding', an asymmetric connectivity between amygdala and primary sensory areas as well as between amygdala and the prefrontal cortex would no longer be necessary. If no 'state-orientation' were generated, 'top-down modulation' and integration and 'state-orientation' within 'goal-orientation' would be superfluous. Phenomenally, any 'feelings' would also not longer exist because there are neither perceptions nor bodily events. Due to the 'sensory code', only stimuli in 'internal' and 'external' sensory afferences as reflected in so-called 'sensory impressions' (see Locke) would subsist. Accordingly, the perception of bodily changes in terms of events remains absent. Furthermore, without the perception of events there would be no qualia either (see 2.3.2). Epistemically, neither 'First-Person Perspective' nor 'autoepistemic limitation' would exist (see 2.3.1), which consequently results in the absence of qualia. Ontologically, however, both 'disembodiment' and 'disembeddedness' would exist. Due to 'separate coding' between 'internal' and 'external' sensory afferences, brain and body would be separated from each other and thus 'disembodied'. Also due to 'separate coding' between sensory and motor function, body and environment would be separated from each other and thus 'disembedded'. Accordingly, absent and inverted qualia would be possible. The thought experiment demonstrates the following: (i) the possibility to experience and perceive is necessarily dependent on the kind of coding; (ii) the possibility of 'feelings' and qualia is necessarily dependent on the possibility of experience and perception; (iii) 'disembodiment' and 'disembeddedness' are necessary conditions for the ontological possibility of absent and inverted qualia.

Imagine a second case of 'environmental' or 'common coding' (see 2.3.1).

'Internal' and 'external' sensory afferences converge within the amygdaloid network. This is necessary to generate 'state-orientation', which would as a result subsist. In contrast to 'embedded coding', 'proximal neglect' would no longer subsist but instead 'proximal absence'. Accordingly, the 'internal' and 'external' sensory code is not even suppressed, as in 'proximal neglect', but remains totally absent. A distinction between 'sensory code' and 'event code' remains thus impossible. Superposition of the former on the latter and unilateral connectivity between amygdala and primary sensory areas would be superfluous. Because of 'distal reference', 'state-orientation' has to be linked with 'goal-orientation' in order for asymmetric amygdala-prefrontal connectivity to be present. Phenomenally, feelings and qualia would exist but both would no longer solely concern the own person but other individuals as well. The distinction between feelings and non-feelings as well as between qualia and non-qualia would be impossible since both the own and other individuals are experienced in terms of mental states i.e. feelings and qualia. Epistemically, a difference between First- and Third-Person Perspective would no longer subsist. 'Autoepistemic limitation', however, would persist but it would be extended because recognizing it as such i.e. as an epistemic inability would also remain impossible. Since both our own and others brains are experienced in terms of mental states, the distinction between mental and neuronal states becomes blurred. This makes it almost impossible to recognize 'autoepistemic limitation' as an epistemic inability. Ontologically, one could no longer speak of 'embodiment' and 'embeddedness' in the above (see 2.3.2) mentioned sense. 'Embodiment' necessarily presupposes the distinction between brain and body since otherwise, as in the present case, integration would be superfluous. 'Embeddedness' necessarily presupposes the distinction between brain/body and environment since otherwise, as in the present case, integration would be superfluous. The thought experiment demonstrates the following: (i) the restriction of experience and perception to the own person is necessarily dependent on the kind of coding; (ii) the recognition of 'autoepistemic limitation'/mental states and qualia is necessarily dependent on the restriction of 'feelings' and qualia to the own person and to the First-Person Perspective; (iii) the ontological possibility of 'embodiment' and 'embeddedness' is necessarily dependent on the possibility to distinguish between brain, body, and environment.

Imagine a third case with a reversed design to the actual one: a case with 'reversed embedded coding' as characterized by 'proximal reference', 'distal neglect', and 'stimulus orientation' (see 2.3.1).

There would be superposition of the 'sensory code' on the 'event code'. This would probably be reflected in reversed connectivity between amygdala and the primary sensory areas (see 2.3.2). Since 'stimulus orientation' prevails over 'goal- and state-orientation', the linkage between 'state- and goal-orientation' would no longer be necessary, which in turn would make asymmetric amygdala-prefrontal connectivity superfluous. Similar to the case of 'isolated coding' (see above), feelings and qualia would not longer exist because both perception and experience are not present in this case. However, unlike in both 'isolated coding' and 'environmental coding', the distinction between 'feelings' and non-feelings' as well as between 'qualia' and non-qualia' would still be possible i.e. although not naturally but logically. Even if there were no feelings and qualia in the actual i.e. natural world, they would at least be imaginable in a different i.e. logically possible world. Epistemically, the First-Person Perspective would remain absent but still imaginable. Moreover, 'autoepistemic limitation' would be replaced by 'autoepistemic recognition' which indicates the ability to recognize the own brain states as brain states. Mental states, on the other hand, would remain naturally but not logically impossible. Ontologically, although with a reversed balance between the two, both distinction and integration between brain, body, and environment may still exist. One could therefore speak of 'embrainment', which reflects the integration of the body within the brain, and 'reversed embeddedness', which accounts for the integration of the environment within the body. The thought experiment demonstrates the following: (i) the possibility to experience and perceive in the First-Person Perspective is necessarily dependent on 'embedded coding'; (ii) the idea of 'feelings' and qualia as logical possibilities is necessarily dependent on the possibility to distinguish between 'sensory code' and 'event code' even if the latter remains suppressed; (iii) the direction of the ontological relationship between brain, body, and environment is necessarily dependent on the balance between distinction and integration.

In summary, the following conclusions can be drawn: (i) the possibility to experience and perceive in the First-Person Perspective is necessarily dependent on 'embedded coding'; (ii) both experience and perception are not necessarily restricted to the First-Person Perspective and thus to the own person exclusively; (iii) the possibility of 'feelings' and qualia is necessarily dependent on the possibility of experience and perception; (iv) the possibility of 'feelings' and qualia is not necessarily dependent on the distinction between feelings and non-feelings and neither on the distinction between qualia and non-qualia; (v) the logical possibility of 'feelings' and qualia is necessarily dependent on the possibility to distinguish between stimuli and events; (vi) the ontological possibility of 'embodiment' and 'embeddedness' is necessarily dependent on both distinction and integration between brain, body, and environment as well as on the balance between both; (vii) the possibility of absent and inverted qualia as a purely logical possibility is necessarily dependent on 'disembodiment' and 'disembeddedness' which reflect the disruption of the ontological relationship between brain, body, and environment.

Neuroepistemological hypothesis

Hypothesis: There is a relationship between 'feelings'/qualia and the neuronal processing of 'internal' and 'external' sensory afferences in terms of events.

Neuroscientific implications: (i) top-down and bottom-up modulation between amygdala and 'internal/external' sensory regions; (ii) involvement of regions with 'internal' and 'external' sensory afferences in emotions; (iii) asymmetric connectivity between amygdala and prefrontal cortex with stronger connectivity from the former to the latter.

Epistemological implications: (i) characterization of qualia by 'feelings' and linkage to phenomenal-qualitative properties of the own body; (ii) necessary relationship of qualia to 'autoepistemic limitation' and First-Person Perspective; (iii) 'embodiment' and 'embeddedness' as necessary natural ontological conditions for the possibility of qualia making absent and inverted qualia impossible in the case of humans.

2.3.3 'Act-oriented embedment': Intentionality and mental causation

The functional organisation of the brain: Neuroanatomical correlates of acts

While events within brain and body indicate the actual state i.e. 'state-orientation' which reflects 'observable events within the environment' (see 2.3.2), 'to-be effectuated events within the environment' rather account for 'act-orientation'.

What is the exact functional relation between 'state-orientation' and 'act-orientation'?

Different pathways that reflect 'separate coding' (see 2.3.1) may account for 'internal'/'external' sensory signals and 'internal' motor signals. The contents would be incommensurate, translation would be needed, and a 'non-instrumental dependence' between bodily/environmental events and bodily action would remain impossible. Alternatively, 'internal'/ 'external' sensory signals and 'internal' motor signals may be subserved by identical pathways; this indicates 'common coding'. These contents would be copies of each other i.e. they would be 'isomorphic'. Moreover, the contents would be commensurate, no translation would be needed and 'non-instrumental dependence' would be possible. The possibility of a 'non-instrumental dependence' between bodily/environmental events and bodily action is empirically more likely since there is direct interaction between bodily/environmental events and bodily action. However, due to the possibility to distinguish between environmental/bodily events and bodily action, the assumption of 'isomorphism' remains rather implausible. Accordingly, a weaker form of 'common coding' i.e. 'embedded coding' may be suggested, which allows for 'non-instrumental dependence' while avoiding 'isomorphism'. In addition to 'sensory/motor code', one may assume an 'event and action code'. Since both event and action share the same code and thus the same reference i.e. 'observable and to-be effectuated events within the environment', a 'non-instrumental dependence' between bodily/environmental events and bodily action is possible. However, since there are two distinct codes i.e. 'sensory/motor code' and 'event/action code', 'isomorphism' is avoided (see also 2.3.1).

In order to allow for linkage between 'state-orientation' and 'act-orientation', sensory afferences and motor efferences should be linked and integrated with each other; this is provided by the orbitofrontal cortex. The orbitofrontal cortex provides a direct linkage between 'state-orientation' and 'act-orientation' and thus between feelings/emotions and behaviour/movement. It may therefore be considered as a 'critical node' in the 'processing of environmental and internal cues to generate feeling states that may influence and modulate behavior' (London 2000). The orbitofrontal cortex (i.e. OFC) encomprises the orbital, inferior, ventral, and polar part of the frontal lobe including the Brodman areas (i.e. BA) 10, 11, 47/12, and 25 (Price et al. 1996, 1998, 2003; Elliot et al. 2000; Rolls 2000a). With respect to connectivity it is possible to distinguish between a medial and a lateral part in the OFC The medial OFC receives inputs from limbic parts like hippocampus, parahippocampal cortex, cingulate, retrosplenial and entorhinal cortex, and anterior thalamus. The medial OFC sends outputs to the caudate nucleus as well as to lateral hypothalamus, preoptic region, and indirectly to brain stem nuclei that control autonomic and endocrine responses. The lateral OFC receives inputs from almost all sensory areas: taste and olfactory inputs, visual inputs from objects via the inferior temporal cortex and visual inputs from faces via the anterior part of superior temporal sulcus, auditory inputs via the superior temporal cortex, somatosensory inputs via the somatosensory cortex (SI and SII) and internal sensory input from the body via the insula (see Rolls 2000). The lateral OFC is connected with the dorsolateral prefrontal cortex (i.e. DLPFC), as well as with posterior parietal cortex and inferior parietal lobule, mediodorsal and midline thalamus and amygdala. It sends strong output to DLPFC, cingulate motor area (i.e. BA 24c), and supplementary motor area (BA 6) (Bates & Goldman-Rakic 1993; Carmichael & Price 1995; Cavada et al. 2000). The crucial role of the orbitofrontal cortex in the linkage and integration between 'state-orientation' and 'act-orientation' is nicely reflected in the process of decision-making (i.e. DM) (see Damasio 1999; Bechara et al. 2000). The decisions made in a gambling task are accompanied by an anticipatory skin conductance response (i.e. SCR's), which, according to Bechara and Damasio, is closely related to the generation of feelings and emotions. In contrast to healthy individuals, patients with lesions in the medial orbitofrontal cortex no longer show anticipatory SCR's. Furthermore, these patients tend to choose disadvantageous strategies in reference to gambling tasks. As a result they seem insensitive to future consequences of their decisions. The failure to 'enact a somatic state appropriate to the consequences of the response' must be considered as a correlate of their ‘inability to choose advantageously’. This may reflect a ‘weakened ability to process the affective attribute of an emotional stimuli or to actually experience the emotion associated with that stimuli’ (Bechara et al. 2000). Accordingly, patients with OFC lesions can be characterized by ’myopia for acts and goals’, disruptions in both emotional and social behavior and an absence of feelings/emotions. Their cognitive abilities themselves, however, remain intact (Bechara et al. 2000; Elliott et al. 2000; Sarazin et al. 1998; Angrilli et al. 1999; Malloy et al. 1993). Linkage and integration between feelings/emotions and behaviour/movement i.e. between ‘state-orientation’ and ‘act-orientation’ subsequently remains impossible in these patients. Since the OFC apparently accounts for integration and linkage between events and actions, one would expect its neurons to respond to behaviourally meaningful environmental events rather than meaningless physical stimuli. This has indeed been demonstrated (Elliott et al. 2000; Schultz et al. 2000). Neurons in the OFC fulfil two criteria for ‘act-directed’ behaviour (see Schultz et al. 2000): (i) the coding of behavioural outcome at the time of behavioural execution. This is reflected in the coding of future events, reflecting ‘acts and goals’, in neurons in OFC; (ii) the coding of causal relationship between action and outcome as contingent i.e. relative to others. This is reflected in preference-related activation of OFC neurons, which distinguish between goals with higher and lower relevance (Schultz et al. 2000). In contrast, neural activity in the OFC neurons is not sensitive to mere physical stimuli as such since they are not related to particular goals ad thus environmental events.

In addition to ‘act-orientation’ and ‘distal reference’, ‘embedded coding’ can also be characterized by ‘proximal neglect’. Within the present context, ‘proximal neglect’ can be accounted for by suppression of the ‘motor code’. Behaviourally, the OFC can be characterized by inhibition and suppression of ‘stimulus-related behaviour’ in favor of ‘act i.e. goal-oriented behaviour’. Especially, the lateral OFC may be closely related to inhibition since it suppresses responses to previously rewarded behavioural (Elliott et al. 2000) and emotional stimuli (Northoff et al. 2000, 2002). The lateral OFC may subsequently provide inhibition by ‘overriding of behavioral choices based on the previous reward values of stimuli and responses’ (Elliott et al. 2000). This is, for example, reflected in the ‘Go- No-Go’ task where movements, as related to the stimulus ‘Go’, have to be suppressed in case of the appearance of the stimulus ‘No-Go’. Patients with lesions in the OFC show severe deficits in the ‘No-Go’ task and display impulsive and repetitive behavior (Sarazin et al. 1998). From a functional point of view, one may therefore speak of a release from ‘proximal neglect’ with consecutive replacement of ‘distal reference’ by ‘proximal reference’.

Neuroepistemological implications: Intentionality and qualia

Intentionality and mental causation

What is intentionality?

The organization of neuronal activity is coded in terms of ‘observable and to-be effectuated events within the environment’ rather than stimuli (see 2.3.1 as well as 3.1.2). Accordingly, we perceive more than we actually see and we act more than we actually execute. We see stimuli but we perceive an ‘observable event within the environment’. We execute a movement but we perform a whole act on a ‘to-be effectuated event within the environment’. Both perception and action reach beyond actual seeing and executing so that they may functionally be characterized by ‘going beyond’ (Prinz 2000b: 18–19; Edelman & Tononi 2000: 173). This is formulated in a paradigmatic way in the following quotation: ‘For instance, we cannot look at a written word without hearing, as it were, how it sounds, and understanding what it means. In these cases, the stimulus information on which perception is grounded is purely visual, but the information that is perceived goes far beyond – capturing sound, meaning, and so on. The same applies to the perception of physical events. When we observe the billiard ball that hits another, the information our percept is grounded on is again purely visual, but the information perceived includes the perception of a causal relationship between the movements of the two balls. In the same vein, when we watch others people’s action, what we see goes far beyond what is contained in the underlying stimulus configuration: We see, for example, what objects people are reaching for, what goals they strive for, and whether they fail or succeed. ... We do it by ordinary perception - which by definition implies that we go beyond the information given’ (Prinz 2000b: 18–19). Concerning action, the ‘going beyond’ is reflected in the difference between ‘motor code’ and ‘action code’. The ‘motor code’ refers to purely mechanical markers and meaningless muscle excitation/movements both being isolated from the respective environmental context. The ‘action code’, in contrast, refers to ‘biomechanical markers’ (see 2.1.1) and meaningful behaviour i.e. action both being integrated within the respective environmental context. Accordingly, action is ‘going beyond’ mere muscle excitation/movements. Analogous to perception, action is directed towards something beyond itself i.e. to ‘to-be effectuated events within the environment’. It is this direction towards events within the environment which one may call ‘intentionality’. ‘Intentionality’ may be defined by the orientation of sensory impressions and movements on ‘observable and to-be effectuated events within the environment’, which subsequently results in perception and action. Accordingly, sensory impressions and movements can be characterized by ‘going beyond’ by means of which they are transformed into percepts and acts.

Functionally, intentionality can be accounted for by a particular way of the functional organisation of the brain i.e. ‘embedded coding’. Subsequently, the brain itself i.e. its neuronal organisation reflects the relationship with the environment and thus intentionality: 'Philosophers often puzzle about the problem of 'intentionality', the intriguing fact that mental contents are 'about' things outside the mind. I believe that the mind's pervasive 'aboutness' is rooted in the brain's storytelling attitude. The brain inherently represents the structures and states of the organism, and in the course of regulating the organism as it is mandated to do, the brain naturally weaves wordless stories about what happens to an organism immersed in an environment' (Damasio 1999: 189).

Phenomenally, intentionality is reflected in percepts, as distinguished from mere sensory impressions, and acts, as distinguished from mere movements. We experience percepts rather than sensory impressions. We perform acts rather than movements; the 'going beyond' is thus reflected in phenomenology. We would otherwise remain unable to distinguish between sensory impressions/movements and perception/action. Accordingly, the possibility to distinguish between sensory impression/movement and perception/action can be considered as a necessary phenomenal condition for the possibility of intentionality. This integration within and the direction towards the environment, which both account for intentionality is nicely reflected in the following quote by Hume (1748, Section V, Part II, 45): 'As nature has taught us the use of our limbs, without giving us the knowledge of the muscles and nerves, by which they are actuated; so has she implanted in us an instinct, which carries forward the thought in a correspondent course to that which she has established among external objects; though we are ignorant of those powers and forces, on which this regular course and succession of objects totally depends'.

Epistemically, intentionality is reflected in the difference between First- and Third-Person Perspective. We are able to experience perceptions and perform actions in First-Person Perspective but, at the same time, remain unable to do so in Third-Person Perspective. In Third-Person Perspective, we can neither experience perceptions nor perform actions. Instead, the Third-Person Perspective provides the observations of others' perceptions in terms of sensory impressions and recognition of others' actions in terms of movements. Intentionality is subsequently tied to the First-Person Perspective as distinguished from the Third-Person Perspective. Accordingly, the possibility to distinguish between First- and Third-Person Perspective can be considered as a necessary epistemic condition for the possibility of intentionality.

Ontologically, intentionality can be characterized by 'embedment'. The direction of sensory impressions and movements towards events within the environment i.e. the 'going beyond' would be impossible if there was no integration between brain, body, and environment. Intentionality in this sense comes close to what Merleau-Ponty (1958: xx), who relies on Husserl, calls 'operative intentionality' ('fungierende Intentionalitaet') which, in the present context, may be described as 'embedded intentionality'. 'Operative intentionality' accounts for the direction of 'phenomenal experience' (in First-Person Perspective) towards events within the environment. It provides the ground and foundation for the possibility of 'thetic intentionality' ('intentionality of acts'), which concerns judgment rather than experience. However, since judgments i.e. 'physical judgments' (in Third-Person Perspective) are necessarily dependent on 'phenomenal experiences' (in First-Person Perspective), 'thetic intentionality' presupposes 'operative intentionality'. 'Operative intentionality' (as 'embedded intentionality') thus provides the ground and foundation for the possibility of 'thetic intentionality' (as 'isolated intentionality') (Merleau-Ponty 1958: 486, 498–499). Accordingly, 'embedment' can be considered as a necessary ontological condition for the possibility of intentionality.

What is the relationship between intentionality and qualia?

Qualia were defined by the experiences when perceiving bodily events in relation to environmental events (see 2.3.2). Intentionality on the other hand reflects the orientation of sensory impression/movement on 'observable and to-be effectuated events within the environment' (see above). Both qualia and intentionality are thus defined by events as distinguished from mere stimuli. Nevertheless, the focus of the events is different in both cases. While qualia primarily reflects bodily events, intentionality rather reflects environmental events. Since bodily and environmental events are intrinsically linked with each other, qualia and intentionality cannot be separated from each other. Their relationship can thus be characterized by a bilateral dependency reflecting mutual dependence. Qualia without intentionality would be 'empty' the experience of percepts would no longer be directed towards 'observable and to-be effectuated events within the environment'. Intentionality without qualia would be 'hollow' since the 'going beyond' i.e. the directedness could no longer be experienced as such: 'As I noted at the outset, it seems unlikely that we can account for the aboutness of conscious phenomenal states without taking into account the subjective aspect of what it's like to be in them' (van Gulick 1995: 277). Due to such 'bilateral dependency' (see 3.3.2 for further definition), the relationship between qualia and intentionality may be characterized by 'co-occurrence and co-constitution'.

Searle (1992) argues that qualia have to be regarded as a 'ground level property' from which intentionality can be inferred. He consecutively considers qualia as primary and intentionality as secondary. Intentionality without qualia would not exist whereas the existence of qualia without intentionality would be possible. Dennett (1991), in contrast, argues that intentionality is a necessary condition for qualia since the latter must be regarded as judgements of the former. Qualia may also be regarded as a higher form of intentionality i.e. a so-called 'meta-intentionality', as suggested by van Gulick (1995). Lower forms of intentionality are therefore not accompanied by qualia. Similar to Searle, we consider qualia as a necessary natural condition for intentionality. Without qualia, which reflect the experience of perceptions and actions, a direction towards 'observable and to-be effectuated events within the environment' would remain meaningless i.e. superfluous since it could no longer be experienced as such. Such a 'hollow' intentionality, i.e. intentionality without experience, remains naturally impossible. We therefore reject Searle's assumption that unilateral dependency between qualia and intentionality exist i.e. with the latter being dependent on the former but not vice versa. Similar to Dennett and van Gulick, we consider intentionality as a necessary condition for qualia. Qualia without intentionality would remain 'empty' which also remains naturally impossible. Finally, we regard both qualia and intentionality as low-level i.e. ground properties. Since the relationship between qualia and intentionality can be characterized by 'co-occurrence and co-constitution' (see above), both have to be classified as either low- or high-level properties. A 'low-level property' within the present context means that the respective property must be considered as basic, constitutive, and characteristic for 'embedment'. 'High-level properties' in contrast, may rather be regarded as additional, non-constitutive and epicharacteristic with respect to 'embedment'. Since we consider both qualia and intentionality as 'low-level properties' they must be regarded as characteristic and constitutive for 'embedment' and thus for the 'intrinsic' integration between brain, body, and environment.

What is mental causation?

Aristotle distinguished between four different kinds of causes. 'Final causes' describe the goal or purpose toward which something aims, 'formal causes' characterize what makes anything one sort of thing and no other, 'material causes' describe the substance it is made of, and 'efficient causes' characterize the force that brings things into being. In contrast to 'efficient causes', 'final causes' presuppose something outside the organism as the purpose or 'goal' towards which they are directed. 'Goal-orientation', which reflects 'observable and to-be effectuated events within the environment', may be regarded as such a 'final cause'. Berkeley gives fine examples for the distinction between 'efficient causes' and 'final causes' with respect to 'goal-orientation': 'To all which my answer is, first, that the connexion of ideas does not imply the relation of *cause* and *effect*, but only of a mark or *sign* with the thing *signified*. The fire which I see is not the cause of the pain I suffer upon my approaching it, but the mark that forewarns me of it. In like manner the noise that I hear is not the effect of this or that motion or collision of the ambient bodies, but the sign thereof' (Berkeley 1710: 65).

However, with the development of modern science and Newtonian mechanics, the concepts of both 'final cause' and 'formal cause' were discarded almost entirely (Juarrero 1999: 211–212). Accordingly, only 'efficient causes' were regarded as properly fundamental, which leaves no room for other kinds of causalities but 'physical causation': 'Once Aristotle's final causes were disallowed, Newtonian mechanics left no room for either objects in the external world or anticipated end-states to serve as intentional objects of desire and goals of action. Once wholes came to be thought of as reducible to the sum of their component particles, the concept of formal cause likewise became otiose.' (Juarrero 1999:21). The restriction of causality to 'efficient causality' lead to the neglect of 'goal-orientation' since it was no longer necessary within the framework of 'efficient causality'. Not considering 'goal-orientation' resulted in the neglect of 'embedment' and the consequential presupposition of 'isolation' with separation between brain, body, and environment. Neglecting 'embedment' lead to the equation of perception/action with sensory impression/movement which could be well accounted for by 'efficient causality'. Accordingly, since dominated by 'efficient causality', qualia and intentionality, as related to perception/action rather than to sensory impression/movement, were excluded from science and consequently regarded as as purely philosophical problems. Analogous to 'final causes', 'formal causes' were eliminated as well. The elimination of 'formal causes' lead to the neglect of self-motion and autonomous dynamics. Interactions were thus restricted to the 'forceful momentum of an external particle activating another in a bumper car fashion' (Juarrero 1999:24). Not considering self-motion and autonomous dynamics lead to the neglect of dynamicity and self-organisation, which are both characteristic and constitutive for the functional organisation of the brain i.e. the brain as a 'dynamic brain' (see 3.1.2). Neglecting dynamicity as well as self-organisation restricted the perspectives (and methodological approaches) relied on in neuroscience. The investigation of dynamicity and self-organization presupposes a 'systems or brain point of view' i.e. 'First-Brain Perspective' (see 2.3.1 and 3.2.1). If dynamicity and self-organization are neglected, elucidation of a 'systems or brain point of view' remains no longer necessary. The empirical investigation of the brain remains subsequently restricted to a point of view from 'outside of the brain' and thus to an 'investigator/person point of view' which, does not necessarily correspond to the 'systems or brain point of view'.

'Efficient causality' is not compatible with 'embedded coding'. Instead, 'embedded coding' is necessarily tied with 'formal causality' and 'final causality' (see also 3.1.2 and 3.3.2 for more detailed accounts). Functionally, 'final causes' may reflect 'goal-orientation', as presupposed in 'embedded coding'; phenomenally, they may account for the possibility of qualia and intentionality. Functionally, 'formal causes' may reflect self-organisation and dynamic organisation of the brain while, phenomenally, they may account for 'autoepistemic limitation' and mental states. Both 'final and formal causes' thus reflect distinct functional and phenomenal aspects of 'embedment'. 'Causa efficiencs' can be characterized as 'physical causality' which is oriented on stimuli and presupposes therefore 'isolation' between brain, body, and environment. 'Causa finalis and formalis', in contrast, may be characterized as forms of 'biological causality' (see 3.3.3 for the distinction between 'physical' and 'biological'), which is oriented on events within the environment and subsequently presupposes 'embedment' of the brain within body, and environment.

Finally, the possibility of mental causation remains incompatible with 'efficient causality'. It can, however, be properly described by 'formal and final causality'. 'Efficient causality' as a form of 'physical causality', which refers to stimuli, remains incompatible with events as experienced in mental states. In contrast, both 'final and formal causality' no longer refer to physical stimuli. Instead, they refer to biologically meaningful events within the environment. Since they refer to events, both forms of causality may be compatible with the possibility of mental states as related to events and consecutively with 'mental causation' (see 3.3.2 for detailed discussion).

Acts and Intentionality

Imagine first the case of 'isolated coding' i.e. 'separate coding'.

While 'act-orientation' would no longer exist 'stimulus orientation' with no convergence of 'internal'/'external' sensory afferences and 'internal' motor efferences onto the orbitofrontal cortex would predominate. The integrative function of the orbitofrontal cortex would be superfluous since 'motor coding' would replace 'action coding'. Due to 'distal absence', the neurophysiological response properties of neurons in the orbitofrontal cortex would no longer be 'act- and goal-oriented' but rather 'stimulus-oriented'. Due to the replacement of 'proximal neglect' by 'proximal reference', superposition of the 'action-code' on the 'motor code' is no longer necessary. There would no longer be any kind of 'going beyond' in either perception or action. 'Observable and to-be effectuated events within the environment' as a reference for mental states are replaced by 'sensory and motor stimuli within the body'. Accordingly, the difference between perception/action and sensory impression/movement vanishes. There are no longer any states that are characterized by intentionality since states do not refer to 'observable and to-be effectuated events within the environment'. Neither kind of intentionality i.e. 'Fungierende und Akt-Intentionalität' would be possible. 'Co-occurrence and co-constitution' between qualia and intentionality as 'low-level properties' would be replaced by 'co-occurrence' between sensory and motor functions. Due to separation, sensory and motor functions are neither 'co-constitutive' nor bilaterally dependent on each other. Finally, causation would be restricted to 'efficient causality' excluding 'final and formal causality'. Accordingly, mental causation remains impossible. The thought experiment demonstrates the following: (i) the difference between perception/action and sensory impression/movement is necessarily dependent on the kind of coding; (ii) the possibility of intentionality is necessarily dependent on the possibility of distinguishing between perception/action and sensory impression/movement; (iii) the possibility of mental causation is necessarily dependent on the possibility of 'final and formal causality'.

Imagine second the case of 'environmental coding' i.e. 'common coding'.

Due to 'proximal absence', one would not be able to distinguish between 'act-orientation' and 'stimulus-orientation'. Accordingly, there would be 'isomorphism' between 'internal'/'external' sensory afferences and 'internal' motor efferences. Due to 'distal reference', the neurophysiological response properties of the neurons in the orbitofrontal cortex would still be 'act- and goal-oriented'. Due to the replacement of 'proximal neglect' by 'proximal absence', the superposition of the 'action-code' on the 'motor code' is no longer necessary. This case could be characterized by 'going beyond' in all our perceptions and actions. Perceptions and actions would no longer be restricted to the own person, as it is the 'normal' case, but would include experiences of other individuals as well. The distinction between experience and observation is thus nivellated. The observation of other individuals would no longer refer to sensory impressions/movements but rather to perceptions/actions. Accordingly, all states could be characterized by intentionality. Making a distinction between intentional and non-intentional states is, as a result, rather difficult. Furthermore, the disparity between qualia and intentionality would be blurred because a difference between bodily and environmental events would no longer exist. 'Final and formal causality' would prevail exclusively while 'efficient causality' would remain impossible. The thought experiment demonstrates the following: (i) the possibility to distinguish between perception/action and sensory impression/movement is necessarily dependent on the kind of coding; (ii) the possibility to distinguish between intentionality and non-intentionality is necessarily dependent on the possibility to distinguish between perception/action and sensory impression/movement; (iii) the possibility to distinguish between different kinds of causality is necessarily dependent on the possibility to distinguish between intentionality and non-intentionality.

Imagine a third case, one of 'reversed embedded coding', which is characterized by 'proximal reference', 'distal neglect' and 'stimulus orientation'.

In this case the superposition of the 'motor code' on the 'action code' would subsist. The inhibitory function of the lateral OFC would be reversed and replaced by an excitatory function. The response properties in the orbitofrontal neurons would no longer be 'goal-oriented' but rather 'stimulus oriented'. Similar to 'separate coding' (see above), there would no longer be any kind of 'going beyond' in either perception or action since they do not refer to 'observable and to-be effectuated events within the environment' but rather to 'sensory and motor stimulation within the body'. In contrast to 'separate coding', there would, however, be a difference between perception/action and sensory impression/movement. Due to 'distal neglect', which replaces 'distal absence', perception/action (although suppressed), would still be present. Consequently, 'intentionality' and 'non-intentionality' would exist but in a reversed way. Experience would be characterized by non-intentional states whereas observation of others would be related to intentional states. Ontologically, 'embedment' would be reversed. The environment would become integrated within the body and one could speak of 'reversed embedment'. Due to 'distal neglect', 'empty' qualia, and 'hollow' intentionality could at least be imagined. Unlike in 'isolated coding' and 'common coding' (see above), both may therefore be considered i.e. imagined as logical possibilities. Unlike in 'embedded coding', qualia and intentionality as such remain naturally impossible. Consequently, the difference between 'embedded coding'/'reversed embedded coding' on one hand and 'isolated coding'/'common coding' on the other consists in the imaginability of 'empty' qualia and 'hollow' intentionality' as logical possibilities. The difference between 'embedded coding' and 'reversed embedded coding', however, consists in the natural possibility of qualia and intentionality, both being present in the former i.e. embedded coding and absent in the latter i.e. reversed embedded coding. A distinction between 'final and formal causes' and 'efficient causes' would still be possible but in a reversed way. Accordingly, 'mental causation' would no longer be related to the own person but rather to the other person. While 'efficient causality' and thus 'physical causation' may be regarded as the problematic case 'mental causation' may no longer be a problem. The thought experiment demonstrates the following: (i) the possibility of perception and action with respect to the own person is necessarily dependent on 'embedded coding'; (ii) intentionality of the own person is necessarily dependent on the possibility of perception and action with respect to the own person; (iii) the relation between 'mental causation' and 'efficient causality' as 'physical causality' is necessarily dependent on the characterization of intentionality with respect to the own and other persons.

In summary the following conclusions can be drawn: (i) the possibility of perception and action in the First-Person Perspective is necessarily dependent on 'embedded coding'; (ii) perception and action are not necessarily related to the First-Person Perspective exclusively and are thus not necessarily restricted to the own person; (iii) the possibility of intentionality is necessarily dependent on the possibility of perception and action as distinct from sensory impressions and movements; (iv) the possibility of intentionality is not necessarily dependent on the possibility to distinguish between intentionality and non-intentionality; (v) the idea of 'empty' qualia and 'hollow' intentionality as logical possibilities is necessarily dependent on the possibility to distinguish between stimuli and events even if the latter may be suppressed as in 'reversed embedded coding'; (vi) the possibility of 'co-occurrence and co-constitution' between qualia and intentionality is necessarily dependent on the distinction between qualia and intentionality; (vii) the possibility of 'mental causation', as distinguished from 'physical causation', is necessarily dependent on the possibility to distinguish between intentionality and non-intentionality.

Neuroepistemological hypothesis
Hypothesis: There is a relationship between intentionality and neuronal processing of 'internal'/'external sensory afferences/'internal' motor efferences in terms of events.

Neuroscientific implications: (i) crucial involvement of the orbitofrontal cortex in linkage i.e. top-down and bottom-up modulation between 'internal'/'external' sensory regions and motor regions; (ii) determination of neural response properties in orbitofrontal neurons by 'act- and goal-orientation' rather than mere physical properties of single stimuli; (iii) inhibition of single, isolated and non-corresponding neural stimuli is subserved predominantly by the lateral orbitofrontal cortex.

Epistemological implications: (i) characterization of intentionality by orientation of mental states on events within the environment; (ii) 'co-occurrence and co-constitution' of qualia and intentionality both being characteristic and constitutive for 'embedment'; (iii) replacement of 'efficient causality' by 'final and formal causality' within the framework of 'embedded coding' which as such can account for the possibility of 'mental causation'.

2.4 'Reflexive embedment': The own brain and other brains

We described spatial (2.1), temporal (2.2) and mental (2.3) 'embedment'. In the case of 'spatial and temporal embedment', the body was integrated within the spatial and temporal coordinates of the environment. 'Mental embedment', on the other hand, provided for the integration of the brain within the own body as accounted for by 'embedded coding' (see 2.3.1). Recognition of the own brain states resulted in 'autoepistemic limitation' and mental states. Following the line of integration, the question for integration of mental states within the brain arises since they would otherwise remain 'isolated' from their respective brain, bodily, and environmental context.

Integration of mental states within the brain may be called 'reflexive embedment'. Mental states are linked, related, and integrated with brain states, which can be accounted for by different forms of cognitions i.e. imagery, autobiographical memory, and social cognition (see below). 'Reflexive embedment' is accounted for by applying the same principles of functional organisation of the brain as in 'mental embedment'. Accordingly, there may be three distinct stages of 'reflexive embedment'. 'Neural embedment' provides for the integration of mental states within perception by means of imagery (see 2.4.1), 'personal embedment' provides for the integration of mental states within feelings and emotions by means of autobiographical memories (see 2.4.2), 'social embedment' accounts for the integration of mental states within action and observation of action (see 2.4.3).

2.4.1 'Neural embedment': First-Person Perspective

The functional organisation of the brain: Neuroanatomical correlates of imagery
'Observable and to-be effectuated bodily events' consist in perceptions (see 2.3.2) and actions (see 2.3.3). Simulated perceptions and actions may therefore be regarded as 'goal-orientation' (see 2.3.1) within the framework of 'reflexive embedment'. Simulation of perception and action does not only provide 'goal-orientation' and 'distal reference' but, in addition, 'proximal neglect'. If perception and action are simulated the simulation rather concerns mental states than neuronal states. Neuronal states are thus neglected which, functionally, may account for 'proximal neglect'. If simulation of perception and action is crucial within the framework of 'reflexive embedment', imagery of perception and action should show more or less similar psychophysiological constraints as original perception and action. This is indeed the case and will be demonstrated in the following relying on the example of motor imagery.

Motor imagery is an 'internal or kinaesthestic first-person process in which subjects feel themselves executing movements' (Mellet 1998: 136). It must therefore be distinguished from visual imagery of movements as an 'external third-person process involving visuospatial representation' (Mellet et al. 1998: 136). Motor imagery builds upon motor execution rather than visual observation. Motor imagery underlies the same psychophysical constraints as motor execution (see Mellet et al. 1998; Jeannerod 1999, 1997). The time needed for actual and imagined movements is the same in both cases. Kinematic parameters like velocity are similar for real and imagined movements. Imagined movements are thus constrained by similar biomechanical parameters so that imagery of biomechanically impossible movements also remains impossible. This is further supported by the investigation of motor imagery in patients with Hemi-Parkinson's disease who showed exactly the same motor deficits during motor imagery as during the execution of movements (Dominey et al. 1995). If motor imagery were constrained by the same biomechanical and physical characteristics, one would expect the involvement of similar anatomical structures during simulated and original movements. Several studies demonstrated the activation of similar cortical areas i.e. the dorsolateral prefrontal cortex (i.e. DLPFC), the anterior cingulate, the supplementary motor area (SMA), lateral premotor areas, parietal areas, and the basal ganglia during both motor preparation/execution and motor imagery (see Stephan et al. 1995; Mellet et al. 1998; Jeannerod 1997, 1999). In contrast, the exact functional role of the motor cortex itself in motor imagery remains unclear. Although they show less intensity than during motor execution there are some measurable electromyographic (i.e. EMG) signals during motor imagery. Furthermore, although at a lower intensity some kind of neural activity has been demonstrated in the motor cortex during motor imagery in EEG (Beisteiner et al. 1995), MEG (Schnitzler et al. 1997), TMS (Foltys et al. 2000) and fMRI (Roth et al. 1996). One may therefore assume partial but incomplete inhibition of motor output during motor imagery (Jeannerod 1997: 112–114). Analogous observations were made in visual imagery. Associative visual areas are definitely activated during visual imagery (see Mellet et al. 1998 for an overview). In contrast, the involvement of the primary visual cortex via top-down modulation remains unclear. While some like Kosslyn et al. (1999), argue for the involvement of primary areas others, e.g. Mellet (1998), rather favour non-involvement. Analogous to motor imagery, the role of primary areas also remains unclear in visual imagery. However, it is clear that the primary areas are not activated to the same degree during imagery as during the execution/observation in both motor and visual imagery.

From a functional point of view, imagery may provide simulation of perception and action, which accounts for 'goal-orientation' within the framework of 'reflexive embedment'. However, if as demonstrated above, the simulation induces activation in similar areas, the question whether a distinction between simulated and original perception/action is possible arises. The differences in the activation in the primary areas, i.e. primary visual cortex and motor cortex (see above) may account for the distinction between original and simulated perception/action. Due to a lower degree of activation in primary areas during simulated perception/action, the latter may be distinguished from the original perception/action. However, it should be noted that there is no total absence of activation in the primary areas during simulated perception/action. Simulation of perception/action i.e. imagery may facilitate the potential activation to be induced by generating and executing original perceptions/actions (Jeannerod 1999: 8–9; Ganis et al. 2000). Simulated and original perception/action are thus directly linked to each other: the former modulating the latter. This may be called 'top-down modulation'. Such 'top-down modulation' may account for 'proximal neglect' by means of superposition of simulated perception/action on original perception/action. There is one-way interaction since the original perception/action cannot be superpositioned on the simulated perception/action. Modulation of 'thresholds' and 'functional clustering' could account for these one-way interactions. 'Thresholds' for synaptic activation may be modulated in such a way that they only allow for certain interactions while preventing others. This is, for example, reflected in the lower excitability (and higher inhibition) in the primary areas during imagery (see above). 'Functional clusters' can be defined in the following way: 'They are a set of neural elements that interact among themselves in a single brain much more than they do with the surrounding neurons. Since a dynamic core constitutes a functional cluster, changes that occur inside the core affect it much less strongly, much less rapidly, or not at all' (Edelman & Tononi 2000: 146). 'Functional clusters' for simulated and original perception/action may be distinguished from each other by the distinct involvement of the primary areas, which, as a result, account for different 'functional borders'. Both 'functional clusters' and 'functional borders' can be modulated by 'thresholds'. As demonstrated in imagery, different levels of excitability can apparently determine inclusion or exclusion of certain neuroanatomical regions and thus the respective 'functional cluster'.

Neuroepistemological implications: Imagery and First-Person Perspective

First-Person Perspective

What are the functional and phenomenal correlates of the First-Person Perspective?

Mental imagery can be considered as an example of mental states, which have to be considered as states of the own brain and body (see 2.3.1). If this is the case, mental states should show the same functional and phenomenal characteristics as body states. Analogous to the states of the own body (see 2.1.2 and 2.1.3), mental states may be characterized as private, individual, and intra-subjective.

Functionally, the intra-subjective and individual character may be accounted for by 'top-down modulation' with a unilateral superposition of simulated perception/action on original perception/action (see above). Phenomenally, this may be reflected in the determination of perception and action by our own subjective and individual mental states. For example, we perceive what we want to perceive i.e. subjectively and individually rather than what is actually to perceive there i.e. objectively and non-individually. Functionally, the private character may be provided by the 'functional borders', 'functional clusters', and 'thresholds' in the functional organization of the brain (see above and Edelman & Tononi 2000: 146). Our own perception/action as such may be distinguished from the perception/action as related to others. Phenomenally, our own and others' perceptions and actions are experienced differently (see 2.3.3): We attribute our own experiences and imaginations to a particular person, our own, as distinguished from all others. Finally, there is a distinction between the own body and the own person. Functionally, the states which characterize perception and action concern the body and are related to the own brain/body. By contrast, mental imagery, which relies on the simulation of perception and action of the own body, is no longer associated with the own body but rather with a particular person. Phenomenally, it is this particular person that we call 'I'. Analogous to the body, which could be characterized as the 'spatial centre' (see 2.1.2), we characterize the 'I' as the 'centre' of all our experiences and imaginations i.e. mental states. This is what Metzinger (1993, 2003) calls 'centre intuition'. Instead of experiencing our own body, as it is, for example, the case in 'phantom limbs' (see 2.1.2), we rather experience a person i.e. an 'I' as the 'centre' of our mental states. One may subsequently speak of a 'phenomenal experience' of an 'I' in First-Person Perspective.

Descartes (1641, sixth mediation) already demonstrated the close relationship between the 'I' and the body. He distinguishes the own body from other bodies so that the former can be characterized in a special way: 'Nor was it without some reason that I believed that this body (which I with a certain special right I call my own) belonged to me properly and more strictly than any other; for in fact I could never be separated from it as from other bodies; I experienced in it and on account of it all my appetites and affections, and finally I was touched by the feeling of pain and the titillation of pleasure in its parts, and not in the parts of other bodies which were separated from it. ... I possess a body with which I am very intimately conjoined...' Despite having recognized the importance of the own body for the 'I', Descartes does not draw the conclusion to characterize the 'I' in bodily terms. Instead, he separates the 'I' from the body by presupposing a 'mind'. One may therefore say that Descartes was on the way i.e. 'half-way through' towards characterizing the 'I' in bodily terms (see below for further details).

What are the epistemic correlates of the First-Person Perspective?

We characterized mental imagery i.e. the simulation of mental states as private, individual, and intra-subjective. Epistemically, they are therefore related to a special perspective i.e. the First-Person Perspective, which remains accessible only for that particular person i.e. its 'I'. The First-Person Perspective (i.e. FPP) must therefore be distinguished from the Third-Person Perspective (i.e. TPP), which can rather be characterized as public, non-individual, and inter-subjective (see also 2.4.3). While FPP can be characterized by 'phenomenal experiences' of the own 'I', TPP can be accounted for by 'physical observation' of others' bodies. The characterization of FPP by the 'I' rather than by the own brain is a result of 'autoepistemic limitation'. Due to 'autoepistemic limitation' (see 2.3.1), we experience our own brain states as mental states. Accordingly, the process of experiencing mental states cannot be related to the brain. Instead, experience and simulation of mental states is rather attributed to an 'I' as distinguished from both brain and body. The 'I' as the 'centre' of all experiences and imaginations can thus be considered as the 'mental analogue' of the body being the 'spatial centre' (see 2.1.2). Both mental and brain states can, however, not be linked directly to each other; this is because we are unable to recognize the underlying source of our mental states i.e. our own brain. It therefore seems as if the 'I' and the mental states are independent from brain and body. Considering 'autoepistemic limitation', this can be revealed as a 'naive realistic self misunderstanding' (Metzinger 1993, 2003). Since they cannot be related to the own brain, mental states are attributed to a particular person i.e. the own person as the 'I'. What the 'body image' is for the body (see 2.1.1), is the 'I' for the brain: The 'I' is the 'brain image' which, however, due to 'autoepistemic limitation', cannot be detected and recognized as such. Accordingly, the inference of an 'I' fills the 'epistemic hole' which was caused by 'autoepistemic limitation'. The 'I' as such may therefore be regarded as a 'conceptual metaphor' or as a 'posit' from an epistemic point of view (Quine 1969).

It remains important to note that the portrayal of FPP by the 'I' remains purely epistemic in nature and bears no ontological implications. If the association of FPP with an 'I' were regarded as an ontological characterization, substrates, which are essential for both FPP and TPP would have to be distinguished from each other in ontological regards. Accordingly, the 'I' would be related to a mind, which is ontologically distinct from the brain. This however may be considered as an instance of 'false ontologization' where ontological differences are inferred from purely epistemic distinctions (see Northoff 1999, 2000b). This is exactly what happened in Descartes (1641, sixth meditation). Although he acknowledges the close relationship between the 'I' and the body (see above), he nevertheless assumes the 'mind' as the underlying substrate of the 'I'. He infers that because of the different properties between the body and the 'phenomenal experience' of an 'I' i.e. with only the latter being indivisible, the 'I' must be subserved by a different ontological substrate i.e. the mind. This implies that he infers from different epistemic properties i.e. body and 'I' to different ontological substrates i.e. body and mind; this can be called 'false ontologization' (see also 1.4.4). However, instead of reflecting different ontological substrates, body and 'I' may rather be characterized by different epistemic perspectives i.e. Third- and First-Person Perspective. The famous sentence 'I think therefore I am' (see also 3.2.1 and 3.2.3) may subsequently reflect 'false ontologization'. The first 'I' in the 'I think' could reflect a particular epistemic perspective i.e. the First-Person Perspective (see 3.2.3 for an interpretation of 'think') while the second 'I' in 'I am' may reflect the ontological characterization of the 'I' by an underlying mind. The term 'therefore' may then be interpreted as the inference from an epistemic characterization to an ontological substrate. A more recent instance of 'false ontologization' is also reflected in Searle's terms 'First- and Third-Person Ontology' which account for different 'modes of existence' in orientation on the different perspectives (Searle 2000: 561). Instead of 'First- and Third-Person Ontology', Searle should rather speak of 'First- and Third-Person Epistemology' (see 3.2.1 and 3.2.3).

What is wrong in the 'What is it like' argument?

The 'What is it like' argument, as introduced by Nagel (1974), concerns the inference of the ontological distinctiveness of mental states from their special epistemic characterization. Unlike physical states, mental states can be characterized by the 'What is it like' in First-Person Perspective. From this special epistemic characterization, a special ontological status of mental states, as distinguished from neuronal i.e. physical states is inferred. According to Nagel, mental states must therefore not only be distinguished from neuronal i.e. physical states in epistemic regard but also ontologically. We acknowledge different epistemic characterization of mental and neuronal states. This is emphasized even further when considering their functional and phenomenal differences (see above). However, we demonstrated that these epistemic, phenomenal, and functional differences could be accounted for by the functional organization of the brain. The assumption of a mind on the other hand, as ontologically distinguished from the brain with its neuronal states and their organization, is not necessary. Accordingly, the ontological inference of a mind from epistemic, phenomenal, and functional differences between mental and neuronal states remains superfluous and thus implausible. If however the ontological inference of a mind remains implausible, the 'What is it like' argument as an argument for the possibility of a distinct ontological characterization of mental states can no longer be considered as valid. Accordingly, the 'What is it like' argument is not compatible with the natural conditions i.e. our own brain and remains therefore empirically implausible. However, even from a purely logical point of view, the 'What is it like' argument may be rejected. Nagel is certainly right when claiming that 'privacy' and 'non-accessibility' are subjective aspects of mental states. Nevertheless, he is wrong when inferring an ontological distinctiveness of mental states from such an epistemic characterization. He relies on the confusion between epistemic and ontological states by inferring ontological differences from the epistemic distinctions that results in 'false ontologization' (see also above). Contrary to Nagel, the epistemic characterization of mental states by the 'What is it like' argument is not necessarily incompatible with the rejection of the ontological distinction between mental and physical states (see 3.3.3 here as well as Papineau 1995; Lycan 1987 who suggest analogous solutions).

Finally, it should be noted that the 'What is it like' argument, which here characterizes 'phenomenal experience' in the First-Person Perspective should refer to 'events' rather than 'facts'. 'Events' reflect changes in the environment and the respective context (see 3.1.2 and 3.2.1 for more detailed discussion of the term 'event'); as such they are accounted for by 'phenomenal experiences' in the First-Person Perspective (see above and also 2.2.1). 'Facts', on the other hand, no longer include the respective context (see 3.2.1 for definition of 'facts') and are accounted for by 'physical judgments' in the Third-Person Perspective (see also 2.2.3 and 2.4.1). One may subsequently speak of 'What is the event like?' as distinguished from 'What is the fact?' (see also 3.2.1). As a result, any characterization of 'phenomenal experience' by means of 'facts' as 'mental or phenomenal facts', as suggested by Nagel (1986) and Chalmers (1996), must necessarily fail since then 'phenomenal experience' could no longer be related to the First-Person Perspective. In these cases one may speak of a neglect of the principal difference between 'events' and 'facts' with the consecutive epistemic confusion between First- and Third-Person Perspective.

Imagery and First-Person Perspective
Imagine first the case of 'separate coding' i.e. 'isolated coding' (see 2.3.1).

'Goal-orientation' would no longer exist and any alterations in bodily and brain states would therefore not be coded in terms of events but rather in terms of physical stimuli. The absence of original 'goal-orientation' would make the simulation of 'goal-orientation' impossible. If feasible at all, imagery would no longer concern perceptions/actions but rather sensory impression/movements. Neuroanatomically, one would therefore assume that different areas are involved in imagined and original sensory impression/movement. If different areas are involved, the distinction between both processes remains superfluous. Consequently, 'functional clusters', 'functional borders', and 'thresholds' would no longer be necessary. Phenomenally, the generation of an 'I' would be impossible. If there are no mental states (see 2.3.1), a 'mental analogue' of brain and body can no longer be generated. Accordingly, an epistemic distinction between different perspectives i.e. FPP and TPP also becomes impossible because only one perspective i.e. TPP remains. Due to the lack of an epistemic distinction, neither 'false ontologization' nor the 'What is it like' argument remain possible. The thought experiment demonstrates the following: (i) a dependence of the experience of an 'I' on the possibility of simulating perception and action; (ii) a dependence of the epistemic distinction between FPP and TPP on the possibility of the experience of an 'I'; (iii) a dependence of 'false ontologization' and the 'What is it like' argument on the possibility of the epistemic distinction between FPP and TPP.

Imagine second the case of 'common coding' i.e. 'environmental coding' (see 2.3.1).

Only 'goal-orientation' would subsist and bodily and brain states would be coded solely in terms of events that presuppose 'isomorphism' between events and stimuli. Simulation would remain central but unlike in the actual case (see 2.4.1), it could be equated with copying. Both imagined and original 'goal-orientation' would probably be subserved by exactly the same neuroanatomical areas in the brain without any possibility of differential involvement of the primary input/output areas (see 2.4.1). There may be confusion between simulated and original perception/action. While identical 'functional clusters' would account for both simulated and original 'goal-orientation' 'functional borders' and 'thresholds' that account for the distinction between simulated and original 'goal-orientation', would no longer be necessary. Phenomenally, the generation of an 'I' as the 'centre' of all experiences and imagination would subsist. However, unlike in the actual case (see 2.4.1), it could neither be distinguished from brain/body nor from other individuals. The 'I' would no longer be restricted to the own person but would be extended to other individuals as well. It (the 'I') could still be considered as the 'mental analogue' of the brain/body with regard to neuronal states but could no longer be characterized as such since a distinction between the 'I' and the 'brain/body' remains impossible. Epistemically, only one perspective would exist: FPP. TPP, on the contrary would remain absent. Ontologically, the possibility of 'false ontologization' and the 'What is it like' argument would still be given. Due to the lack of TPP, the danger of 'false ontologization' of FPP by means of the assumption of a mind as distinguished from brain/body may be even higher. The thought experiment demonstrates the following: (i) a dependence of the restriction of the 'I' to the own person on the possibility to distinguish between simulated and original 'goal-orientation'; (ii) a dependence of the epistemic distinction between FPP and TPP on the possibility to restrict the 'I' to the own person; (iii) a dependence of 'false ontologization' and the 'What is it like' argument on the epistemic possibility of mental states and FPP.

Imagine third the case of 'reversed embedded coding' (see 2.3.1).

Unlike in 'separate coding', simulation would still be crucial and similar to 'separate coding' it would only concern sensory impressions/movements. However, imagined and original sensory impressions/movements may not be separated in order to imply overlapping neuroanatomical areas. A neuroanatomic overlap between simulation and original should only concern the primary input/output areas. Other i.e. higher cortical areas can neither be involved in original nor in simulated sensory impressions/movements. Due to the co-occurrence of 'proximal reference' and 'distal neglect', interaction between original and simulation would be reversed. Consequently, activation in the primary input/output areas could be increased during imagery as compared to the original sensory impressions/movements. 'Functional borders' and 'thresholds' may be reversed while 'functional clusters' are maintained. The 'I' would no longer be related to the own person but rather to other individuals. The 'I' would not be experienced as the source to which our own experiences and imaginations can be attributed. The 'I' would rather be considered the source to which the experiences and imaginations from other individuals can be accredited. One may consequently speak of reversed attribution. Although the simulating person itself experienced the mental states, they are nevertheless attributed to another person. Epistemically, FPP and TPP would be reversed. While experience would be characterized by TPP observation would rather be associated with FPP. Ontologically, although in reversed way 'false ontologization' and the 'What is it like' argument remain possible. Instead of mental states, neuronal states may become associated with an ontological substrate, which is distinct from brain/body. The thought experiment demonstrates the following: (i) an attribution of the 'I' to one particular person is necessarily dependent on the relation between original and simulated 'goal-orientation'; (ii) an epistemic characterization of FPP and TPP is necessarily dependent on the kind of person to which the 'I' is attributed; (iii) the direction of 'false ontologization' and the 'What is it like' argument is necessarily dependent on the epistemic characterization of FPP and TPP.

Auditory hallucinations could probably be considered as an empirical example for 'reversed embedded coding'. In the case of auditory hallucinations an increased activity exists in the primary auditory cortex, which, functionally, may be considered as a simulation of auditory events (see Dierks et al. 1999; David & Busatto 1999; David 1994). In addition, as reported by several authors (David & Busatto 1999; Dierks et al. 1999), there is decreased prefrontal cortical activity during auditory hallucinations. Within the present context, this may be interpreted as neglect i.e. suppression of 'goal-orientation'. Increased activity in the primary auditory cortex is probably related to decreased inhibitions of the temporal cortical areas by the prefrontal cortex (Frith 2000). Functionally, 'proximal reference' replaces 'proximal neglect', 'functional clusters' are extended and 'functional borders' are dissolved. Patients with auditory hallucinations are no longer able to generate and adjust original and simulated 'goal-orientation' in relation to bodily and environmental events. Instead, bodily and environmental events are generated and adjusted in relation to 'physical stimuli'. This results in the interpretation of activities in the auditory cortex as external voices i.e. auditory hallucinations. From her/his point of view, the patient correctly locates auditory cortical activities within the environment and infers that external voices are speaking to him. Consequently, during a true external auditory stimulation the auditory cortical activity is decreased in these patients (Frith 1992, 2000). Furthermore, one would expect a decreased capacity for internal auditory imagery in patients with auditory hallucinations. That is indeed the case (David 1994: 292). Hallucination and imagery are competing with each other (Vogely 1999), as it is functionally reflected in the co-occurrence of 'distal neglect' and 'proximal reference'.

In summary, the following conclusions can be drawn: (i) the experience of an 'I' as attributed to the own person/body is necessarily dependent on 'embedded coding'; (ii) the possibility of a distinction between the 'I' and the brain/body is necessarily dependent on the possibility to distinguish between mental and neuronal states; (iii) a contingent relation between FPP/TPP and experience/observation exists; (iv) a contingent relation between FPP/TPP and own/other persons exists; (v) the possibility of 'false ontologization' and the 'What is it like' argument is necessarily dependent on an epistemic occurrence of FPP and mental states.

Neuroepistemological hypothesis

Hypothesis: There is a relation between the simulation of perception/action and the 'phenomenal experience' of an 'I' in the First-Person Perspective.

Neuroscientific implications: (i) the simulation of perception and action relies on similar neuroanatomical areas as the original perception and action; (ii) the difference between simulated and original perception/action consists in the neural excitability in the primary input/output areas which are necessary for the distinction between simulation/imagery and original; (iii) a modulation of 'functional clusters' and 'functional borders', which are essential for simulated and original perception/action, by means of 'thresholds' exists.

Epistemological implications: (i) the epistemic characterization of FPP by 'phenomenal experience' of an 'I' as distinguished from the 'physical observation' of other bodies in TPP; (ii) a characterization of the 'I' as the 'mental analogue' of the 'brain image' of the own brain; (iii) the distinct epistemic characterization of FPP and mental states is a necessary condition for the possibility of 'false ontologization' and the 'What is it like' argument.

2.4.2 'Personal embedment': Second-Person Perspective

Functional brain organisation: Autobiographical memory

Feelings and emotions reflect events within our own brain and body in relation to the respective environment and thus the actual 'state-orientation' (see 2.3.2). Past events that are 're-lived and re-experienced' in the context of the present feelings and emotions may be regarded as simulated 'state-orientations'; this is paradigmatically reflected in autobiographical memories.

Autobiographical memory is regarded as a 'transitory dynamic construction generated from an underlying knowledge base' (Conway et al. 2000: 261; see also Schacter 2001). An endogenous pattern of activation may account for the 'underlying knowledge base'. This pattern is recreated and instantiated during recall i.e. retrieval and thereby transforms this 'knowledge' into autobiographical memories. According to Conway et al. (2000), autobiographical memories include three types of knowledge: lifetime periods, general events, and event-specific knowledge. Lifetime periods concern the separation of life into specific periods and may be related to abstraction as probably subserved by an activity in the right inferior lateral prefrontal cortex. General events concern the classification of events and may be related to activity in the medial temporal lobe i.e. especially the hippocampus. Event-specific knowledge concerns sensory-perceptual details that are specifically associated with that particular event and may be related to activity in the parieto-occipital cortical networks. Since it may be 'critical in leading a rememberer to believe the truth of his or her memories' (Conway et al. 2000: 263), imagery i.e. simulation (see also 2.4.1) may be crucially involved during the retrieval of particularly event-specific knowledge. The retrieval of autobiographical memories can be characterized by a certain vividness of experiences as created by imagery. This form of 'retrieval' is called 'remembering'; it reflects 're-experience and re-living of the past event including its spatio-temporal, cognitive, and sensory-perceptual details' (Wheeler et al. 1997: 335) i.e. a so-called 'auto-noetic consciousness' or 'conscious awareness' (Wheeler et al. 1997: 333). The central role of imagery and thus of simulation during the retrieval of autobiographical memory is further supported by a considerable overlap of the areas that are involved in both retrieval and imagery (see Mellett et al. 1998). In addition, because there is a close relationship between perceptions and memories, the latter can be regarded as 'imagination of perceptions' (Edelman and Tononi 2000: 101). This may be reflected in 'remembering' as described by 're-experiencing and re-living' of the original 'goal-orientation'.

In contrast, the retrieval of non-autobiographical memories concerns bare facts i.e. semantic memories. Accordingly, this mode of retrieval is no longer accompanied by vivid imagery and 're-experience and re-living'. Instead, the retrieval of heterobiographical and semantic memories can be characterized by 'knowing' as a 'feeling of familiarity' i.e. a so-called 'noetic consciousness' (Wheeler et al. 1997). Both modes of retrieval cannot only be distinguished neuropsychologically but neurophysiologically as well. 'Remembering' seems to be associated with activity in the right prefrontal and posterior cingulate cortex and the sustained right frontopolar positive ERP (event-related potentials). 'Knowing', on the other hand, seems to be subserved by activity in the left medial temporal lobe and a brief late positive ERP component (Düzel et al. 1997, 1999; Eldridge et al. 2000). However, the question whether integration of autobiographical memories i.e. past 'goal-orientation' within the actual event i.e. present 'goal-orientation' exists, remains. The process of encoding original 'goal-orientation' and retrieval of simulated 'goal-orientation' is determined by actual 'goal-orientation' via 'state-orientation' i.e. emotions (Conway et al. 2000: 266–271). If simulated and actual 'goal-orientation' are discordant, negative feelings and emotions may arise. On the contrary, in the case of concordance between simulated and actual 'goal-orientation' positive feelings and emotions may be generated. If 'state-orientation' i.e. feelings and emotions (see 2.3.2), as related to past events, are too strong and not concordant with the ones from a present event, the retrieval of the past event may be blocked. Accordingly, a 're-experience and re-living' of past feelings/emotions is inhibited or attenuated. Consequently, the relation between past and present feelings/emotions i.e. between simulated and actual 'state-orientation' remains crucial for the integration of autobiographical memories within the present context. Psychologically, blockade of integration between past and present feelings/emotions may be reflected in defence mechanisms, as described in psychodynamics. Extreme feelings and emotions during autobiographical events, such as war experiences, may inhibit the retrieval of the event in later times. 'Re-experience and re-living' of a past event within the present context becomes inhibited which may, for example, result in posttraumatic stress disorder. Physiologically, the crucial role of feelings and emotions in the 'retrieval' of autobiographical memory may be reflected in the participation of regions like the amygdala and the medial prefrontal cortex, which subserve the generation of feelings/emotions. These regions are specifically activated in relation to emotional contents during the retrieval of autobiographical and episodic memories (Dolan et al. 2000; McGaugh et al. 2000). Such an assumption is further supported by observations of patients with either structural or functional lesions in these areas that show specific disturbances when retrieving autobiographical memories (Markowitsch et al. 1997, 1999; Yasuno et al. 2000; Schacter 2001).

What are the exact functional and physiological mechanisms for the linkage between actual and simulated 'goal-orientation'?

Conway et al. (2000) presupposes a close relationship between the retrieval of autobiographical memory and a control process for the coordination between different events: 'Thus, we propose that the instantiation of memories in consciousness and their incorporation into ongoing processing sequences is modulated by central or executive processes. Control processes implement plans generated from the currently active goals of the working self, and, somewhat ironically, one of their main functions may be to inhibit constantly occurring endogenous patterns of activation in the knowledge base from entering consciousness where their usual effect would be to interrupt current processing sequences' (Conway et al. 2000: 261). This control process may be provided by working memory, which compares discrepancies and similarities between simulated and actual 'goal-orientation' via positive and negative feedback loops. Since both are compared, linked and integrated with each other the simulated i.e. past 'goal-orientation' is retrieved as autobiographical memory in terms of the actual i.e. present 'goal-orientation' (Conway et al. 2000). Conversely, as demonstrated above (see 2.4.1), the actual 'goal-orientation' is constrained by the simulated 'goal-orientation'. Accordingly, the process of retrieving autobiographical memories is modulated by the present context while, at the same time, the former determines the latter. This interaction between simulated and actual 'goal-orientation', presupposing comparison, linkage, and integration may be predominantly subserved by working memory. It is generally assumed that working memory is subserved by the areas in the dorso-lateral prefrontal cortex (areas 9 and 46 according to Brodman) as well as in the ventro-lateral prefrontal cortex (areas 45 and 47 according to Brodman). The former region may subserve both manipulation and monitoring of information while the latter accounts for the explicit retrieval of information from posterior association cortical areas (Haxby et al. 2000; Owen et al. 1999). One would consequently expect early activation in these regions during the retrieval of autobiographical memory. This is indeed the case as demonstrated in PET and EEG (Conway et al. 1999, 2000; Duezel et al. 1997, 1999; Fink et al. 1996). The early stages (100–300ms) throughout the retrieval were accompanied by activation in both left dorso- and ventro-lateral prefrontal cortex, reflecting the decision of constructing memories. In contrast, intermediate stages (300–500ms) showed activation in the right inferior ventro-lateral prefrontal cortex. This may show a formation of the retrieval model with the selection of one particular simulated 'goal-orientation' and the inhibition of others (Konishi et al. 1999). Finally, in late stages (500–800ms) the activation shifted to the right temporal (anterior pole, hippocampal and posterior areas) and parieto-occipital cortical areas. This may reflect 'remembering' with 're-experience and re-living', which implies a vivid imagery of sensory-perceptual details of that particular event (see above).

The simulation of 'goal-orientation' and its retrieval as autobiographical memory is determined by both simulated and actual 'state-orientation'. This in turn accounts for 'top-down modulation' with the consecutive integration of the latter within the former. As a result, 'distal reference' can be provided from a functional point of view. In addition there is also 'proximal neglect'. We demonstrated that past events were retrieved in terms of present events by comparison, linkage and integration as subserved by working memory. This can be considered a one-way interaction which as such accounts for 'proximal neglect'. Due to the limited temporal capacity of working memory, which in general only lasts for a few seconds, present events cannot be integrated directly within past events. The past events would have to be held in working memory over a long time. This however remains impossible. Physiologically, a one-way interaction may be reflected in the reverse relationship between prefrontal and medial temporal cortex (Frith 1992, 2000). If the former becomes activated the latter is deactivated i.e. inhibited and vice versa. The prefrontal cortex, subserving working memory and retrieval, controls the medial temporal cortex, which is responsible for the storage of memories. However, the exact coordination between the different cortical areas that are involved in the one-way interaction between past and present events remains unclear. 'Reentry' as a special and more integrative form of feedback and feedforward loops (Edelman & Tononi 2000) may be of crucial importance. 'Reentry' may be characterized by a 'constructive function' that resolves conflicts between neural responses in different areas and subsequently generates novel neural patterns. Moreover, 'reentry' shows a 'correlative function'. It may provide temporal correlations in neural activities between the different neuronal groups either within one particular region or between different regions (Tononi et al. 1992: 310; Edelman & Tononi 2000: 107). 'Reentry' may be particularly crucial for the neuronal coordination between cortical areas that are involved in working memory. Functionally, the 'constructive function' of 'reentry' may be reflected in the different possible linkages between simulated and actual 'goal-orientation'. For example, a past event can be remembered in different ways within different present contexts and Edelman consequently speaks of a 'remembered present' (Edelman & Tononi 2000: 110). Functionally, the 'correlative function' of 'reentry' may provide 'synchronization' and 'recurrent processing' (see Singer 1999; Engel et al. 1999) thus coordinating and organizing neural responses in different neuronal groups and regions (Tononi & Edelman 1998a, b; Lamme & Roelfsema 2000). However, the exact functional and physiological mechanisms of 'reentry' and its 'constructive' and 'correlative' functions remain unclear. The mechanisms that are essential for the blockade of a 'reversed' interaction between simulated and actual 'goal-orientation', which would make an integration of present events into past events ('experienced past') possible, have yet to be elucidated.

Neuroepistemological implications: Autobiographical memory and Second-Person Perspective

Second-Person Perspective

What are functional and phenomenal correlates of the Second-Person Perspective?

Functionally, autobiographical memories can be characterized by a linkage between past and present 'goal-orientation'. Past 'goal-orientations' are simulated in order to become 'available' for the actual i.e. present 'goal-orientation'. Nonetheless, the simulation of past 'goal-orientation' cannot be considered as mere copying since, due to the orientation on present 'goal-orientation', it may be slightly modified. Feelings and emotions provide the linkage between past and present 'goal-orientation'. This is reflected in the comparison between past and actual feelings and emotions. If both past and actual feelings are compatible with each other, a feeling of 're-experiencing and re-living' arises. This feeling characterizes the retrieval of a past event within the context of the actual event. Accordingly, memories may be regarded as 're-vival' rather than 'storage'. Nonetheless, the 're-vival' is not a simple '*re*-vival' since the original contents may be modified by the actual context and its respective emotions. This has already been pointed by Locke (1690, Book II, Chapter X, 2): '… this laying up of our ideas in the repository of the memory signifies no more but this - that the mind has a power in many cases to revive perceptions which it has once had, with this additional perception annexed to them, that it has had them before. And in this sense it is that our ideas are said to be in our memories, when indeed they are actually nowhere; – but only there is an ability in the mind when it will revive them again, and as it were paint them anew on itself, though some with more, some with less difficulty; some more lively, and others more obscurely'.

Phenomenally, 're-experiencing and re-living' can be characterized as a non-phenomenal but qualitative state. The 'feeling', since accompanied by recognition and reflection that consist in the comparison between past and actual feelings, is no longer 'phenomenal' i.e. 'raw'. Nevertheless, there is still some kind of 'feeling' or qualitative component i.e. a 'recognized or reflected feeling'. Though it is no longer 'lived and experienced', the feeling related to the past event becomes at least 're-lived and re-experienced'. Accordingly, one may speak of so-called 'non-phenomenal qualia' (Metzinger 1993). While 'semi-transparence' as described by 'lucidity' and 'feelings of direct contact' exists, both 'immediateness' and 'feeling of completeness' remain absent (see 2.1.1, 2.1.3 and, 2.2.1 for definitions of these terms). The past event is still directly given so that we have a 'feeling of direct contact'. However, the 'immediateness' is lost since the event is only 're-experienced and 're-lived'. Moreover, the 'completeness' is missing as well because the full extent of certain sensory-perceptual and emotional details may no longer be present (see also Gadenne 1996: 63–66). Because of the comparison with the feelings of the actual event, the feelings that are related to the past event become 'relativized and undermined', which in turn transforms 'phenomenal certainty' into 'phenomenal uncertainty'. The 're-experience and re-living' of the past event can be characterized by a 'presence' in the temporal dimension. While 'temporal homogeneity' and 'phenomenal time' (i.e. as characterized by 'retention' and 'protention') are lost (see 2.2.1 and 2.2.2). Simulation of the past event disrupts temporal homogeneity and thus the integration of past and future temporal dimensions within the presence (i.e. 'retention' and 'protention'). This is reflected in the isolation of past events from present and future events which make it possible for past events to appear and to be judged as past events: For example, past events can be detected and recognized as past events that provide a basis for the direct comparison with present and future events. The processes of detection, recognition and comparison of past and present events and their respective phenomenal-qualitative states may be subserved by particular types of judgments i.e. so-called 'phenomenal judgments' (see below and also 2.2.2 as well as Chalmers 1996: 219). Accordingly, the temporal segregation between past, present, and future events may be considered as a necessary condition for the possibility of 'phenomenal judgments'.

What are epistemic correlates of the Second-Person Perspective?

The 'experiencing person' re-experiences its own experiences. Epistemically this presupposes a switch between the different perspectives. Whereas actual events are 'lived and experienced' 'from the inside', past events must necessarily be 're-lived and re-experienced' 'from the outside'. Otherwise, the phenomenal distinction between 'experience' and 're-experience' would be blurred and there would no longer be a difference between past and present events. Accordingly, a phenomenal distinction between two modes of experience must be accompanied by the epistemic distinction between the different points of view i.e. perspectives. The point of view 'from the outside' during 're-experiencing and re-living' can be characterized in two ways. On one hand, it must be distinguished from the 'from the inside' perspective and thus from FPP. FPP can be characterized by phenomenal-qualitative states (see 2.4.1) subserving 'living and experiencing' of present events. Meanwhile the 'from the outside' point of view can no longer be characterized by 'phenomenal-qualitative states' but rather by 'non-phenomenal' yet 'qualitative' states (see above), which subserve 're-living and re-experiencing' of past events within the present context. On the other hand, the 'from the outside' perspective must be distinguished from the absence of any point of view at all, which characterizes TPP. TPP subserves observations of other people's behaviour while their phenomenal-qualitative states remain inaccessible. Accordingly, other's phemomenal-qualitative states can neither be 'lived and experienced' nor 're-lived and re-experienced'. The 'from the outside' point of view can epistemically be characterized by an intermediate position between FPP and TPP. It no longer shows phenomenal-qualitative states like FPP but, unlike TPP, still has access to them. Due to this intermediate position between FPP and TPP, one may characterize the 'from the outside' perspective by means of SPP i.e. the 'Second-Person Perspective'. SPP, similar to FPP shows qualitative but no longer phenomenal properties. SPP, similar to TPP, also makes judgments but it makes them about phenomenal states rather than about physical states. While FPP can be characterized by 'phenomenal experience' and TPP by 'physical judgments', SPP should be associated with 'phenomenal judgments' (see also 2.2.2 and 3.2.2). The term 'phenomenal judgment' describes the ability to detect, recognize, and compare phenomenal-qualitative states (Chalmers 1996).

The term 'Second-Person Perspective' has been used in psychoanalysis where it describes introspective processes (Bollas 1997: 53–55). It also has a predecessor in Shoemaker's (1984: 24–27) distinction between an 'experiencing person' and a 'sensoric-cognitive person' in regard to the context of memory and personal identity. However, neither account explicitly 'thematizes' and characterizes SPP in functional, phenomenal, and epistemic terms. 'Phenomenal judgment' has also been related to 'introspection' (Gadenne 1996). 'Introspection' shows reference to the own person (i.e. 'intro') as distinguished from other individuals (i.e. 'extrospection'). Unlike 'introspection' 'phenomenal judgment' focuses less on the person and more on the task i.e. judgment, which is different from experience in FPP. Unlike in TPP, the judgment does not concern physical but rather phenomenal states. Since 'phenomenal judgments' allow for the detection, recognition and comparison of the own phenomenal-qualitative states, they provide 'intra-subjective communication'. The person cannot only experience phenomenal-qualitative states in FPP but, in addition, can relate them directly to the own person by judging them in SPP. Consequently, 'intra-subjective communication' serves for the development of a 'relation of minessness' (Metzinger 1993): This describes the attribution of phenomenal-qualitative states to the own person i.e. to my 'I' which also leads to the attribution of an 'I' to one particular person (see also 2.4.1). Moreover, 'intra-subjective communication' in SPP may be good for the development of an 'objective self' (Nagel 1986), which 'relativizes' the 'subjective self' in FPP, and the personal identity (Northoff 2001b). 'Intra-subjective communication' in SPP must be distinguished from both 'intra-subjective experience' in FPP and 'inter-subjective communication' in TPP. Although both are 'intra-subjective', SPP must be distinguished from FPP since it no longer concerns experiences but judgments.

Experience by itself is non-communicable, but judgment, on the other hand, is communicable. Despite the fact that both concern 'communication', SPP must be distinguished from TPP because it does not communicate inter-subjectively accessible physical states but rather intra-subjective phenomenal states. The similarities and differences between SPP on one hand and FPP and TPP on the other may have contributed to the fact that the epistemic abilities of SPP have often been subsumed under either FPP or TPP. However, the present account provides strong evidence for a distinguished characterization of SPP in functional, phenomenal, and epistemic terms (see above). This is further supported by empirical evidence that shows the possibility to dissociate SPP from both FPP and TPP in neuropsychiatric diseases like catatonia (Northoff 2000a, 2001b). Accordingly, epistemology should no longer be restricted to 'First- and Third-Person Epistemology' (see 3.2.1 and 3.2.3) but should also include 'Second-Person Epistemology' (see 3.2.2). Due to the intermediate position of SPP between FPP and TPP, 'Second-Person Epistemology' may mediate between 'First- and Third-Person Epistemology' making the integration of all three within a common underlying epistemological framework necessary (see 3.2.1).

What kind of knowledge does Mary gain in the 'Knowledge argument'?

The central question in the 'Knowledge argument' concerns distinct types of knowledge (Jackson 1982, 1986). Though Mary, a brilliant physicist, has complete knowledge about colours, she never experienced them personally – does she gain a new understanding when she is exposed to a coloured environment for the first time? Often the 'What is it like argument' and the 'Knowledge argument' are considered as identical. However, there are important differences between the two arguments concerning the type and content of knowledge. The 'What is it like argument' focuses on the principal possibility of experiences i.e. the way a bat experiences the world. The 'Knowledge argument', in contrast, points out the possibility of knowledge. Phenomenally, this distinction is reflected in the difference between 'phenomenal experience' and 'phenomenal/physical judgment'. Epistemically, this difference may be reflected in the difference between First- and Second-Person Perspective. While the former accounts for the 'What is it like' argument by means of 'phenomenal experience' the latter is associated with 'phenomenal judgment'. Even if Mary has been able to imagine a coloured environment, this simulation may still lack sensory-perceptual details and emotional involvement that renders it as vivid, real, and concrete. A simulation, that lacks sensory-perceptual details and emotional involvement, shall be called an 'abstract' simulation. Such an 'abstract' simulation may nevertheless be possible through the inference of her prior knowledge. Being exposed to a coloured environment for the first time, Mary will experience sensory-perceptual and emotional details that might complement deficits in her 'abstract' simulation. Mary therefore makes new phenomenal experiences, which predominantly concern sensory-perceptual and emotional details to which she had no access in her previous knowledge. Accordingly, Mary gains new phenomenal knowledge (Nida-Ruemelin 1995: 279–281).

The Churchland's (1981, 1989) are right by pointing out that there are limitations in the imaginations of Mary with regard to a coloured environment. Indicating these limitations, we used the term 'abstract' simulation as distinguished from 'concrete' simulation. However, Churchland is not right by claiming that these limitations are due to certain deficits in her 'knowledge for imagination'. Rather, Mary has a deficit in her 'imagination for knowledge' which can be traced back to her deficits in vivid, real, and concrete experiences. Accordingly, imagination must be considered as a necessary condition for knowledge and not vice versa, as presupposed by Churchland. Though, Mary has complete 'physical knowledge' about colours in TPP, she lacks the corresponding 'phenomenal knowledge' in FPP (see Nida-Ruemelin 1995 for distinction between 'phenomenal and physical knowledge'). Both sensory-perceptual and emotional details are necessarily related to the experiences in FPP while remaining inaccessible to TPP (see 2.3.2). Accordingly, 'physical knowledge' in TPP cannot entirely account for 'phenomenal knowledge' in FPP. From an epistemic point of view, Mary gains new knowledge i.e. 'phenomenal knowledge' in FPP when she experiences a coloured environment for the first time. However, Mary does not gain new 'recognitional abilities'. Even before she experienced a coloured environment, she had a FPP. For example, she experienced black and white colours in FPP. Accordingly, one should distinguish between epistemic abilities i.e. 'recognitional abilities' and knowledge, which can be made on the basis of these epistemic abilities. Moreover, Mary does not gain new ontological knowledge. Knowledge in different perspectives i.e. FPP and TPP is not necessarily different in ontological respect since one cannot infer from epistemic distinctions to ontological differences (see 1.4.3 and 2.4.1). Her new phenomenal knowledge gained in FPP may ontologically be identical with her previous physical knowledge as obtained in TPP. Sensory-perceptual and emotional details may ontologically be characterized in the same way i.e. as physical as her previous knowledge. The only difference consists in the epistemic access to sensory-perceptual and emotional details, which are only accessible in FPP but not in TPP.

Autobiographical memory and Second-Person Perspective

To start with, imagine the case of 'separate coding' i.e. 'isolated coding' (see 2.3.1).

Simulation would only concern sensory and motor stimuli but no longer 'goal-orientation' or 'observable to and to-be effectuated bodily events'. A connection between simulated and actual sensory/motor stimuli would be superfluous since the former would be integrated within the latter similar to the way novel i.e. actual stimuli are integrated within sequences of stimuli. Accordingly, a functional distinction between past and present events would no longer exist. Feelings and working memory, which provide intermediation and linkage, would probably be superfluous. In addition, one-way interaction between simulated and actual sensory/motor stimuli would no longer be necessary. Phenomenally, 'phenomenal judgment' would be impossible in this case. 'Non-phenomenal qualia', semi-transparence, 'phenomenal uncertainty', and 'presence' would not exist. The development of introspection and a 'from the outside' perspective would be impossible and one would, as a result, not be able to distinguish between auto- and heterobiographical events. Epistemically, SPP would no longer be distinguished from TPP. The thought experiment demonstrates the following: (i) the possibility to distinguish between past and present events is necessarily dependent on the kind of coding; (ii) the possibility to distinguish SPP from FPP is necessarily dependent on the possibility to distinguish between past and present events; (iii) the possibility to distinguish between SPP and TPP is necessarily dependent on the distinction between auto- and heterobiographical events.

Following imagine the case of 'common coding' i.e. 'environmental coding' (see 2.3.1).

The simulation would solely be a copy of the respective 'goal-orientation' with no difference at all between 're-experiencing and re-living' and 'experiencing and living'. If there is no principal difference between simulation and copy, 're-experience and re-living' of the past event in terms of the present event remains impossible; this precludes the possibility of re-interpretation. Neither linkage nor integration between simulated and actual event would be necessary, which in turn make both feelings and working memory superfluous. Furthermore, 'one-way interaction' would no longer be needed, which makes 'reentry' redundant. And finally, only 'experienced past' but not 'remembered present' would subsist (see also 2.4.2) so that past and present events would be experienced as separate events without any possibility of integration. Phenomenally, 'phenomenal judgments' in the above-described sense would probably be impossible. Instead there would only be 'phenomenal qualia' but no 'non-phenomenal qualia'. There would only be 'transparence' but no 'semi-transparence', there would be 'phenomenal certainty' but no 'phenomenal uncertainty', there would be 'phenomenal time' but no 'presence' without 'protention' and 'retention'. Epistemically, SPP would be subsumed under FPP. Mediation between FPP and TPP by SPP would no longer be possible. 'Relation of minessness' and 'objective self' as well as introspection and the 'from the outside' perspective would remain impossible. The thought experiment demonstrates the following: (i) the possibility to integrate autobiographical memories within the present context is necessarily dependent on the kind of coding; (ii) the possibility to distinguish between FPP and SPP is necessarily dependent on the possibility to integrate autobiographical memories within the present context; (iii) the possibility of epistemic mediation between FPP and TPP by SPP is necessarily dependent on the possibility of epistemic distinction between FPP and SPP.

Finally imagine the case of 'reversed embedded coding' (see 2.3.1).

Actual 'goal-orientation' would be integrated within simulated 'goal-orientation'. Real events could then be 'experienced and lived' only in terms of 're-experience and re-lived' i.e. in terms of past events. Integration and linkage between simulated and actual events would exist but in a reversed way. Feelings and working memory may still be intermediate. 'Reentry' would still allow 'one-way interaction' but in a reversed way. Neuroanatomically, connectivity would probably no longer be primarily directed from the temporal cortex over the prefrontal cortex to the motor cortex but rather from the prefrontal cortex to the medial temporal cortex with the latter providing the capacity for storage. A 'remembered present', describing a past event that is remembered in the present, would no longer exist but rather a 'present remembrance' that reflects a present event that is remembered in the past. Phenomenally, the relation between 'phenomenal judgments' and 'phenomenal experience' would be reversed. 'Phenomenal judgments' though principally possible would most likely remain 'empty'. The 'from the inside' point of view would be integrated within the 'from the outside' point of view so that the person can experience itself predominantly 'from the outside'. Every 'phenomenal experience' may be preceded by 'phenomenal judgment'. This, for instance, can empirically, be observed in chronic schizophrenic patients. Since their 'phenomenal experience' becomes almost entirely dependent on 'phenomenal judgment' they have to ask and judge everything about their own states before they can experience anything. Accordingly, the relation between 'phenomenal experience' and 'phenomenal judgment' seems to be reversed in this case. Epistemically, the relation between FPP and SPP would be reversed. FPP would no longer be a necessary condition for the possibility of SPP since the former becomes necessarily dependent on the latter. The thought experiment demonstrates the following: (i) the possibility to integrate autobiographical memories within the actual context is necessarily dependent on the kind of coding; (ii) the possibility of the unilateral dependence of SPP on FPP is necessarily dependent on the possibility to integrate autobiographical memories within the actual context; (iii) the possibility of epistemic mediation between FPP and TPP by SPP is necessarily dependent on the possibility of unilateral dependence of SPP on FPP.

In summary, the following conclusions can be drawn: (i) a close relationship between the possibility of autobiographical memories and 'embedded coding' exists; (ii) the dependence of a possible integration of autobiographical memories within the actual context on the direction of linkage between simulated and actual events; (iii) the relationship between FPP, SPP and TPP is necessarily dependent on the relationship between auto- and heterobiographical memories; (iv) the direction of unilateral dependence between FPP and SPP is necessarily dependent on the kind of linkage between past and present events; (v) the epistemic distinction between FPP, SPP and TPP is necessarily dependent on a co-occurrence of distinction and integration between past and present events.

Neuroepistemological hypothesis
Hypothesis: There is a relation between autobiographical memories and 'phenomenal judgment' in the Second-Person Perspective.

Neuroscientific implications: (i) feelings/emotions as mediators for comparison between simulated and actual 'goal-orientation'; (ii) working memory provides integration of simulated 'goal-orientation' within actual 'goal-orientation'; (iii) 'reentry' accounts for one-way interaction between simulated and actual 'goal-orientation'.

Epistemological implications: (i) epistemic characterization of SPP by 'phenomenal judgment'; (ii) there is a close relationship between SPP, autobiographical memories and personal identity, (iii) characterization of SPP by 'phenomenal knowledge', as distinguished from 'physical knowledge' in TPP, only the former accounting for the possibility of the 'Knowledge argument' as an epistemic argument.

2.4.3 'Social embedment': Third-Person Perspective

The functional organisation of the brain: Social cognition
We demonstrated that both simulation of 'goal-orientation' and simulation of 'state-orientation' were crucial for cognitive abilities like imagery and autobiographical memory (see 2.4.1 and 2.4.2). Yet, the issue of simulation of 'act-orientation' still raises the following questions: (i) How can 'act-orientation' be simulated? (ii) How can simulated 'act-orientation' be linked with simulated and actual 'state-orientation'? (iii) How can simulated 'act-orientation' be linked and integrated within actual 'goal-orientation'? Simulation of 'act-orientation' may be characterized as 'mental action' whereas original 'act orientation' may be described as 'physical action' (see 2.3.1). Psychologically, 'mental action' may be reflected in cognitions i.e. thoughts. If thoughts can be accounted for by the simulation of original 'act-orientation', analogous to imagery, more or less similar anatomical structures in both 'physical and mental action' can be assumed. They may be distinguished from each other with respect to primary input/output areas as, for example, the motor cortex. Though not as strong as in the case of imagery (see 2.4.1), there is some empirical evidence for common neuroanatomical substrates that are essential for both thought and action. Due to the apparently close relationship between action and thought, one may speak of a 'motor system of thought' with 'thinking as the most highly developed human motor activity' and characterize thought as 'a motor process that invokes some of the same structures that control movement' like the prefrontal and parietal cortex, the cerebellum, and the basal ganglia (Feinberg & Guazzelli 1999: 197, 200, 201): (i) The prefrontal cortex, especially the dorso-lateral prefrontal cortex (DLPFC), has been related to an abstraction from the respective context and thus to 'abstract' deductive reason-

ing (Adolphs 1999; Esposito et al. 2000). The DLPFC accounts for the categorization and conceptualisation of information both cognitive and motor (Rushworth & Owen 1998); (ii) The parietal cortex may be involved in the process of thinking and thus in the generation of simulated 'act-orientation'. Since the parietal cortex provides spatial estimation and coordinates of movements, it may be particularly involved in those cognitive processes within thinking which are based upon spatial evaluation (see 2.1.1 and 2.1.2); (iii) The cerebellum has been shown to be involved in cognitive processes and thus in thinking as well (see Andreasen 1997; Feinberg & Guazelli 1999). Similar to its role in the generation of movements, the cerebellum may be involved in the regulation of speed, capacity (i.e. reflecting force with regard to movements), consistency (i.e. reflecting rhythm with regard to movements), and appropriateness (i.e. reflecting accuracy with regard to movements) in thoughts (Schmahmann 1991); (iv) There are several indicators that the basal ganglia are strongly involved in cognitive processes and thus in thought (see Graybiel 1995, 1997). Similar to their role in movements, they may be critically involved when it comes to the planning and sequencing of cognitive processes. Graybiel (1997) therefore characterizes the basal ganglia as 'cognitive pattern generators'.

In addition to the problem concerning the simulation of 'act-orientation', the question considering the linkage and integration between simulated 'act-orientation', simulated/actual 'state-orientation', and actual 'goal-orientation' arises. 'State-orientation' may account for feelings/emotions (see 2.3.2) while simulated 'act-orientation' may be reflected in thoughts/cognitions (see above). Psychologically, the relationship between actual/simulated 'state-orientation' and simulated/actual 'act-orientation' should be reflected in the interaction between emotions and cognitions. Feelings and emotions may modulate cognitions by guiding and selecting thoughts as it has been shown, for example, in decision-making (see 2.3.3). One may assume that negative emotions could prevent certain thoughts from being generated and/or integrated within actual 'goal-orientation' (see also Ciompi 1997: 95–99, 301–303). Positive emotions on the other hand may rather reinforce the integration of thoughts within actual 'goal-orientation'. This is reflected in depressive and manic patients. Depressive patients, suffering from negative emotions, show no confidence to take action since their emotions prevent them from transforming their thoughts into action i.e. the patients remain withdrawn. Manic patients, in contrast, no longer suffer from a deficit in action, as it is the case in depression. They rather show a surplus in action, which may be related to an abnormally close relationship between thoughts and actions which was probably induced by their extremely positive emotions. Physiologically, direct interaction between emotions and cognitions has been demonstrated. Error-related negativity, for example, which reflects an electrophysiological correlate of error detection, may be modulated by negative emotions, which leads to significantly higher amplitude (Luu et al. 2000; Bush et al. 2000; Kuhl & Karzen 1999; Kuhl 2000). Moreover, reciprocal suppression inducing a reversed pattern of activation and deactivation may be crucial for the modulating interactions between emotions and cognitions. Emotional processing, as reflected in emotional experiences, induced both activation in the medial prefrontal cortex and concurrent deactivation in the lateral prefrontal cortex (Northoff et al. 2000, 2002; Baker et al. 1997; Mayberg et al. 1999; Drevets & Raichle 1998). Cognitive processing, as reflected in judgement and working memory, rather induces activation in the lateral prefrontal cortex and concurrent deactivation in the medial prefrontal cortex (Northoff 2003a; Northoff et al. 2002; Drevets & Raichle 1998). An analogous pattern of activation and deactivation has been observed in the different subdivisions (cognitive (ACcd) and affective (ACad)) of the anterior cingulate (i.e. AC). While studies that emphasize the cognitive component within the Stroop paradigm lead to activation in ACcd and deactivation in ACad (Bush et al. 1998), studies that introduce an emotional component within the same task i.e. Stroop paradigm generate a reversed pattern: activation in ACad and deactivation in ACcd (see Whalen et al. 1998; Bush et al. 2000).

Until now we demonstrated simulation of 'act-orientation' and interaction between simulated 'act-orientation' and 'state-orientation'. Integrating simulated 'act-orientation' within actual 'goal-orientation' has not yet been discussed. If simulated 'act-orientation' were not integrated within actual 'goal-orientation' 'proximal neglect' would be replaced by 'proximal reference'. Accordingly, 'proximal neglect' may functionally be realized by an integration of simulated 'act-orientation' within actual 'act-orientation'. Simulated 'act-orientation' may be superpositioned on actual 'act-orientation', as described above (see 2.4.2), facilitating the generation and execution of the latter. In addition, simulated 'act-orientation' may be linked with behaviours and movements as observed in other individuals, which explains so-called 'social cognition' (see also Grezes & Decety 2001: 15). The observation of others may be realized by the simulation of the potential 'act-orientation' as inferred from their observed behaviour and movements: '...to obtain information about another's mental state, it may be necessary to imagine what it would be like to be the other person via direct simulation' (Adolphs 1999: 476). Consequently, the meaning and intentions of others' behaviours and movements i.e. their underlying mental states can be indirectly inferred as suggested in the following quote: 'A second strategy would be to generate somatosensory images that correspond to the way one would feel if one were making the facial expression shown in the stimulus. This second idea proposes that subjects judge another person's emotional state from the facial expression by reconstructing in their own brains a simulation of what the other person might be feeling. That is, subjects who are looking at pictures of facial expressions ask themselves how they would feel if they were making the facial expression shown in the stimulus' (Adolphs 1999: 477). Both, amygdala and the ventrolateral prefrontal cortex are apparently crucially involved in social cognition (Adolphs 1999). Both regions may account for the recognition of others' emotions and behaviour as well as their identity. Moreover, the medial prefrontal cortex may be involved in subserving representation of mental states as ascribed to another person (Frith & Frith 1999). Simulated 'act-orientation', as linked to social cognition, may be integrated within actual 'goal-orientation' while a 'reversed integration' remains impossible. One-way integration between simulated 'act-orientation' and actual 'goal-orientation' explains 'proximal neglect' and may therefore be subserved by the following mechanisms: (i) different neuronal reagibility of primary input/output areas as provided by 'functional borders', 'thresholds', and 'functional clusters'; this allows for a superposition of simulated 'act-orientation' on actual 'goal-orientation' but not vice versa (see also 2.4.1); (ii) predominantly one-sided connectivity from VLPFC/DLPFC to the motor cortex (see 2.3.3); this prevents a superposition of actual 'goal-orientation' on simulated 'act-orientation' i.e. a so-called 'reversed integration'; (iii) 'reentry' that provides both 'correlative' and 'constructive' functions (see 2.4.2) and only allows for one-way interaction by means of temporal coordination i.e. neuronal oscillation and synchronization (Hari & Salmelin 1997; Lumer et al. 1997a, b, 1998, 1999); (iv) predominance of neural inhibition and desinhibition, which apparently control at least partially the pattern of activation and deactivation in the prefrontal cortex (see Northoff et al. 2002) which may prevent 'reversed integration'.

Neuroepistemological implications: Social cognition and Third-Person Perspective

Third-Person Perspective

What are functional and phenomenal correlates of the Third-Person Perspective?

Functionally, the observation of others relies on the inference of their probable 'goal-orientation' from their movements and behaviour. Movements and behaviour can only be observed in terms of mechanical stimuli (see 2.1.1 and 2.1.2). The observation of others can thus be characterized by 'stimulus-orientation' rather than 'goal-orientation'. The scrutinized movements and behaviours of other individuals are linked to the simulated 'goal-orientation' from the own person. We can therefore indirectly surmise 'goal-orientation' of other individuals from our own ('goal-orientation') i.e. with the latter being assumed to correspond to the observed behaviour and movements of the other person. If there is a 'good match' between the observed stimuli of other people and the own 'goal-orientation', we can understand their intentions and behaviours. In case of a 'bad match', their intentions as well as their behaviours would remain inaccessible for us. The 'matching process' itself may depend on both the ability to observe others and the availability of a variety of different own i.e. personal 'goal-orientation' of which at least one may correspond more or less to the respective observation.

Phenomenally, the difference between experiencing our own 'goal-orientation' and observing others' in terms of 'stimulus orientation' is reflected by the difference between mental and physical states. The own 'goal-orientation' is experienced in terms of mental events (see 2.3.1), whereas other individuals are observed in terms of physical stimuli. Since we have no direct access to others' 'goal-orientation', we cannot access their mental states either. Accordingly, the observed states can no longer be characterized by phenomenal properties i.e. the 'What is it like', 'phenomenal certainty', 'phenomenal time', and 'phenomenal space' (see 2.3.1). Instead, they rather show physical properties as characterized by 'What are the facts', 'factual certainty', 'physical time', and 'physical space'. While the First-Person Perspective provides experience of 'events' ('What is the event like?') (see 2.3.1 and 2.4.1), the Third-Person Perspective can rather be characterized by the observation of 'facts' ('What are the facts?'). While this is not the case in 'facts', 'events' include the actual context i.e. time ('When'), place ('Where') and kind of occurrence ('How') of changes in the environment. Due to their reliance on stimuli, 'facts' are stripped off the actual context (see 2.3.1 and 3.1.2). Since there is no access to the mental states of others, detection, recognition, and comparison of them by means of 'phenomenal judgments' (see 2.4.2) also remain impossible. Even if we remain unable to access other peoples' phenomenal-qualitative states, we are nevertheless able to detect, recognize and compare their physical states i.e. making 'physical judgments'. Such 'physical judgments' provide 'inter-subjective communication', as distinguished from both 'intra-subjective experience' and 'intra-subjective communication' (see Table 1). This results in social cognition.

What are epistemic correlates of the Third-Person Perspective?

Table 1. Comparision between experience, judgment and observation

	Experience	**Judgment**	Observation
Functional	Original 'goal-orientation'	Integration of 'simulated goal-orientation' within actual 'goal-orientation'	Linkage between others behavior/movement and own actual 'goal-orientation'
Phenomenal	'Phenomenal experience'	'Phenomenal judgment'	'Physical judgment'
State	Unconscious mental states	Conscious mental states	Non-conscious physical states
Perspective	First-Person Perspective	Second-Person Perspective	Third-Person Perspective
Epistemology	'First-Person Epistemology'	'Second-Person Epistemology'	'Third-Person Epistemology'
Ontology	'Mental ontology'		'Physical ontology'

The phenomenal difference between the experience of mental states, judgment of mental states, and the observation of physical states becomes clear in the epistemic difference between FPP, SPP and TPP (see Table 1). Unlike FPP, TPP has no access at all to the own or others' mental states. Accordingly, TPP can be characterized by the observation of physical states rather than the experience of mental states. Unlike SPP, TPP has no access to mental states, which makes any kind of judgment about them impossible. Accordingly, TPP can only make 'physical' but no 'phenomenal judgments'. Each of the three perspectives shows different epistemic abilities and inabilities respectively. FPP provides the experience of the own phenomenal states but can neither judge them nor observe others' physical states. It consequently accounts for 'phenomenal experience' and unconscious mental states (see 3.2.2 for discussion about unconsciousness and consciousness). SPP can judge the own phenomenal states but has no access to others' physical states and therefore accounts for 'phenomenal judgment' and conscious mental states. TPP can observe others' physical states but has no access to any mental state at all. It accounts for 'physical judgment' and non-conscious physical states. Considering their distinct epistemic abilities and inabilities, FPP, SPP and TPP must be regarded as complementary. The complementary character between FPP, SPP and TPP is nicely reflected in their functional roles: FPP provides 'intra-subjective experience', SPP accounts for 'intra-subjective communication' and TPP makes 'inter-subjective communication' possible. Accordingly, the respectively associated epistemologies, 'First-, Second- and Third-Person Epistemology', must be regarded as distinct aspects of one integrative underlying epistemology i.e. 'embedded epistemology' (see 3.2.1).

The relationship between the three perspectives can be characterized by the unilateral dependence of TPP on FPP and SPP (see, however, 3.2.3 for dependence of FPP and SPP on TPP with regard to communication). While TPP is necessarily dependent on FPP the latter remains independent from the former with regard to its generation. If there were no FPP, the physical stimuli from others, as observed in TPP, could no longer be related to the own 'goal-orientation'. Any behaviour and movement of others would remain meaningless and their intentions inaccessible to us. TPP without FPP would thus remain 'hollow' since no meaning could be attributed to the observed behaviour and movements. In contrast, experiencing our own mental states remains possible without the observation of physical stimuli in other individuals. This shows that FPP is independent from TPP. TPP is also necessarily dependent on SPP while the latter remains independent from the former. The matching process between observed behavior and movement and own 'goal-orientation' requires a specific selection of the latter from a wide variety of the own 'goal-orientations'. A specific selection presupposes some detection, recognition, and comparison i.e. 'phenomenal judgment' as it is epistemically accounted for by SPP. If there is no SPP, the selection of 'goal-orientation' that potentially corresponds to the observed behavior and movement, is no longer specific which may result in a 'bad match' (see above). TPP without SPP would thus remain 'empty' since no corresponding or matching 'goal-orientation' i.e. mental event could be related with the observed behavior and movement. The 'phenomenal judgment' of our own mental states remains possible without any correspondence to the observed behaviors or movements in others. SPP remains therefore independent from TPP. Finally, let's identify the unilateral dependence between FPP and SPP. Detection, recognition, and comparison of phenomenal-qualitative states necessarily presuppose the experience of such states. Accordingly, SPP is dependent on FPP. At the same time the experience of phenomenal states is possible without their detection, recognition, and comparison of them so that FPP remains independent from SPP.

Is there an 'explanatory gap' between phenomenal and physical states?

Since phenomenal and physical states show distinct functional, phenomenal and epistemic properties, the question concerning the existence of a gap between both kinds of states arises. Is there such a gap? How, if at all, can this gap be bridged? This has been discussed as the 'explanatory gap argument' in philosophy of the mind (Levine 1983, 1990, 1993).

Functionally, we demonstrated that while the experience of phenomenal states can be related to 'event coding', the observation of physical states reflects 'stimulus coding' (see above). One may therefore assume that there is a 'functional gap' between phenomenal and physical states, 'Event coding' predominates while 'stimulus coding', although suppressed, remains present by means of superposition of the former on the latter (see 2.3.1). Due to this superposition, phenomenal and physical states interfere with each other; this presupposes some 'functional continuity' accompanying the 'functional gap'.

Phenomenally, the 'functional gap' between phenomenal and physical states is reflected in the difference between the experience of 'events' and the observation of 'facts'. Phenomenal states can be experienced and therefore refer to 'events' while physical states can be observed and, as a result, refer to 'facts'. For that reason, one may presuppose the existence of a 'phenomenal gap' between phenomenal and physical states. As demonstrated above, the observation of physical states is dependent on the experience of phenomenal states, which reflects some kind of interference between both types of states. In view of that, the 'phenomenal gap' may be accompanied by 'phenomenal continuity'.

Epistemically, the difference between FPP and TPP indicates the existence of a 'phenomenal gap' between experience and observation. While FPP accounts for the experience of phenomenal states observation of physical states is related to TPP. One may therefore assume an 'epistemic gap' between phenomenal and physical states. However, TPP is necessarily dependent on FPP and SPP (see above), which points towards a direct interference between the different perspectives. Accordingly, the 'epistemic gap' may be accompanied by some kind of 'epistemic continuity'.

Ontologically, the 'epistemic gap' between FPP and TPP may be reflected in the difference between mind and brain. Yet, the inference of ontological differences from epistemic differences can be regarded as an instance of 'false ontologization' (see 2.4.1). Accordingly, inferring from the experience of phenomenal states in FPP to the mind as ontologically different from the brain is not only unnecessary but also remains naturally implausible. We demonstrated that the functional organisation of the brain and thus the brain itself, as characterized by 'embedded coding' (see 2.3.1), can account for the occurrence of mental states as phenomenally and epistemically distinguished from neuronal states. Accordingly, the assumption that the mind is ontologically different from the brain remains superfluous from an empirical i.e. natural point of view; there is no 'ontological gap' at all which makes the assumption of any form of 'ontological continuity' superfluous. One could however argue that the possibility of generating mental states within the brain only shows the possibility of 'ontological continuity' but not the natural impossibility of a mind as ontologically distinguished from the brain. In this case, a common ontological substrate underlying both brain and mind would have to be assumed. Otherwise the mind could not be generated within the brain itself. This solution has been suggested by Thomas Nagel (see 3.3.1 for more extensive discussion) and David Chalmers (see 3.3.1 and 3.3.3 for more extensive discussion). Both however have to be accused of 'false ontologization' and 'natural implausibility'.

Nagel (1979, 1986) 'ontologizes' mental states and distinguishes them ontologically from physical states. Both phenomenal and physical i.e. neuronal states arise within the brain. In order to reconcile these two assumptions he assumes a so-called 'fundamental essence', which results in 'panpsychism'. This 'fundamental essence' shows physical and proto-mental properties. If physical states are combined and organized in a certain way ('unusual chemical and physiological structure') phenomenal states may be generated. First, Nagel infers an ontological difference between brain and mind from the epistemic distinction between FPP and TPP, which can be considered as an instance of 'false ontologization'. Second, the special combination and organisation of physical i.e. neuronal states does not necessarily imply a generation of ontologically different states. The functional organisation of the brain can indeed be characterized by such special combination and organisation as it is reflected in 'embedded coding'. This however does not generate states that are ontologically different from the brain itself. Accordingly, Nagel's theory remains naturally implausible and may thus be regarded as a purely logical possibility. Chalmers (1996) presupposes 'information' as the 'fundamental essence', which may be realized in both ways i.e. physical and phenomenal. The notion of 'information' (see also 3.3.1 and 3.3.3 for extensive discussion of the philosophical implications) is central within the present framework of 'event coding' and

’goal-orientation’. ‘Double realization’ of ‘information’ as both physical and phenomenal may be equated with the two kinds of coding. ’Stimulus coding’ may be related to physical realization of information whereas ‘event coding’ may rather be related to phenomenal realization. In contrast to Chalmers, ‘double realization’ of ‘information’ does not necessarily imply ontological dualism since both forms of coding remain indifferent to the ontological distinction between ‘mental and physical properties’ (see also 3.3.3).This implies that no ‘bridging principles’ between both realizations of ‘information’ are needed. The only ‘bridging principle’ needed would be functional in nature as it reflects the superposition of the ‘event code’ on the ‘stimulus code’ with the consecutive suppression of the latter by the former (see 2.3.1). Chalmers infers two distinct ontological properties from distinct ways of realizing information i.e. physical and phenomenal. He can therefore be accused of ‘false ontologization’. Furthermore, different ways of realization of ‘information’ do not necessarily imply different ontological substrates. Different ways of the functional organisation of the brain as, for example, ‘event coding’ and ‘stimulus coding’ do not imply different ontological substrates. As a result, Chalmer’s theory remains naturally implausible and must therefore be considered as a purely logical possibility.

The ‘explanatory gap’ may be considered in either a strong or a weak sense. A strong sense of the ‘explanatory gap’ would not allow for any kind of ‘continuity’ accompanying the ‘gap’. Since all three kinds of gaps demonstrated here i.e. the ‘functional gap’, the ‘phenomenal gap’, and the ‘epistemic gap’ were accompanied by ‘continuity’, the ‘explanatory gap’ in a strong sense has to be rejected from a natural point of view. An ‘explanatory gap’ in a strong sense still remains at least a purely logical possibility. In contrast, we must assume an ‘explanatory gap’ in a weak sense. We demonstrated co-occurrence between ‘gap’ and ‘continuity’ in functional, phenomenal, and epistemic regards. Accordingly, an ‘explanatory gap’ in a weak sense, which allows for some kind of ‘continuity’ remains naturally plausible. Unlike in functional, phenomenal, and epistemic regards, an ontological ‘explanatory gap’ has to be rejected even in a weak sense. Neither assumption of an ‘ontological gap’ nor ‘ontological continuity’ was empirically plausible. Instead, both assumptions were revealed as superfluous and implausible from a natural point of view. The assumption of an ontological ‘explanatory gap’ in both strong and weak sense subsequently remains a purely logical possibility.

The conditions for the possibility of raising the idea of an ‘explanatory gap’ as such (see Birnbacher 1998: 3–5) may consist in the conjunction of neglect of ‘continuity’, occurrence of ‘false ontologization’, and lack of insight into unilateral dependence between epistemic perspectives. Neglecting ‘continuity’ may at least have opened the door for the almost exclusive consideration of the ‘explanatory gap’ in a strong sense, which however no longer allows the possibility of any kind of ‘continuity’. Since the ‘explanatory gap’ is strongly motivated by ontological concerns, the idea of an 'explanatory gap' may be closely related to the possibility of 'false ontologization'. Inferring ontological differences from functional, phenomenal, and/or epistemic distinctions was therefore made possible. In addition, since the possibility of 'continuity' as such was neglected, these ontological differences were then interpreted as a 'gap' in a strong sense. The lack of insight into the unilateral dependence between the three epistemic perspectives i.e. between FPP, SPP and TPP (see above) may have contributed to the idea of an 'explanatory gap'. The 'continuity' between the epistemic perspectives was therefore no longer visible, which may have opened the door for the possibility of 'false ontologization'.

Social cognition and Third-Person Perspective

Imagine first the case of 'separate coding' i.e. 'isolated coding' (see 2.3.1).

A functional relationship between our own actions and the observation of others with respect to structure, correlation, and overlapping underlying neuroanatomical areas would no longer exist. The observation of others would no longer be related to our own actions or movements but rather entirely separated. Accordingly, others' behaviours and movements could no longer be regarded as meaningful so that one should speak of 'social observation' rather than 'social cognition'. Phenomenally, observing others would still be possible but only in terms of 'stimulus-orientation'. The observed physical stimuli, however, could no longer be linked to the own phenomenal events as reflected in simulated 'goal-orientation'. Accordingly, we would remain unable to access the intentions and 'goal-orientation' that are essential for the behaviour and movements of other individuals. Epistemically, TPP would no longer be dependent on FPP. FPP and TPP would either be entirely separated from each other or would be mutually exclusive with elimination or subordination of FPP under TPP. The thought experiment demonstrates the following: (i) the possibility of attributing intention, meaning, and 'goal-orientation' to other peoples' behaviour/movement is necessarily dependent on the kind of coding; (ii) the possibility of social cognition is necessarily dependent on the possibility to attribute meaning and intentions to the behaviour and movement of others; (iii) the possibility of an epistemic dependence between FPP, SPP, and TPP necessarily relies on the possibility of social cognition.

Imagine second the case of 'common coding' i.e. 'environmental coding' (see 2.3.1).

Our own and others' actions would be isomorphic and thus copies of each other so that they could no longer be distinguished from one another. The observed behaviour and movement of others would induce identical behaviour and movement in the observing person. This is, for example, the case in patients with lesions in the ventrolateral prefrontal cortex (see Northoff 2003b). Accordingly, the distinction between 'stimulus orientation', as observed in others, and our own 'goal-orientation' would be blurred with the former being equated with the latter.

A difference between observation and execution and thus between others' and the own persons' behaviour and movement would no longer exist. Phenomenally, we would fully understand the meaning and intention of other peoples' behaviour and movement in exactly the same way that we understand our own actions. The phenomenal distinction between experience and observation would thus be blurred. Epistemically, the distinction between FPP and TPP would be blurred with the latter being associated with the former. Accordingly, only one perspective i.e. FPP would account for the experience and observation of the own and others' mental states. TPP becomes superfluous since the observation of physical states is no longer necessary. Accordingly, the difference between 'inter-subjective communication', as related to TPP, and 'intra-subjective experience', as related to FPP, is no longer present. Analogous to TPP, judgments about the own or others' mental states are superfluous and SPP therefore remains absent as well. The thought experiment demonstrates the following: (i) the possibility to distinguish between the own and other peoples' intentions, meanings and 'goal-orientation' is necessarily dependent on the kind of coding; (ii) the possibility of social cognition, as distinguished from phenomenal experience is necessarily dependent on the possibility to distinguish between our own and others' intentions, meanings and 'goal-orientation'; (iii) the possibility to distinguish between TPP and FPP is necessarily dependent on the possibility of social cognition

Imagine third the case of 'reversed embedded coding' (see 2.3.1).

The observation of others' actions and our own could still be distinguished but the relationship of integration would be reversed. Others' behaviour and movement could probably be observed in terms of 'goal-orientation' while our own action would rather be oriented on 'stimulus-orientation'. Accordingly, we would have access to others' 'goal-orientation' and could directly understand the meaning and intention of their behaviour and movement. In the case of our own action, meaning, and intention would remain only indirectly accessible to ourselves (via the others). One may therefore speak of 'mental cognition' rather than 'social cognition'. Phenomenally, whereas other individuals could be observed in terms of 'goal-orientation' and mental events the own person could only be experienced in terms of 'stimulus-orientation' and physical stimuli. Epistemically, the relationship between FPP and TPP would be reversed. TPP would no longer be dependent on FPP since it accesses other peoples' mental states directly and by itself, which makes the linkage with the own mental states and thus with FPP superfluous. FPP on the other hand may be dependent on TPP with the latter potentially providing access to the own mental states. The thought experiment demonstrates the following: (i) the possibility to observe others in terms of 'stimulus-orientation' is necessarily dependent on 'embedded coding'; (ii) the possibility of social cognition is necessarily dependent on the possibility to observe others in terms of 'stimulus-orientation'; (iii) the possibility of an epistemic dependence of TPP on FPP is necessarily dependent on the possibility of social cognition.

In summary, the following conclusions can be drawn: (i) the way we observe other peoples' behaviour and movement is necessarily dependent on the kind of coding; (ii) the relationship between the experience of the own person and the observation of others is necessarily dependent on the kind of coding; (iii) the possibility of social cognition as such is necessarily dependent on the distinction between experience and observation; (iv) the possibility to distinguish between social cognition and phenomenal experience is necessarily dependent on the possibility to distinguish between the own and other persons; (v) the distinction between FPP and TPP is necessarily dependent on the distinction between experience and observation; (vi) the distinction between FPP and TPP is necessarily dependent on the possibility to distinguish between the own and another person.

Neuroepistemological hypothesis

Hypothesis: There is a relationship between social cognition and 'physical judgment' in the Third-Person Perspective.

Neuroscientific implications: (i) activation in identical or overlapping neuroanatomical regions during the observation of others' behaviour/movement and the generation of the own behaviour/movement; (ii) differences in the primary output areas (i.e. motor cortex) between the observation of others' behaviour/movement and the execution of the own behaviour/movement; (iii) unilateral connectivity and one-way interaction between neuroanatomical areas that account for the formation of 'goal-orientation' and primary output areas that in turn subserve the execution of action; this allows for a superposition of the former on the latter but not vice versa.

Epistemological implications: (i) epistemic characterization of TPP by 'physical judgment', which reflects the possibility of social cognition; (ii) unilateral dependence of TPP on both FPP and SPP; (iii) co-occurrence of 'gap' and 'continuity' between FPP, SPP, and TPP in functional, phenomenal, and epistemic regard, which account for the possibility of an epistemic 'explanatory gap' between phenomenal and physical states in a weak sense.

Chapter 3

'Philosophy of the brain'

Empirical hypothesis of the brain, 'epistemology of the brain', and 'ontology of the brain'

An outline of a 'philosophy of the brain' that is based on the 'epistemic-empirical relationship' (see Chapter 2), shall be developed in the present chapter. The 'philosophy of the brain' includes an empirical hypothesis of the brain (see 3.1), an 'epistemology of the brain' (see 3.2) and an 'ontology of the brain' (see 3.3). This 'philosophy of the brain' is based on both neurophilosophical methodology (see 1.4) and neuroepistemological account of the brain (see Chapter 2). Moreover, the 'philosophy of the brain' can be characterized by 'embedment' which in turn presupposes a 'philosophy of embedment' (see 1.3.2).

'Embedment' in the empirical characterization of the brain (see 3.1) is reflected as a 'dynamic brain' (see 3.1.2) with 'event coding' and 'dynamic transients' (see 3.1.2). 'Embedment' is also reflected in the necessity (see 3.2) for the development of an 'embedded epistemology' as distinguished from an 'isolated epistemology' (see 3.2.1). 'Embedment' is furthermore reflected in the ontological determination of the brain (see 3.3) as an 'embedded brain' (see 3.3.2) and the necessity for the development of an 'embedded ontology', as distinguished from an 'isolated ontology' (see 3.3.3).

3.1 Empirical hypothesis of the brain: 'Dynamic brain', 'event coding', and 'embedded brain'

> 'As far as the brain is concerned, humans are distinctly amateur mechanics. We hope to find one simple thing that is wrong with the brain in a particular disease, then to cure the disease by fixing this problem. Considering the complexity of the brain, it is remarkable that anything we have done has worked at all.'
>
> (W. J. Freed & T. D. Smith 1995)

We investigated the relation between epistemic abilities/inabilities and the empirical brain function that relies on a so-called 'epistemic-empirical relationship' (see Chapter 2). We demonstrated that certain epistemic abilities/inabilities were related to particular features in the organization of neuronal states. Moreover, as revealed in thought experiments (see Chapter 2), an alteration in the neuronal organization is accompanied by changes in epistemic abilities/inabilities. One may therefore presume a specific neuronal organization, which must be considered a necessary condition for particular epistemic abilities and inabilities. By defining the brain as a 'dynamic brain' this empirical hypothesis of the brain reveals its dynamic organization (see 3.1.2) which in turn presupposes intrinsic integration of the brain within both body and environment. Consequently, the brain can no longer be regarded as isolated from both body and environment. One may therefore speak of an 'embedded brain', as distinguished from an 'isolated brain' (see 3.3. for further discussion).

In a first step (see 3.1.1), we will characterize the dynamic brain organization. We will rely on empirical mechanisms that were raised in the preceding (i.e. Chapter 2) section. This will be followed by the determination of the brain as a 'dynamic brain' (see 3.1.2) as characterized by dynamic states, 'event coding', 'mental presentation', and context-dependence of function.

3.1.1 The dynamic organisation of the brain

The characteristics of the neuronal organisation will be briefly reviewed based on the empirical findings as discussed in Chapter 2. In addition to existing knowledge, lack of knowledge with respect to the dynamic organisation of the brain will be identified (see 3.1.1).

What we know: The principles of the dynamic organisation of the brain
Relying on empirical findings discussed in the Chapter 2, we postulate that the following principles account for the dynamic organisation of the brain (see Table 2).

The principle of event coding
The principle of event coding characterizes the orientation of the neuronal organisation on events rather than stimuli. These events reflect 'observable and to-be effectuated events within the environment' (see 2.3.1). The principle of event coding may be closely related to the characterization of the 'brain code' by 'event coding' (see 3.1.2). The principle of event coding is realized and implemented by the principles of 'goal-orientation', functional asymmetry, meaningful organisation, double realization and individuality.

The principle of 'goal-orientation'
'Observable and to-be effectuated events within the environment' are the goals according to which neuronal states within the brain are organized. 'Goal-orientation'

Table 2. Principles of dynamic brain organisation

Principle of event coding	
	– Principle of goal-orientation
	– Principle of asymmetry in functional connectivity
	– Principle of meaningful organisation
	– Principle of double realization
	– Principle of individuality
Principle of economy	
	– Principle of anatomo-structural similarity
	– Principle of reciprocal suppression
	– Principle of functional primacy
	– Principle of complex modulation
	– Principle of thresholding
Principle of contradictory complementarity	
	– Principle of distributed localization
	– Principle of polytemporal unity
	– Principle of realization by simulation
	– Principle of simulated reality
	– Principle of heterogenous homogeneity

is subserved by dynamic connectivity in neural networks as, for example, by fronto-parietal circuits (see 2.3.1. and 2.2.1).

The principle of functional asymmetry

'Goal-orientation' is maintained by asymmetry in functional connectivity as it is reflected in, for example, thalamocortical connectivity or amygdaloid-prefrontal connectivity. If asymmetry in functional connectivity were replaced by symmetry, 'goal-orientation' could no longer be maintained. In this case, 'stimulus coding' would probably replace 'event coding' (see, for example, the thought experiments in 2.3.1 and 2.3.2).

The principle of meaningful organisation

Neuronal activity is organized primarily in orientation on the behavioural significance of 'observable- and to-be effectuated environmental events' rather than the physical properties of single stimuli. It is therefore that neurons respond rather to environmental events with behavioural significance than single stimuli without behavioural significance (see 2.1.2 and 2.3.3). The orientation on behavioural significance implies that meaning is an intrinsic feature of the dynamic organisation in the brain, which thus has to be considered as meaningful by itself.

The principle of double realization

There are several lines of evidence that 'goal-orientation' may be realized in two ways in the dynamic organisation of the brain. First, 'goal-orientation' is realized in a 'fast system' as being responsible for the observation and effectuation of events within the environment. Second, there seems to be a 'slow system' in which simulation or re-processing subserves recognition and monitoring/planning of both the observation and effectuation of events within the environment. Phenomenally, double realization of 'goal-orientation' in 'fast and slow system' may be reflected in the difference between unconsciousness and consciousness (see 2.2.2 and 3.2.2).

The principle of individuality
The dynamic organisation of the brain reflects distinct 'observable and to-be effectuated events within environment' in different individuals. While phenomenally, this accounts for the individuality of 'phenomenal experience' empirically, it is reflected in inter-individual differences in the dynamic brain organisation as, for example, in the case of phantom limbs (see 2.1.2).

The principle of economy
The principle of economy characterizes the economic use of limited anatomo-structural capacities of the brain with respect to the generation of functions. While there are apparently almost unlimited possibilities for the generation of functional contents (in the same and different person), the anatomo-structural capacities of the brain remain limited. Due to the principle of economy, limited functional abilities of anatomical structures may possibly be extended and varied. Accordingly, the 'principle of economy' describes functional mechanisms by means of which dynamic processes can operate across anatomical structures of the brain. The 'principle of economy' may subsequently be considered as crucial for individual and for variable grouping and linkage of heterogenous stimuli into a homogenous event, which makes 'event coding', as distinguished from 'stimulus coding', possible (see also 3.1.2). The principle of economy is realized and implemented by the principles of anatomo-structural similarity, reciprocal suppression, functional primacy, complex modulation and thresholding.

The principle of anatomo-structural similarity
Different functions may rely on similar anatomical structures or at least on partially overlapping anatomical structures. For example, different functions like working memory, visuo-spatial attention and motor planning have been shown to involve more or less similar regions like the orbitofrontal cortex, the dorso-lateral prefrontal cortex and the parietal cortex (see also Chapter 2). The simulation of functions as, for example, in the case of imagery, may even rely on similar i.e. identical anatomical structures as the function that is to be simulated (see 2.4.1). By extending its limited functional abilities, the same anatomical structure may account for a variety of different functions.

The principle of reciprocal suppression

Activation in one region may lead to deactivation in another region and vice versa. This may result in a reciprocal dependence between two (or more) anatomo-structural areas. Reciprocal suppression has been demonstrated in the medial and lateral orbitofrontal cortex (see 2.3.3), in different areas within the anterior cingulate (see 2.4.3) and in relation between the prefrontal and parietal cortex (see 2.2.3). Reciprocal suppression may be predetermined by a dynamic connectivity and neurochemical modulation (as for example GABA and Glutamate). Reciprocal suppression may therefore extend and vary functional abilities that are related to particular anatomical structures.

The principle of functional primacy

The dynamic organisation of the brain seems to be determined by a functional connectivity between the different anatomical structures rather than by the respective anatomical structures by themselves. Accordingly, 'functional primacy' seems to replace 'structural primacy'. 'Functional primacy' may be revealed during the determination of the anatomical structures by means of functional connectivity. Functional requirements may determine the relation between anatomical structure and function. As a result the functional capacities of the limited anatomical structures may be extended.

The principle of complex modulation

Functional connectivity allows for different and multiple ways of transregional modulation. This is, for example, reflected in the possibility of 'top-down' and 'bottom-up modulation', 'horizontal and 'vertical feedback' and 'feedforward and feedback loops' (see 2.2.1, 2.3.1, 2.3.2, and 3.1.2). Different and multiple ways of transregional modulation thus allow for the functional extension of limited anatomical-structural resources.

The principle of thresholding

The distinction between the different functions that rely on similar anatomical structures may be guided and modulated by regulating thresholds i.e. particular functions may be specified by specific thresholds. This is also reflected in cortical reorganisation, observation of others and imagery (2.1.2, 2.4.1). In all these cases, variations in thresholds over similar anatomical structures determine the respective functional abilities. Thresholding may therefore potentiate and extend the functional abilities of anatomical structures.

The principle of contradictory complementarity

The principle of contradictory complementarity characterizes both co-occurrence and integration between the different/contradictory properties in the dynamic organisation of the brain. One may therefore speak of a 'complementary brain' (Grossberg 2000: 244).

The principle of contradictory complementarity reveals the importance of the difference between a view on the brain 'from without' and a view 'from within' the brain itself with the latter reflecting a 'First-Brain Perspective' (see 3.1.2, 3.2.1 for further explanation). While certain properties appear as different/contradictory 'from without', this may no longer be the case by taking a view 'from within' the brain itself. Moreover, the 'First-Brain Perspective' seems to be crucial for empirical investigation of the brain as a 'dynamic brain' and 'event coding'. The principle of contradictory complementarity is realized and implemented by the principles of distributed localization, polytemporal unity, realization by simulation, simulated reality, and heterogenous homogeneity.

The principle of distributed localization

There has been considerable debate over whether functional abilities are localized within certain brain areas or rather distributed across several brain areas (see Goetz 2000; Northoff 1997; Goldman-Rakic 2000). Contradiction between localization versus holism may be replaced by complementarity between localization and distribution in dynamic brain organisation. For example, 'goal-orientation' is apparently subserved by a fronto-parietal network, which can be distinguished from other networks. Accordingly, both localization and distribution, reflecting functional segregation and integration respectively, can co-exist at the same time.

The principle of polytemporal unity

Despite showing distinct temporal firing properties, the neural activity in different neurons and anatomical structures is nevertheless temporally coordinated, which results in 'polytemporal unity'. Phenomenally, 'polytemporal unity' may for example be reflected in the experience of 'phenomenal time' (see 2.2.1). Different temporal coordinates may thus co-exist and even be integrated within each other.

The principle of realization by simulation

Certain functions may be realized by simulation of others. For example, motor imagery is apparently realized by simulating motor functions (see 2.4.1). Different functional mechanisms like the original generation and simulation of the original may thus co-exist and even be integrated within each other.

The principle of simulated reality
Even though certain functions are realized by simulation, they are nevertheless integrated within the respective actual environmental context. For example, even though autobiographical memories are functionally based on simulation, they are nevertheless retrieved, modulated and categorized in orientation on the respective actual environmental context (see 2.4.2). Instead of remaining a mere simulation of reality, they become part of the reality itself, which can be called 'simulated reality'. Simulation of reality and reality itself can thus co-exist and can furthermore be integrated within each other.

The principle of heterogenous homogeneity
Although several functions show distinct i.e. heterogenous aspects, these aspects are nevertheless integrated within each other into one homogenous function. For example, movements can be split into planning, initiation, execution and termination (see Northoff 2003b). Despite these distinct aspects, action and movement remain homogenous. Consequently, heterogenous and homogenous properties of action/movement can co-exist and can even be integrated within each other.

What we don't know: Functional mechanisms of dynamic brain organisation
Above we showed the principles of dynamic brain organisation. However, exact functional mechanisms that account for the dynamic organisation of the brain are not well known yet.

Functional connectivity
First, the exact mechanisms underlying the generation of functional connectivity are not known yet. These may include the following mechanisms: distinct kinds of local and non-local activity spread, poly- and monosynaptic propagation, weighting of activity spread, grouping of functional clusters, grouping of areas within one functional cluster, relation between areas (repulsion, attraction, etc), constellations and balance between attraction and repulsion within and between grouping of areas and functional clusters, internal and external cohesion, conduction velocities within functional connections, coupling strength between areas and functional clusters, relation between global and local connectivity, and vulnerability and sensitivity of functional connections. Since, at present, it remains almost impossible to investigate these mechanisms directly in the brain itself, simulations of neural networks (see Koetter et al. 2000; Stephan et al. 2000) may be combined with functional imaging of the brain.

Secondly, asymmetries in functional connectivity are known only partially and fragmentarily. Due to the high number of functional connections between the different anatomo-structural areas, particular functional relevance may be attributed to the asymmetries in functional connections (see 2.3.1 and 2.3.2). At the same time as they prevent 'stimulus coding, functional asymmetries may be of particular importance for the realization of 'event coding' (see 2.3.1).

Thirdly, feedback and feedforward connections, being crucial for realization and implementation of 'event coding', are not well known either. Especially functional mechanisms of 'top-down' and 'bottom-up' modulation have rarely been investigated in detail yet there is strong phenomenological and physiological evidence for these types of modulations (see 2.2.1 as well as Hurely 1998; Northoff 2003b).

Fourthly, neurochemical modulation of functional connectivity is also not well known. For example, functional connectivity between medial and lateral orbitofrontal cortex may be modulated by gaba-ergic transmission (see 2.2.2) – however exact mechanisms and involvement of other transmitter systems like dopamine, glutamate, serotonine etc. is not known at this time.

Thresholding

The principle of thresholding remains crucial for both extension and differentiation of functional abilities as it is also reflected in imagery. However, exact mechanisms of the modulation of the spatiotemporal activity pattern by variation in thresholds are not known as of now. For example, the dependence of functional clusters on thresholds, the determination of thresholds, the generation of thresholds and of functional borders by thresholding, the relation between inhibitory and excitatory thresholds, phasic and tonic thresholding, the gating function of thresholding as well as linear and non-linear thresholding etc. are not known at present. Furthermore, neurochemical modulation of thresholds is only partially known.

Dynamic processes

Self-organisation and non-linear mechanisms in the function of the brain remain unclear. There may be functional stabilities and instabilities that reflect certain spatiotemporal activity pattern across different anatomo-structural areas. For example, the motor cortex may be considered a 'labile area'. Instead of a static pattern with a predetermined motor program, dynamic patterns of activity are dominating. These dynamic patterns may account for flexible and variable movements depending on the respective context and thus on 'observable and effectuated environmental events' (see Kelso 1995: 261–262; Fuchs et al. 2000).

Mechanisms subserving context-dependent self-organisation remain unclear. For example, there is not much knowledge about 'competitive and cooperative processes between intrinsic connectivity and external inputs together with local fluctuations in cellular interactions jointly generate (relational and labile) topographic maps' (see Kelsö 1995: 268). There may be critical and uncritical as well as coherent and incoherent stabilities and instabilities that account for the dynamic patterns with attractors and trajectories across space (i.e. anatomo-structural areas) and time. Moreover, self-organisation is reflected in 'state parameters' (see also 3.1.2) like spontaneity, attraction, repulsion, intermittency, crisis, instability, transitions and synchronicity.

Interaction between different levels of organisation

Relying on the principles of functional brain organisation, we predominantly focused on functions related to anatomical structures and neglected cellular and molecular mechanisms underlying such functions almost entirely. Realization, manifestation and expression of genes may be closely related to functions and environmental events and thus to the respective social context (see Akil et al. 2000; Eisenberg 2000). Though molecular and cellular knowledge about the brain has increased almost exponentially in the last decade, exact relations between molecular, cellular, anatomo-structural and functional levels remain unclear (see Koetter et al. 2001; Tagamets & Horwitz 1998 as well as Searle 2000: 559). No one should give priority to any single level of description either causally or functionally. Instead, guided by a search for 'common principles acting on each level', there should be 'translation back and forth between the main languages that separate molecular biology and behavior' (Kelso 1995: 229).

3.1.2 The 'dynamic brain': 'Dynamic states' and 'First-Brain Perspective'

In the following section, we want to characterize the brain as a 'dynamic brain'. The brain shows the characteristics of dynamic systems that account for its 'intrinsic' integration within body and environment. We will describe general characteristics of dynamic systems that are subsequently specified further with regard to the brain.

Dynamic systems

Cognitive and connectional systems show non-dynamic characteristics and can thus not be regarded as dynamic systems. This is reflected in the function of the input, precoded instruction/algorithm, the kind of representation and the explanatory focus.

A digital computer is a cognitive system that performs effective computation via representation reflecting precoded signals or symbols. The input is a symbolic description of a problem to be solved. The explanatory focus is therefore on structure and content of the representation as well as on the nature and efficiacy of the respective algorithms.

Connectionist models are typically layered networks of simple, neuron-like elements that are trained to transform a numerical input representation into a nu-

Table 3. Comparision between cognitive/connectionist and dynamic systems

	Cognitive/connectionist systems	Dynamic systems
States and change	State as primary: Change as the medium of states	Change as primary: States as the medium of changes
State	Internal syntactic/combinatorial structure: what the state is	Geometric understanding of structure: where the state is
Structure	Static structure: written word	Dynamic structure: spoken word
States and Behaviour	What kind of behavior: Correlation with states	How is behavior generated: Correlation with geometry of states
Processing	Serial, local, independent: Mapping of input onto output	Parallel, global, interdependent: Mapping of ongoing activity onto input and output
Interaction	Interaction as setting state: Input and output as start- and endpoints	Interaction as modulation: Input and output as ongoing perturbations
Representation	Static configuration: Representation	Dynamic configuration: Presentation

merical output representation. In contrast to cognitive systems, where representation remains local and modular (see Coltheart 1999), here representation is rather distributed across distinct units with multiple superpositions. The explanatory focus lies therefore on network architecture, learning algorithms and developing intermediate distributed representations.

In dynamic systems, the input no longer specifies an 'internal' state that describes and represents an 'external' state. The 'internal' state does not represent an 'external' state. Instead, the input serves as a source for the perturbation of the intrinsic dynamics of the system. Unlike in cognitive and connectionists systems, the input is subsequently no longer of primary importance in dynamic systems (see Table 3).

The primary importance of the input is replaced by 'state parameters', which mirror the state of the whole system during the perturbation by an input. 'State parameters' can be regarded as 'order parameters', which describe change, transitions, critical and non-critical instabilities, phase shifts, fluctuations, etc. (see Thelen & Smith 1994: 45–71; van Gelder 1991: 620–621). Unlike 'internal' states, these 'state parameters' no longer represent or reflect some 'external' state i.e. they do not stand for something else (see also 3.1.2): 'Likewise, a system's internal state does not necessarily have any special straightforward interpretation as a representation of an external state of affairs. Rather, at each instant in time, the internal state specifies the effects that a given perturbation can have on the unfolding trajectory' (Beer 2000: 97). Subsequently, the relation between input and output is fundamentally different in dynamic and non-dynamic systems. In cognitive and connectionist systems, input and output show a unilateral dependence the latter being dependent on the former but not vice versa. Computational relations between input and output can therefore be characterized by sequential processing which determines the state of the whole system. Dynamic systems, in contrast, no longer attribute primary importance to input and output. Instead of 'unilateral dependence' between input and output, 'bilateral dependence' (see also 3.3.2) explains the 'intrinsic' linkage between input and output within the 'state parameters' (see above). Sequential processing in computational relations between input and output is replaced by simultaneous processing. The input modulates the output while, at the same time, the output determines the input. Both input and output are thus predominantly determined by mutual and reciprocal exchange i.e. interaction. Rather than input and output the interaction itself reflects the state of the system i.e. its 'state parameters'. The primary importance of input and output is therefore replaced by the consideration of 'state parameters'.

A distinction between 'internal' and 'external' states, as presupposed in cognitive and connectionist systems, remains impossible in dynamic systems. Both become integrated and coupled within the 'state parameters'. The 'state parameters' are structured by what has previously been called 'external' state and at the same time, they can be modulated by the input, which reflects what has formerly been called 'internal' state. Accordingly, both 'external' and 'internal' state are 'intrinsically' integrated within the 'state parameters' which makes their distinction impossible. The distinction between 'internal' and 'external' states is replaced by coupling i.e. 'selective-adaptive coupling' (see 3.3.2 for the exact definition): 'The cognitive system does not interact with the body and the external world by means of the occasional static symbolic inputs and outputs; rather, interaction between the inner and the outer is best thought of as a matter of coupling, such that both sets of processes continually influencing each other's direction of change. At the level at which the mechanisms are best described, cognitive processing is not sequential and cyclic, for all aspects of the cognitive system are undergoing change at the same time. Any sequential character in cognitive performance is the high-level, overall trajectory of change in a system whose rules of evolution specify not sequential change but rather simultaneous mutual co-evolution' (van Gelder 1995: 373).

Brain states as dynamic states

The brain shows many characteristics of dynamic systems. These dynamic characteristics are constitutive for the brain as a brain. Subsequently, one may, from an empirical point of view, define the brain as a 'dynamic brain'. The brain can therefore be characterized by dynamic states and 'First-Brain Perspective'. Defining brain states as 'internal and/or external states' presupposes a distinction between mental and neuronal states. Mental states can be regarded as 'internal states' while neuronal states mirror 'external states'. Brain states may then be defined as either mental and/or neuronal states. Nonetheless, either definition of brain states remains implausible (see below). Subsequently, neither mental states nor neuronal states characterize or constitute the brain as a 'dynamic brain' (see Churchland 1989; Bickle 1998 for a more detailed characterization of the brain by dynamic states with vector-to-vector transformations).

The empirical definition of brain states by mental states as 'internal states' presupposes the following assumptions: (i) distinction of these 'internal states' from neuronal states, (ii) location of 'internal states' within the brain itself and (iii) separation i.e. 'isolation' between brain and environment, which accounts for the possibility to distinguish between 'internal and external states'. If brain states can be defined by mental states as 'internal states', one may define the brain itself as a 'mental brain' (see 3.3.1) which however remains implausible. The first assumption may be true because mental states as 'internal states' can be distinguished from neuronal states as 'external states'. However, the second assumption is not plausible. Mental states cannot be located within the brain itself. Nobody has ever detected a mental state i.e. the contents of 'phenomenal experience' within the brain itself. Even the modern imaging techniques, allowing for direct and on-line insight into the brain, have not been able to detect any mental states within the brain itself. Accordingly, mental states as 'internal states' cannot be located within the brain itself. Moreover, the third assumption i.e. 'isolation' of the brain from the environment remains implausible as well. As demonstrated above (see 2.3.1), functional brain organization can be characterized by the orientation on 'observable and to-be effectuated events within the environment'. The brain is therefore 'intrinsically' related to the environment. This makes any 'isolation' between brain and environment impossible.

The empirical definition of brain states by neuronal states as 'external states' presupposes the following assumptions: (i) distinction of these 'external states' from mental states; (ii) characterization of the dynamic organization of the brain by neuronal states themselves; (iii) lack of distinction between brain and environment because both are defined by 'external states'. If brain states can be defined by neuronal states as 'external states', one may define the brain itself as a 'physical brain' (see 3.3.1) which however remains implausible. The first assumption may be true because neuronal states as 'external states' can be distinguished from mental states as 'internal states'. However, the second assumption remains no longer plausible. The dynamic organization of the brain describes the kind of organization that neuronal states have. The organization of neuronal states can, however, not be equated with the neuronal states themselves since their distinction would otherwise no longer be necessary. While neuronal states reflect stimuli with (classical) physical properties and can thus be described as 'physical states' the organization of neuronal states is governed by 'observable and to-be effectuated events within the environment' (see 2.3.1). This organization can be described by 'state parameters' and 'order parameters' i.e. 'dynamic states' which can be portrayed as 'biological states' rather than (classical) 'physical states'. Finally, brain and environment are distinguished from each other. While the environment itself, as isolated from the brain, can be accounted for by 'physical states' the brain can rather be depicted by a certain organization of neuronal states with the organization by itself reflecting a 'biological state' that as such cannot be equated with 'physical states' (see above). Since brain and environment can be characterized by different states, their distinction is possible; this makes the third assumption and thus their characterization by 'external states' impossible.

Brain states can subsequently neither be defined by mental states nor neuronal states which makes the definition of the brain as either 'mental brain' or 'physical brain' (see 3.3.1) implausible. We hypothesize instead that the brain can be identified as a 'dynamic brain' which in turn implies that brain states can be defined as dynamic states. Dynamic states are characteristic and constitutive for the brain as a 'dynamic brain' – brain states are dynamic states. Subsequently, dynamic states must be considered a sufficient condition for brain states. Dynamic states reflect the type of organization that neuronal states possess. Neuronal states must therefore be deemed a necessary condition for dynamic states since any organization remains impossible without neuronal states. However, due to the difference between the organization of neuronal states and neuronal states themselves (see above), the latter cannot be regarded as a sufficient condition for dynamic states. It should be noted that we do not deny the existence of neuronal states in the brain. We only deny their constitutive role for the brain as a brain. Neuronal states are present in the brain but they are not constitutive for the brain – brain states are not neuronal states.

Brain states as dynamic states can be characterized in the following way: (i) brain states are 'biological states' rather than 'physical states'; (ii) the distinction between 'neuronal and mental states' is replaced by the distinction between 'state and order parameters'; (iii) the separation between input and output is replaced by mutual determination and reciprocal interaction. The dynamic states, which account for the kind of organization of neuronal states, must be distinguished from neuronal states themselves. This is reflected in the distinction between 'biological states' and 'physical states'. While neuronal states can be described as (classical) 'physical states', dynamic states may rather be defined as 'biological states' (see above) that are non-reducible to (classical) 'physical states' (see above and 3.3.3). The distinction between 'internal and external states' is no longer possible in dynamic states because both become integrated and coupled within 'state parameters' and 'order parameters' (see 3.1.2). However, if the distinction between 'internal and external states' remains impossible, neuronal and mental states can also no longer be distinguished. Instead, they are integrated and coupled within the 'state and order parameters' of the dynamic states of the brain. Because of mutual determination and reciprocal interaction a separation between input and output is no longer possible. This is for example reflected in sensorimotor integration (see 2.2.1). Mutual determination and reciprocal interaction is provided by multiple feedforward and feedback loops i.e. 'exafference', 'reafference' and 'efference copy' which allow for simultaneous processing and bilateral dependence between input and output.

The characterization of brain states as dynamic states implies a shift in the focus of the empirical investigation. The empirical focus can no longer be put exclusively on 'physiological microproperties' as, for example, action potentials, single cell recordings, proteins, etc.; one should also consider 'dynamic macroproperties'. For example, dynamic pattern formations, non-linear dynamical laws, bifurcations, stable and instable states, fluctuations and transitions should be investigated (Kelso 1995: 5–26). 'Dynamic laws', which can neither be equated with nor reduced to 'physical laws' (i.e. classical physics; see below and 3.3.3 for explanation of the meaning of 'classical'), must subsequently be considered in the empirical investigation of the dynamic states of the brain: 'The thesis is here that the human brain is fundamentally a pattern-forming, self-organized system governed by non-linear dynamical laws. Rather than compute, our brain 'dwells' (at least for short times) in metastable states: it is poised on the brink of instability where it can switch flexibly and quickly. By living near criticality, the brain is able to anticipate the future, not simple to react to the present. All this involves the new physics of self-organisation in which, incidentally, no single level is any more or less fundamental than any other' (Kelso 1995: 26). The principles of dynamic brain organisation, as described above, provide the necessary anatomo-functional conditions for the possibility of 'dynamic pattern formation' and 'self-organisation' in the human brain. However, they by themselves cannot be considered as sufficient for dynamic states. Only 'state parameters' that reflect 'dynamic pattern formation' and 'self-organisation', can be regarded as a sufficient condition for the generation of the brain's dynamic states. 'Dynamic pattern formation' and 'self-organisation' replace 'instructional codes' and predefined algorithms. A 'dynamic pattern formation' allows for the construction of different kinds of patterns i.e. 'pattern construction' which may be realized through selection, degeneracy and reentrant circuits (Edelman & Tononi 2000: 47–49, 81, 212–214). Selection describes the specific inclusion and exclusion of different neuronal groups in particular functions. It replaces predefined instructional codes. Degeneracy reflects the possibility of realizing the same function across different neural networks. It provides flexibility in the formation of each dynamic pattern. Reentrant circuits reflect variable functional connectivity between different brain areas (see Edelman & Tononi 2000: 85, 87). They account for the modulation and construction of specific dynamic pattern.

Finally, both 'dynamic pattern formation' and 'self-organization' are no longer compatible with the concept of causality as presupposed in (classical) physics. The 'causa efficiencs', where cause and effect can be determined and separated, should be replaced by 'causa formalis' and 'causa finalis' (see 2.3.3 for further definition). In the case of 'causa finalis' and 'causa formalis', cause and effect can neither be determined nor separated. Instead, cause and effect are reciprocally connected with each other. This, for example, is the case in sensorimotor integration (see above) and 2.2.1). Due to reciprocal modulation, the sensory input as the apparent cause can no longer be distinguished and separated from the motor output as the apparent effect. 'Dynamic pattern formation' and 'self-organization' allow for mutual determination and reciprocal interaction between sensory input and motor output, i.e., between cause and effect. Dynamic systems like the brain are therefore compatible with 'causa formalis and finalis' rather than 'causa efficiencs' (see 3.3.2).

The empirical investigation of dynamic states in the 'First-Brain Perspective'

The question for the possibility of empirical investigations of a brain's dynamic states arises. Neither the Third-Person Perspective nor the First-Person Perspective can justify dynamic states. The Third-Person Perspective provides a 'from the outside' point of view on the brain while the First-Person Perspective accounts for a 'from the inside' point of view of the person (see 3.2.1 and 3.2.2 for further details). Nevertheless, both points of view remain unable to explain the dynamic states of the brain. The Third-Person Perspective refers to physical states (see 2.4.3 and 3.2.3). Since dynamic states have to be distinguished from physical states (see above), they can epistemically not be accounted for in the Third-Person Perspective. The First-Person Perspective refers to mental states (see 2.4.1 and 3.2.1). However, due to 'autoepistemic limitation' (see 2.3.1), mental states, as experienced in First-Person Perspective, cannot be directly related to the brain and its brain states. The First-Person Perspective remains subsequently unable to account for dynamic states as brain states. Even a combination i.e. conjunction of both First- and Third-Person Perspective remains unable to provide direct epistemic access to brain states as dynamic states because mental states (of the person) and physical states (of the brain) cannot be tied together; their respective epistemic referents i.e. mental states and brain states 'do no meet each other': 'Physical phenomena can be analyzed into their physical constituents, with the aid of scientific experimentation, and mental phenomena can perhaps be analyzed into their mental constituents at least in some cases, but these two path of analyses do not meet' (Nagel 2000: 446).

Empirical access to the dynamic states of the brain may be provided by a 'from the inside' point of view of the brain itself i.e. 'viewing the brain from within' (see Edelman & Tononi 2000: 217). This point of view must be distinguished from both

First- and Third-Person Perspective and may therefore be called 'First-Brain Perspective' (see 3.2.1 for further explanation). This 'First-Brain Perspective' may account for the empirical access to dynamic states of the brain by revealing 'state parameters', 'dynamic pattern formation' and 'self-organization' (see above). This approach for an empirical investigation of the brain's dynamic states is well reflected in the following quotation: 'Perhaps some of the confusion in simulating and understanding brain function comes from the concept of a (mental) state; this may be an area where the dynamical approach can make an important conceptual contribution. Philosophers are always discussing '(mental) states' of consciousness, alertness, and so forth. However, seen from the brain that is doing the job of creating consciousness, the (mental) state is ephermeral. When we look inside the brain we see no (mental) states, only constantly fluctuating scintillations of graded potentials and quickly flashing action potentials. We record from electrodes and see everything in flux. If there is no change, there is no function. Where do (mental) states arise in such an environment? Put simply, they do not – what seem to be (mental) states from the outside are processes on the inside' (Bridgeman 1998, see also 3.2.1 here for further elaboration of the view 'from inside the brain' accounting for 'First-Brain Perspective').

However, due to 'autoepistemic limitation' (see 2.3.1), the 'First-Brain Perspective' cannot be accessed directly. Instead, the 'First-Brain Perspective' may rather indirectly be explained by a linkage between First- and Third-Person Perspective as it is provided by 'First-Person Neuroscience' (see Lutz et al. 2002; Varela & Shear 1999a, b; Northoff 2000b, 2001b as well as 3.2.1 here). 'First-Person Neuroscience' allows for linkage between mental states, as experienced in First-Person Perspective, and neuronal states, as recognized in Third-Person Perspective. The way neuronal states are organized, e.g., the type of organization can be inferred from the linkage between neuronal and mental states. The organization of neuronal states, in turn, indicates the dynamic states, which can subsequently be accounted for in 'First-Person Neuroscience'. Since 'First-Person Neuroscience' allows for the investigation of dynamic states, it may also be called 'Dynamic Neuroscience' [It should be noted that the present meaning of the term 'neuroscience' is rather broad, covering all disciplines that are involved in the direct or indirect empirical investigation of the brain.]. In addition to the empirical investigation i.e. observation of dynamic states in relation to the brain itself, 'dynamic neuroscience' may also rely on the simulation of dynamic states in so-called neural networks (see Koetter et al. 2000). Unlike in the own brain, the dynamic states with their respective parameters are directly accessible in these neural networks. However, unlike in the case of brain states, relations to mental states and thus to events within the environment can, if at all, only be drawn indirectly.

3.1.3 The 'brain code': 'Event coding' and the 'empirical mind problem'

The code of the brain i.e. the 'brain code' or 'neural code' can be defined as 'a system of rules and mechanisms by which a signal carries information' (Decharms & Zador 2000: 614). The 'brain code' concerns both functional mechanisms as well as the content of information. The functional mechanisms may be accounted for by 'event coding' while the content of information consists in events as experienced in mental states. Functional mechanisms may be subserved by single neurons i.e. 'single neuron coding' and/or by a group/population of neurons that reflect any transactions between different brain areas i.e. 'population coding' (Decharms & Zador 2000). Though 'single neuron coding' is also important to consider (see Shadlen & Newsome 1994), we will solely focus on 'population coding' within the cerebral cortex. Transactions between different cortical regions that account for 'population coding', may be crucial for higher cognitive and emotional functions.

'Event coding' as the 'brain code'

The functional organisation of the brain is rather oriented and directed on events i.e. 'observable and to-be effectuated events within the environment' than single and isolated stimuli (see 2.3.1). These events cannot be explained by single and separated stimuli but can instead be defined by the differences between different and selected stimuli. Through their differences, different stimuli can be linked and grouped together, which results in the transformation of heterogeneous stimuli into a homogenous event (see below for further details). Neural activity in the brain is subsequently no longer determined by absolute, single and separated stimuli (see also Hommel et al. 2001). Instead of coding the absolute values of single 'stimuli' that are independent from each other, the brain rather codes the relative value of the differences between multiple and interdependent stimuli, which results in the formation of an 'event'. This shows that the code of the brain is oriented on 'events' rather than 'stimuli' (see also 2.3.1). Due to linkage and grouping between different stimuli, the organization of the brain can account for 'changes' and their 'context' (see below for further definition) reflecting the respective environment. 'Changes' and their respective 'contexts' may describe 'events' (or 'gestalts') while 'stimuli', as distinguished from 'events', exclude both 'change' and 'context'. If the organization of the brain can account for 'changes' and their respective 'context' i.e. the environment, it is necessarily oriented on 'events' i.e. 'observable and to-be effectuated events within the environment'. This form of coding may therefore be described as 'event coding' as distinguished from 'stimulus coding' (see also 2.3.1) which can neither account for 'changes' nor for the respective 'context'.

The 'context' describes the time ('When'), space ('Where') and kind of occurrence ('How') of 'changes' in the environment. The intensity of a stimulus at a time point x is not encoded for by itself but rather the difference of that stimulus' intensity between the previous time point y and the current time point x. The temporal 'context' ('When') is thus necessarily included (as the relative temporal 'change') in the coding of the brain. Moreover, the appearance of a certain stimuli at a certain spatial location x is not encoded for by itself but again the difference between the novel location x and its previous location y. The spatial 'context' ('Where') is thus necessarily included (as the relative spatial 'change') in the coding of the brain. This is also reflected in the difference between 'mechanical markers' and 'biomechanical markers' (see 2.1.1). While 'mechanical markers' reflect the absolute value of the respective position and thus one particular stimulus 'biomechanical markers' account for the difference between two positions i.e. the relative position and reflect the difference between distinct stimuli.

The occurrence ('How') of a novel stimulus is not encoded for by itself. The novel stimulus leads to deviations from the pre-existing and already present spatiotemporal differences, which, dynamically, may be accounted for by spatiotemporal trajectories. The brain may subsequently develop a high non-linear and dynamic sensitivity (see also Meister & Barry 1999) for these deviations e.g. novel spatiotemporal differences as compared to the already pre-existing ones. The spatiotemporal deviations caused by the novel stimulus are then related to the standard spatiotemporal differences so that the 'change' in spatiotemporal differences is coded for in relation to the respective spatiotemporal 'context'. These self-organizing functional mechanisms may link and group stimuli together within as well as across different modalities (auditory, visual, taste, etc) and functions (cognition, emotion, etc). This results in a 'supramodal' 'event' within which the single modal and functional 'stimuli' themselves can no longer be distinguished from each other. The 'supramodal' nature of 'events' is nicely reflected in the example of pain as pointed out by Hardcastle (2001). A characterization of pain by cognitive, sensory or emotional components remains impossible. Moreover, the distinction and isolation between these different modalities within pain also remains impossible. Accordingly, pain must be regarded as a 'supramodal' 'event': 'So far as the brain is concerned, pain is an important and all-encompassing event' (Hardcastle 2001: 308). Therefore, events cannot be accounted for in terms of a mechanistic physiology in the sense of Descartes. If that were the case the different modalities would be primarily separated i.e. isolated from one another and only secondarily integrated within each other by some higher integrative 'superinstance'. This higher integrative 'superinstance' was in former times related to the subject i.e. the cogitatio itself: '... the psycho-physical event can no longer be conceived after the model of Cartesian physiology and as a juxtaposition of a process in itself and a cogitatio' (Merleau-Ponty 1958: 102).

'Event coding' and 'stimulus coding' can also be distinguished from each other with regard to their principal nature i.e. one being active the other passive and their general purpose. 'Stimulus coding' presupposes the response to or detection of modal stimuli ('to what are the receptors responding', 'what do the signals of the system detect'; see Akins 2001: 379) so that neural activity remains essentially tied to the appearance of the stimuli themselves. 'Stimulus coding' is therefore 'passive'. The purpose of 'stimulus coding' consists thus in an accurate reflection of the 'stimuli' as they are appearing in the world ('what is it like out there'; see Akins 2001: 376). 'Event coding', in contrast, links and groups different stimuli together in a 'supramodal' 'event' which necessarily presupposes that neural activity remains independent from the single stimuli themselves. 'Event coding' is therefore 'active' ('what is it doing'; see Akins 2001: 379). Here the purpose consists no longer in an accurate reflection of the 'external world' but rather in the usefulness and effectiveness of the respective 'event' for the brain: 'What the organism is worried about, in the best narcissistic traditions, is its own comfort. The system is not asking 'what is it like out there?' – a question about the objective temperature state of the body's skin. Rather it is doing something – informing the brain about the presence of any relevant thermal events. Relevant, of course, to itself.' (Akins 2001: 376).

Conceptually, 'event coding' may be regarded as an 'empirical hypothesis' with reference to the dynamic organisation of the brain. As such it is open for 'empirical falsification' by 'experiments' (see 1.4.4 for further details). In addition to its orientation on the empirical function of the brain, it bears strong epistemic and ontological implications. Epistemic implications concern, for example, 'autoepistemic limitation' and ontological implications are reflected in 'embedment' as distinguished from 'isolation' (see 2.3.1, 3.2.1 and 3.3.3). Despite these strong epistemic and ontological implications, the hypothesis of 'event coding' can neither be regarded as a 'philosophical theory' nor as a 'neurophilosophical hypothesis'. Since it includes and refers to the empirical function of the brain, it cannot be characterized as a 'philosophical theory' and is thus not subject to 'logical falsification'. Since it does not include philosophical theories and their linkage to the empirical hypothesis, it cannot be characterized as a 'neurophilosophical hypothesis' either and is thus not subject to 'transdisciplinary falsification'. Instead, 'event coding' as an 'empirical hypothesis' is subject to 'empirical falsification' (see 1.4.4).

'Event coding' and dynamic states

The difference between 'stimulus coding' and 'event coding' reflects the difference between neuronal and dynamic states. Neuronal states refer to stimuli and dynamic states refer to events. Neuronal states as physical states are coded for in terms of stimuli, which presuppose not just 'stimulus coding' but also defines the brain as a 'physical brain'. Dynamic states, in contrast, are coded for in terms of events, which presuppose 'event coding' and identify the brain as a 'dynamic brain'. One may subsequently assume a necessary relationship between dynamic states and 'event coding' (and mental states; see below) (see Figure 12). Due to the necessary relationship between 'event coding' as the 'brain code' and the distinction between dy-

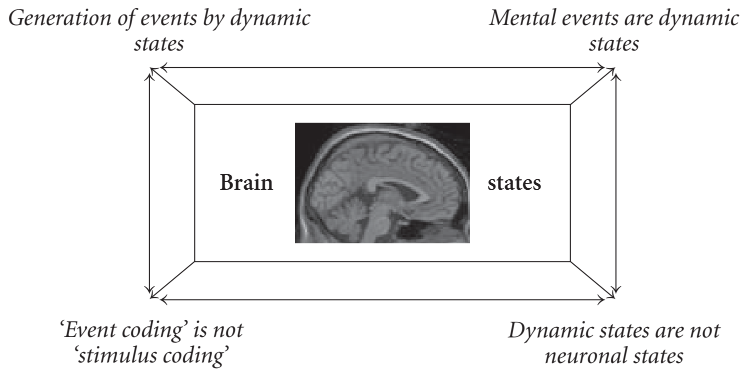


Figure 12. Characterization of brain states

namic states and neuronal states, the 'brain code' cannot be equated with the 'neural code': The term 'neural code' suggests reference to neuronal states. As pointed out above, neuronal states cannot be considered as constitutive for the brain i.e. they do not define the brain as a brain. Dynamic states on the other hand must be considered as constitutive for the brain. However, if neuronal states are not constitutive for the brain, the 'neural code' that refers to neuronal states, cannot account for the 'brain code'. Since the brain as a 'dynamic brain' can be defined by dynamic states one may speak of the 'brain code' as a 'dynamic code' rather than as a 'neural code'.

The brain as a brain has been defined by dynamic states. If the 'brain code' can be explained by 'event coding', dynamic states should be able to account for events as experienced in mental states (see Figure 12). However, the exact functional mechanisms by means of which dynamic states can account for events remain unclear. Functional mechanisms must provide spatial as well as temporal integration of different stimuli in order to account for 'events'. Different suggestions for the possibility of temporal integration were assumed which reflects different forms of 'population coding' (see Friston 1997; Decharms & Zador 2000).

First, one may speak of 'temporal coding', when the precise timing of individual neuronal spikes at one particular time point is regarded as sufficient for elucidating neuronal interactions and thus for carrying information.

Second, one may speak of 'rate coding', when the average firing rates of all the systems' components at one particular time point are regarded as sufficient for elucidating neuronal interactions and thus for carrying information. Individual neuronal spikes are considered in conjunction that can be accounted for by stochastic processes.

Third, when different brain areas interact with each other by synchronizing firing patterns or oscillations over an extended time period, one may speak of 'synchrony coding' (Engel et al. 2001; Varela et al. 2001; Lutz et al. 2002). Unlike 'temporal coding' and 'rate coding', 'synchrony coding' no longer presupposes one particular time point but rather an extended period of time. Friston (1997) described functional mechanisms that set the foundation for spatiotemporal integration of neuronal activity as 'transient coding'. One may speak of 'transient coding' when dynamic correlations between neuronal activities in different brain areas extend over time periods between 10ms and 1000ms. Unlike 'synchrony coding' (see above), 'transient coding' is not necessarily tied to synchronized firing or oscillation. Instead of requiring symmetry between different brain areas, as in 'synchrony coding', the interaction among brain areas can be asymmetric as well in the case of 'transient coding' (Friston 1997; Varela et al. 2001). For example, one brain area that shows high frequencies may interact i.e. dynamically correlate with a brain area, which exhibits low frequencies. These dynamic correlations may endure over an extended period of time so that one could speak of 'neuronal transients': 'This transient code hypothesis suggests that interactions are mediated by the expression and induction of reproducible, highly structured spatiotemporal dynamics that endure over extended periods of time (i.e. neuronal transients)' (Friston 1997: 214). 'Transient coding' accounts for spatiotemporal integration by means of stable i.e. transient states or so-called 'neuronal transients'. These 'neuronal transients' no longer reflect particular neuronal states by themselves but rather the specific spatiotemporal organization of these neuronal states. 'Neuronal transients' therefore account for dynamic states rather than neuronal states. The 'neuronal transients' may subsequently be better typified as 'dynamic transients'. The exact empirical characterization of these 'dynamic transients' via 'state parameters', 'dynamic pattern formation', and 'self-organization' remains however to be explored.

'Dynamic transients' are for example preliminarily reflected in the experience and judgment of emotional pictures: an early and a late one. In the period between 200 and 500ms after stimulus onset, stable topographic maps can be demonstrated in the analysis of evoked potentials as obtained with EEG (Northoff et al. 2003). Moreover, as revealed in a source analysis of EEG data and in fMRI, this time period corresponds well to the localization of neural activity in the medial prefrontal cortex in experience and in the lateral prefrontal cortex in judgment (Northoff et al. 2003). Whereas this early 'dynamic transient' has to be distinguished from a later one that occurs between 500 and 1000ms and is limited to the area in the posterior association cortex. However, the characterization of these 'dynamic transients' by dynamic parameters as well as the exact relation of these two 'dynamic transients' to events remains unclear. The early 'dynamic transient' may account for the formation of events, as potentially related to the medial prefrontal cortex (Northoff 2003a; Northoff & Bermpohl 2003). The late 'dynamic transient' in contrast may potentially account for imagery and vivid experience of this event, as it is often related to the posterior association cortex (see also 2.4.1).

'Event coding' and mental states

Mental states reflect events within the environment. We do not experience heterogeneous stimuli but rather homogenous events. The processing of mental states is thus determined by events rather than stimuli, which makes 'stimulus coding' impossible. Analogous to the 'brain code', the 'mental code' can therefore be characterized by 'event coding' (see Figure 12). If one defines the 'brain code' by means of neuronal states and thus 'stimulus coding', as it is often presupposed, the referents differ between 'mental code' and 'brain code'. The 'mental code' refers to events while the 'brain code' refers to stimuli. These different referents, however, make a linkage between 'mental code' and 'brain code' a priori impossible because stimuli cannot be tied conceptually to events. Only stimuli and stimuli or events and events can be related to each other in conceptual regard. Meanwhile a relation between events and stimuli remains a priori impossible i.e. for conceptual reasons. The possibility of an empirical relation between mental states and brain states therefore presupposes similar referents because otherwise, in the case of different referents i.e. events and stimuli, their relation must necessarily fail for purely conceptual reasons. If both 'brain code' and 'mental code' refer to events, the question for their relationship arises. If they refer to different events, both codes must be distinguished from each other, meaning that the 'brain code' is not the 'mental code'. If they refer to the same event, both codes must be regarded as identical: the 'brain code' is the 'mental code'. We hypothesize that 'mental code' and 'brain code' are identical i.e. the 'brain code' is the 'mental code' and the 'mental code' is the 'brain code'. Accordingly, both 'brain code' and 'mental code' not only refer to events within the environment but, moreover, to identical events within the environment (see also Figures 12 and 13).

The 'brain code' refers to 'observable and to-be effectuated events within the environment' (see above). If the 'brain code' is the 'mental code', the 'mental code' should also refer to these events i.e. 'observable and to-be effectuated events within the environment'. Mental states can be characterized by 'phenomenal experience' of events in the First-Person Perspective (see 2.3.1 and 2.4.1). These events are experienced as events within the respective environment. Analogous to the 'brain code', the 'mental code' therefore refers to 'observable and to-be effectuated events within the environment'. However, these events within the environment do not have to be necessarily identical with those to which the 'brain code' refers. If, however, the events, to which the 'mental code' refers, depend on the events on which the 'brain code' is oriented, it seems rather likely that both codes refer to identical events. This seems to be the case since the change in the 'brain code' (from 'event coding' to 'stimulus coding') is accompanied by the impossibility of experiencing events in mental states (see thought experiments in 2.3.1). Direct proof of reference to identical events in 'brain code' and 'mental code' remains however impossible. Due to 'autoepistemic limitation' (see 2.3.1), we have no direct epistemic access to our own

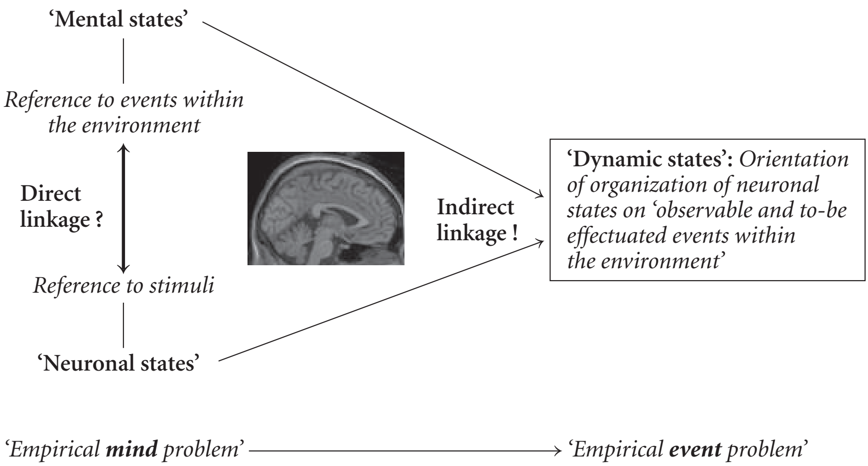


Figure 13. Indirect linkage between mental and neuronal states through dynamic states

brain states as brain states. The respective event is therefore only accessible when experiencing mental states i.e. the 'mental code' while the 'brain code' itself remains hidden. This means that we remain unable to elucidate the events directly to which the 'brain code' itself refers to. Though direct access to the 'brain code' remains impossible, it can nevertheless be accessed indirectly by means of linkage between 'dynamic transients' and mental states. If 'brain code' and 'mental code' refer to the same events within the environment, both should be accounted for by identical 'dynamic transients' as dynamic states. 'Dynamic transients' reflecting specific dynamic states can be accounted for in the 'First-Brain Perspective', which then can be linked to the events as experienced in mental states in the First-Person Perspective. The linkage between both 'First-Brain Perspective' and First-Person Perspective is provided by 'First-Person Neuroscience' (see above and 3.2.1). 'First-Person Neuroscience' can link 'dynamic transients' to mental states by showing reference of both to identical events i.e. 'observable and to-be effectuated events within the environment'.

Dynamic states are constitutive for the co-occurrence of both neuronal and mental states. The relation between mental and neuronal states can therefore be characterized by 'co-occurrence and co-constitution' rather than mere 'psychophysiological correlation' or 'physical causality'. Accordingly, the mere correlations between neuronal and mental states are replaced by 'co-occurrence and co-constitution' between both kinds of states within dynamic states. Dynamic states can thus be regarded as a 'third term which entails both of them': 'It would have to be a third type of variable (i.e. dynamic states in our case), whose relation to the other two (i.e. mental and neuronal states in our case) was not causal but constitutive. This third term should not leave anything out. It would have to be an X such that X's being a sensation and X's being a brain state both follow from the nature of X itself, independent of its relation to anything else' (Nagel 2000: 458).

The 'empirical mind problem'

Mental states can be related to neuronal states in empirical investigation through dynamic states (see above). 'First-Person Neuroscience' accounts for empirical investigation of dynamic states. Dynamic states, in turn, refer to identical events within the environment as mental states. The empirical investigation of dynamic states subsequently provides empirical access to mental states. The first part of the 'empirical mind problem' (see 1.1.1), consisting in the empirical inaccessibility of mental states, is thus solved: Mental states can empirically be investigated in relation to the brain though not through its neuronal states but through the brains dynamic states. Moreover, the 'empirical mind problem' then no longer concerns the empirical relation between neuronal and mental states. Instead, it reflects the relation between events to which both dynamic states and mental states refer: The question arises whether both dynamic states and mental states refer to an identical event in empirical investigation. Accordingly, the second part of the 'empirical mind problem', consisting in the empirical relation between neuronal and mental states, is transformed into an 'empirical event problem' (see Figure 12 and 13): Mental states and brain states as dynamic states are supposed to refer to an identical event within the environment while neuronal states refer to stimuli rather than to events.

Finally, one may ask for the conditions that are necessary to make the 'empirical mind problem' possible. Empirically, the distinction between neuronal and mental states can be considered as a necessary condition for the possibility of the 'empirical mind problem'. In contrast to dynamic states, neuronal states do not refer to 'observable and to-be effectuated events within the environment'; this is because they presuppose 'stimulus coding' rather than 'event coding'. Since they do not refer to events but stimuli, neuronal states cannot directly be related to the events as experienced in mental states. The problem of the empirical investigation of mental states in relation to neuronal states of the brain could therefore be raised. Consequently, the distinction between neuronal and mental states with respect to events may be considered as a necessary empirical condition for the possibility of the 'empirical mind problem'. Epistemically, the neglect of the 'First-Brain Perspective' may be regarded as a necessary condition. Due to neglecting the difference between events and stimuli, mental states were searched for in neuronal states. This, however, because of the different referents i.e. events and stimuli was bound to fail for conceptual reasons (see above). Consecutively, the brain was characterized by the wrong kind of information processing (see also Searle 2000: 576) i.e. 'stimulus coding', which made a linkage between brain states and mental states a priori impossible. Due to neglect of the 'First-Brain Perspective' it was overlooked that the dynamic brain organisation is oriented on events. This made the linkage between the events in mental states and the events as generated by brain states as dynamic states impossible. The question for a possible detection and recognition of mental states in the neuronal states of the brain and thus the 'empirical mind problem' could therefore arise.

3.1.4 The 'embedded brain': 'Mental presentation' and 'context-dependence'

We elucidated the principles of dynamic organisation of the brain (see 3.1.1), determined the brain as a 'dynamic brain', and revealed the 'brain code' i.e. 'event coding' (see 3.1.3). All three characteristics presuppose 'intrinsic' integration of the brain within body and environment and thus determination of the brain as an 'embedded brain'. Though the ontological determination of the brain as an 'embedded brain' will be discussed later (see 3.3.2), here the implications for the empirical account of the brain shall be demonstrated. These concern predominantly the way of representation of information i.e. 'embedded representation' and the dependence of the brain functions on the respective context i.e. context-dependence.

'Mental presentation' as 'embedded representation'

Representation can be characterized as a specific relation between 'internal' and 'external' states. The 'internal' state of a particular system represents an 'external' state within the environment. Mental states have often been characterized as 'internal' states that represent 'external' states. Since we experience the world by means of mental states (see 2.3.1 and 2.4.1), mental states may be regarded as 'internal' states representing 'external' states i.e. the world. One may subsequently speak of 'mental representation': 'According to representational views, things are not as they seem. What we are aware of is not our world, only our representations of it. A representation is like a little person inside the head making sense of the meaningless sensations that impinge on the eye (or the ear, or the head, or the nose)' (Kelso 1995: 188). The sensory system is considered as the classic example for representation. It is often conceived that the senses 'function to inform the brain of what is going on 'out there', in the external world and in one's own body' (Akins 2001: 369). However, Akins, by relying on the example of the thermoreceptive system, shows that this view is wrong. The thermoreceptive system does not reflect the temperature of the 'external world' and thus the thermal stimuli but rather the relation of thermal stimuli to other stimuli and their importance for the person i.e. a 'suprathermal' or 'supramodal' 'event'. These 'suprathermal' 'events' are thus defined by 'relation to the subject's interests' i.e. 'relational properties' rather than 'relation to the external world' i.e. 'objective properties' (see also Akins 2001: 387). Due to the decoupling of the sensory system from 'stimuli' of the 'external world', the 'external world' is no longer represented. Instead, an 'event' within the environment is presented rather than represented. Accordingly, the replacement of 'stimulus coding' by 'event coding' necessarily implies the rejection of the notion of 'representation'.

The term 'representation' is derived from the Latin term 'representation' which is composed of 're' and 'praesentare'. 'Re' means 'again'/'anew' and 'praesentare' means 'bringing something into presence'. Therefore, 're-presentation' means that 'something else' (i.e. E), which by itself is not present, is brought into presence by 'something' (i.e. S). E is thus only indirectly accessible via S. In contrast, 'presentation' means that 'something else' (i.e. E) is present by itself thus being directly accessible without the necessity of being re-presented by 'something' (i.e. S) (see Schumacher 1996: 926, 931–932). Accordingly, 're-presentation' necessarily presupposes the distinction between S and E since otherwise E could not be accessed via S i.e. brought into presence by S. A distinction between S and E on the other hand remains superfluous in the case of 'presentation' because E is already present and directly accessible by itself.

Due to description of the 'brain code' by 'event coding', the brain may be characterized by 'mental presentation' rather than 'mental representation'. 'Mental presentation' can be defined as a common state between brain and environment, which makes the distinction between 'internal' and 'external' states superfluous. Mental states can neither be detached from their respective environment nor from the underlying brain. Instead, mental states present the 'intrinsic' relationship between brain, body and environment i.e. they are a specific 'dynamic configuration' within this relationship. The 'extrinsic' relationship between mental states and environment in 'mental re-presentation' is replaced by an 'intrinsic' relationship between brain, body and environment in 'mental presentation'. One may therefore refer to 'mental re-presentation' as an 'isolated representation'. 'Mental presentation' may, on the other hand, rather be characterized as an 'embedded representation'. Since 'event coding' reflects the 'intrinsic' relationship between brain, body and environment, the brain as a 'dynamic brain' can be distinguished by 'mental presentation': '... in fact there is nothing preventing dynamical systems from incorporating some form of representation; indeed an exciting feature of the dynamical approach is that it offers opportunities for dramatically reconceiving the nature of representation in cognitive systems, even within a broadly noncomputational framework' (van Gelder 1995: 376).

Clark (1997, 1999) distinguishes between 'radical embedment' and 'simple embedment'. 'Radical embedment', reflecting the 'intrinsic' relationship between brain, body and environment, requires a new and revised concept of 'representation' (see for further details also Keijzer 1998, 2001). Albeit 'simple embedment' acknowledges the possibility of 'extrinsic' interactions between brain, body and environment, it nevertheless does not require revision of the concept of 'representation'. Clark speaks of so-called 'representation-hungry problems' (Clark 1999: 349–350, 1997: 166–167). These 'representation-hungry problems' especially include abstract, detached and apparently environmentally-decoupled functions like language (see 3.2.3), thought (see 3.2.3), propositional attitudes (see below), memories (see below), consciousness (see 3.2.2), etc. (see also 3.1.2). According to Clark, these functions can only be justified by representation in the classical sense because they must be considered as 'internal' states with precoded signals and symbols that represent and reflect 'external' states i.e. environmental events. It is apparent, that 'radical embedment' in the sense of Clark is well compatible with 'mental presentation' as it is defined here. 'Simple embedment' on the contrary may rather be associated with 'mental re-presentation' in the traditional sense. Grush (2001: 358) suggests a so-called 'emulation theory of representation' (ETR). He still relies on the notion of 'representation' where 'something stands for something else'. The emulator i.e. the brain portrays the environment. The brain represents the external world, 'not because it is causally linked to the real system (i.e. the external world), not because it carries information about the state of the real system, but because it is used to stand for it' (Grush 2001: 358). Whereas Grush is certainly right in no longer characterizing representation as a reflection of a 'real world' i.e. external world, he neglects the 'creative and productive' aspects, which characterize our notion of 'presentation'. He therefore neglects the existence of mutual interdependence between brain and environment out of which a 'presentation' arises. One may therefore say that his theory of ERT goes into the right direction but stops halfway. Bechtel (2001) does not even go in this direction; he defends the existence of representations as defined in terms of having the function to carry information, which he illustrates by the Watt Governor as an exemplar representational system.

'Mental presentation' can be characterized by direct access to 'external states' as distinguished from indirect access in 'mental representation'. The environmental events are directly accessible by themselves and are accounted for by the dynamic state of the brain. They are present in the 'event coding' of the brain (see 3.1.2). Due to 'autoepistemic limitation' (see 2.3.1), these dynamic states are experienced as mental states in such a way that the mental states are particular environmental events by themselves. Hence, mental states do not re-present the environment but instead create and present the respective environmental event. Memories may be deemed as an almost paradigmatic example for our ability to create and present events within the environment (see below and 2.4.2). However, memories, especially autobiographical memories, have often been considered as typical examples for representation in the sense of 'isolated representation'. 'Isolated representation' presupposes some precoded signals or symbols in the 'internal' states, which represent the 'external' states. But, as demonstrated above, there is no precoded message in the signal, no homunculus that is able to read signals, no symbols, no capacity for storage of any kinds of representata, neither locally nor distributed, and no high precision storage of such code (see Edelman & Tononi 2000: 93–95). Instead of reflecting precoded signals or symbols, autobiographical memories can be regarded as a simulation of past 'goal-orientation' with subsequent integration within the actual 'goal-orientation' (see 2.4.2). They do not merely re-present or re-create environmental events. Instead, autobiographical memories create and present events within the respective environmental context. Accordingly, autobiographical memories are compatible with 'mental presentation' rather than 'mental re-presentation'.

If the dynamic states of the brain create and present events within the environment, the distinction between 'internal' and 'external' states is no longer necessary. 'Internal' and 'external' states can only be distinguished from each other in the case of disruption of the 'intrinsic' relationship between brain, body and environment. In this case, the 'internal' states are detached from the environmental events which results in the absence of any content i.e. they remain 'empty'. Subsequently, the possibility of contents i.e. meaningful contents is necessarily related to an 'intrinsic' brain, body and environment relationship. This is paradigmatically reflected in propositional attitudes that can be accounted for by the experience of events rather than 'internal' states. Propositional attitudes do not reflect an 'internal' structure, as it is presupposed in the assumption of a 'language of thought'. Instead of being determined by 'internal' signals or symbols that re-present 'external' states, propositional attitudes are rather structured and created by environmental events (Ramsey et al. 1991: 291–292). Since their meaning is inherent in the 'intrinsic' relationship between brain, body and environment, it no longer needs to be introduced and attached by 'internal' signals or symbols (Putnam 1988, 1999). Even though propositional attitudes appear almost like 'virtual experiences', they are nevertheless based upon 'real experiences' (see Clark 1999: 347). For example, even complex metaphors, characterized by a very abstract and detached meaning, can be traced back to environmental events and thus to the 'intrinsic' relationship between brain, body and environment: 'Complex metaphors are embodied through bodily experiences in the world which pairs sensorimotor experiences with subjective experiences' (Lakoff & Johnson 1999: 59, 73).

The reasons for the neglect of 'mental presentation' with respect to the brain remain unclear. Apparently, 'mental presentation' has not been distinguished from 'mental re-presentation'. Lack of distinction may be traced back to 'autoepistemic limitation' (see 2.3.1) by means of which we confuse 'contents of representation' and 'vehicle of representation' (see below as well as 3.3.2). The assumption of 'mental representation' can subsequently be characterized as an 'epistemic illusion'. Due to the fact that the brain as the 'vehicle of presentation' stays hidden, we remain unable to draw a direct relationship between brain states and mental states. Mental states therefore appear to be distinct from both brain states and environmental events. If, however, they appear as distinct from both brain states and environmental events, one may characterize them as 'internal' states as opposed to 'external' states. Once, however, 'internal' and 'external' states are distinguished from each other, 'mental presentation' can no longer be distinguished from 'mental representation'. Hence, the brain itself, as characterized by 'autoepistemic limitation', suggests the concept of 'mental representation'.

Within the framework of the classical notion of 'representation', both 'contents and vehicle of representation' are transparent and directly accessible. For example, in a computer, the software may be regarded as the 'content of representation' while the hardware may account for the 'vehicle of representation'. However, the situation is different in the case of the brain. While the 'content of representation' is known and accessible, as experienced in mental states, there is no transparency and direct access to the 'vehicle of representation' i.e. the brain. Due to 'autoepistemic limitation', we remain unable to recognize our own brain states as brain states. The brain itself is neither transparent nor directly accessible. Accordingly, the brain as the underlying 'vehicle of presentation' remains hidden for us: 'So it now turns out that brain representations (at least some of them) are remarkably different from all the representations we are familiar with. I can become aware of what certain brain states represent (their content) in the complete absence of any awareness of the properties of the brain states which are doing the representing (their vehicles). How is this possible? ... But the representational theory must ascent to the idea that we are conscious of what is represented without the necessity (or even the possibility) of being aware of the representation's 'enabling' features' (Seager 1999: 176). One might speculate even further. If there were no 'autoepistemic limitation', the brain would probably be characterized by 'mental representation'. Accordingly, 'autoepistemic limitation' may be regarded as a necessary condition for the possibility of 'mental presentation'. Consequently, there is a close i.e. interdependent relationship between 'autoepistemic limitation', 'mental presentation' and the 'intrinsic' relationship between brain, body and environment.

The context-dependence of function(s)

The brain and the computer are often compared on the subject of their functional abilities. The computer can be considered as particularly strong in those functions that are less dependent on the respective context. Unlike the brain, the computer remains rather weak in those functions that are strongly dependent on the respective context. The comparison between computer and brain with respect to functional abilities may therefore reveal the influence and importance of context-dependence. Both cognitive (i.e. GOFAI as Good old fashioned artificial intelligence) and connectionist systems are incorporated in the term 'computer'. The recently constructed versions of 'embedded computers' are not considered here. In the following, different abilities shall be compared between computer and brain: (i) intelligence; (ii) autobiographical memory; (iii) symbol manipulation; (iv) action; (v) observation of own and others; (vi) consciousness and phenomenal-qualitative states i.e. qualia.

i. A classical measure of intelligence stems from the Turing test, which was invented by A.Turing. If independent judges cannot distinguish between the answers (to the same question) from a computer and those from a brain, the machine may be deemed intelligent. Until now, computers have failed the Turing test and can therefore not be regarded as intelligent. However, the concept of intelligence remains problematic by itself. There are some neuropsychological measures of intelligence such as the Hamburg Wechsler Intelligence test (HAWIE). They presuppose distinct verbal and non-verbal components of intelligence, which may dissociate from each other. Other concepts of intelligence distinguish between different forms of intellect such as cognitive and emotional intelligence or analytic, creative and practical intelligence (Sternberg 2000). Intelligence may also be regarded as a common factor underlying distinct verbal, non-verbal, perceptual-motor and perceptual-spatial abilities (Duncan et al. 2000). Considering the ambiguities in the concept of intelligence itself, the comparison between the brain and a computer concerning intelligence remains problematic.
ii. Memories can be generated in computers quite well. Especially connectionist systems show functional equivalents of encoding, storage, and retrieval of memories, which resemble the human brain (see 2.4.2). However, even connectionist systems still rely on representation, unambiguous and context-independent inputs and syntactic operations. Memory in the brain, in contrast, is rather characterized by non-representation, ambiguous and context-dependent inputs and semantic i.e. meaningful organisation (see 2.4.2, 3.1.2 and Edelman & Tononi 2000: 93–94). The most important difference between brain and computer is the mode of retrieval. Though both brain and computer rely on realization by simulation, the simulation itself remains dependent on the respective actual context only in the case of the brain. Integration within the actual context is achieved by linking simulation to the actual state-orientation as it is reflected in 'conscious recollection' i.e. 'remembering' (see 2.4.2). Even the retrieval of past events as autobiographical memories remains dependent on present 'goal-orientation'. In contrast to the brain, a computer does not show such a linkage between simulation and actual 'goal-orientation'. While it even remains possible in animals a computer's 'autobiographical memories' cannot be modulated in orientation on the respective actual context.

iii. Computers can perform symbol manipulation, which, however, remains meaningless, as it has been demonstrated in the Chinese room argument (Searle 1997). As per Searle, the example of the Chinese room shows that syntax cannot be transformed into semantics as it would be required for meaningful symbol manipulation: 'I perform certain operations on the symbols in accordance with the rules (that is, I carry out steps in the program) and give back small bunches of symbols (answers to the questions) to those outside the room. I am the computer implementing a program for answering questions in chinese, but all the same I do not understand a word of chinese. And this is the point: if I do not understand chinese solely on the basis of implementing a computer program for understanding chinese, then neither does any other digital computer solely on that basis, because no digital computer has anything that I do not have' (Searle 1997: 11). Computer programs in both cognitive and connectionist systems perform symbol manipulation in a purely syntactical way and in compliance with predefined and fixed rules i.e. instructions. The brain, in contrast, can be characterized by truly semantic operations. Meaning itself is intrinsic within the dynamic organisation of neuronal states – this is reflected in the principle of meaningful organization (see 3.1.1). However, one should be cautious: Searle (1997: 11–18) does not consider his Chinese room argument as an argument against computer and machines in general. He rather regards it as an argument against programs and certain types of machines i.e. those governed by programs. Therefore, he can still characterize the brain as a machine; though not as one governed by programs, like computers, yet as an 'organic or biological machine' (Searle 1997: 17). 'Biological' in the sense of Searle may imply inclusion of semantic dimensions, as in contrast to purely syntactic machines i.e. computers. The term 'machine', however, suggests the possibility of reducing the 'biological properties' of the brain to 'physical properties' exclusively. Accordingly, his definition of the brain as a 'biological machine' may still be regarded as a physicalistic account of the brain which presupposes the definition of the brain as a 'physical brain' (see also 3.1.2, 3.3.1 and 3.3.3 for a more detailed discussion of Searle). Consequently, the crucial question does not concern the distinction between brain and machine but rather the relation between 'biological and physical properties'.

iv. Similar to meaningless symbol manipulation, computers can perform actions without understanding them. Collins and Kusch (1998: 1, 23, 33, 37) call such actions 'mimeomorphic actions' which cannot account for context-dependence and the respective meaning. These may be contrasted with 'polymorphic actions' where actions are accompanied by an understanding of the 'Why' and 'How' of that behavior i.e. its meaning and context. While the brain may be able to perform both types of action, the computer may possible be restricted to context-independent actions i.e. 'mimeomorphic actions' (see Collins & Kusch 1998: 196–197). In the case of 'polymorphic action', both situation and response remain open i.e. undetermined. Therefore, this kind of action cannot be copied from previous instances which indicates that learning is necessarily tied to 'experience' without any possibility of copying previous behavior (Collins & Kusch 1998: 88–89). 'Mimeomorphic action', in contrast, can be characterized by the predetermination of both situation and response, which makes context-independent learning by 'drill' and copying possible. Consequently, only 'polymorphic action' requires 'embedment' and may therefore be characterized as an 'embedded action'. In contrast, 'mimeomorphic action' can occur independently from the respective context so that one may speak of 'isolated action'. Accordingly, Collins/Kusch (1998: 196–197) ascribe 'mimeomorphic actions' (as 'isolated actions') to both computer and brain. 'Polymorphic actions' (as 'embedded actions') can, on the other hand, be attributed to the brain but not the computer.

v. One central feature of the human brain consists in the epistemic difference between the own and other individuals. While the own person can be experienced in terms of mental states and events (see 2.3.1 and 2.4.1), other people can be observed only in terms of physical states and stimuli. Events and mental states in others cannot be recognized directly but only indirectly through linkage of the observed stimulus to the own experienced events. Accordingly, the problem of inter-subjectivity arises. The computer, in contrast, can experience itself in terms of neither mental states nor events. It remains also unable to link others' stimuli to the own stimuli. Accordingly, the problem of inter-subjectivity cannot even be raised in the case of the computer.

vi. Finally, the crucial question for the possibility and existence of consciousness and subsistence of phenomenal-qualitative states arises. The computer can be characterized by 'stimulus coding' rather than 'event coding'. Accordingly, computers are able to recognize their own computational states as computational states because they do not suffer from 'autoepistemic limitation'. 'Autoepistemic limitation' is a necessary condition for the possibility of mental states. The absence of 'autoepistemic limitation' may therefore make the generation of mental states impossible. Accordingly, computers should show no mental states i.e. mental states as such remain absent in the computer. This, however, is no longer the case in the brain. Due to 'event coding', the brain can be characterized by 'autoepistemic limitation'. Since 'autoepistemic limitation' must be considered as a necessary condition for the possibility of mental states (see 2.3.1), mental states are generated in the case of the brain.

In general, computers may be well able to perform those functions that do not necessarily require strong context-dependence and thus 'embedment'. For example, a computer may be able to perform logical combinations and calculations (i.e. as paradigmatically reflected in chess playing), which at a first glance seem rather independent from the respective context. However, as reflected in the example with the Chinese room (see above), the computer can perform the function by itself while the contents remain absent. It seems 'as if' the computer can perform these functions while neither their contents nor the respective meaning are generated – they remain 'empty' and devoid of meaning. Accordingly, one may speak of 'as-if' functions. The 'as-if' functions reflect the context-independent generation of functions and thus 'isolation' between computer and environment. In contrast, due to 'intrinsic' integration within body and environment, the functions of the brain are necessarily dependent on the respective context. This context-dependence makes 'as-if' functions impossible in the case of the brain i.e. its functions are neither 'empty' nor devoid of meaning. The context-dependence subsequently accounts for the contents and the meaning of the functional abilities of the brain. These 'as-if' functions concern predominantly those functions that, functionally, rely strongly on simulation for their generation. While the simulation itself remains independent from the respective context its modulation by and integration within the actual 'goal-orientation' is strongly dependent on the respective context (see 2.4.1). Functionally, the computer can be characterized by simulation. Yet, in contrast to the brain, it lacks the ability of modulation and integration of simulation within the actual 'goal-orientation'. The simulation in the case of the computer may subsequently be regarded as mere copying. The principal functional difference between computer and brain may therefore consist in the difference between copying (i.e. simulation without integration) and simulation (with integration).

3.2 'Epistemology of the brain': 'Embedded epistemology', 'epistemology of events and environments' and First-, Second-, and Third-Person Epistemology

> 'If the brain would be so simple that we could understand it, we would be so simple that we could not understand it.' Emerson Pugh

An 'epistemology of the brain' investigates the specific epistemic abilities and inabilities of the brain as well as the respective epistemological framework. Epistemic abilities and inabilities of the brain have rarely been investigated in philosophy, which may be related to methodological issues. Due to the lack of methodological tools, which can bridge the gap from empirical hypothesis to epistemic concepts (see 1.4), the brain has been neglected almost entirely in the epistemological discussion. Instead, epistemology attributed epistemic abilities to the mind and focused therefore rather on the mind and its logical conditions as supposed to including natural conditions and thus the brain. Accordingly, the epistemic investigation of the brain has often been regarded as superfluous and non-philosophical. Based on neurophilosophical methodology (see 1.4), we started our epistemic investigation with the brain itself which reflects the development of a 'Neuroepistemology'. 'Neuroepistemology' focuses on direct linkage between the brain on one hand and epistemic abilities and inabilities on the other. This is well reflected in the 'epistemic-empirical relationship' as developed in Chapter 2: First, these may contribute to our current empirical knowledge about the brain and thus to neuroscience by revealing the epistemic purpose of particular brain functions. Second, consideration of epistemic abilities and inabilities of the brain may reveal the necessary natural conditions for the possibility and impossibility of developing certain types of epistemology. Third, giving some descriptive insight into the reasons why the brain has been neglected in epistemology may contribute to philosophical discussions. 'Neuroepistemology', by providing a direct linkage between empirical hypothesis and epistemic concepts with respect to the brain, may therefore contribute to both philosophy and neuroscience.

'Neuroepistemology' may be regarded as the core of an 'epistemology of the brain'. An 'epistemology of the brain' covers a broader epistemological framework than 'neuroepistemology'. Whereas 'neuroepistemology' focuses on the determination of epistemic abilities/inabilities of the brain itself, an 'epistemology of the brain' investigates the epistemological conditions for the possibility of 'epistemic-empirical relationship'. The 'epistemology of the brain' reveals and develops the epistemological framework, which is necessary for the possibility of the epistemic determination of the brain. It may therefore contribute to philosophy by developing novel epistemological frameworks that are compatible with the epistemic determination of the brain. The 'neuroepistemology', as developed in the second chapter, shall therefore be complemented by the development of an 'epistemology of the brain' as an 'embedded epistemology' in the present chapter. Relying on the three perspectives, First-, Second-, and Third-Person Perspective (see 2.4.1, 2.4.2 and 2.4.3), 'First-Person Epistemology', 'Second-Person Epistemology', and 'Third-Person Epistemology' may be regarded as distinct though complementary aspects of an 'embedded epistemology'. These distinct epistemologies presuppose 'embedment' and are dependent on each other within the framework of an 'embedded epistemology'. Their separation i.e. 'isolation' may result in an 'isolated epistemology', which, however, remains incompatible with natural conditions i.e. the human brain. 'Isolated epistemology' remains incompatible with 'epistemic-empirical relationships' and must therefore be considered as a purely logical epistemic possibility. Only 'embedded epistemology' is compatible with an 'epistemic-empirical relationship' i.e. the human brain and can thus be considered as a natural epistemic possibility (see below for further details).

3.2.1 'First-Person Epistemology' and 'Embedded epistemology'

The 'First-Person Epistemology' can be characterized by the following: a novel epistemological framework i.e. 'embedded epistemology', resolution of the 'epistemic mind problem', introduction of the 'First-Brain Perspective' and development of both 'First-Person Neuroscience' and 'epistemology of events and environments'.

'Embedded epistemology'
'First-Person Epistemology' can be defined by the depiction of epistemic abilities and inabilities in First-Person Perspective (FPP).

Since the First-Person Perspective is characterized by mental states, 'First-Person Epistemology' has often been regarded as an 'epistemology of the mind'. It necessarily presupposes the possibility of a mind to which epistemic abilities and inabilities in First-Person Perspective can be attributed. 'First-Person Epistemology' has therefore been defined as an investigation of the epistemic abilities and inabilities of the mind of a person. The term 'person' implies a grammatical-substantial metaphor (Metzinger 1995: 29). It takes the grammatical position of a noun, which may be interpreted in the sense of an underlying correlate or substance to which the respective epistemic abilities and inabilities can be attributed. The grammatical-substantial metaphor may be regarded as an ontological metaphor, which suggests ontological correlates of epistemic perspectives. In the case of the First-Person Perspective, the mind has been assumed to be the underlying ontological correlate with the consecutive assumption of an 'epistemology of the mind'. The 'First-Person Epistemology' was subsequently detached i.e. 'isolated' from both the brain and the environment, which lead to characterization of the 'epistemology of the mind' as an 'isolated epistemology' (see below). Moreover, by assuming a mind, 'First-Person Epistemology' separated First- and Third-Person Perspective from each other the former referring to mental states and the latter to neuronal states. As a result, the epistemic dichotomy between First- and Third-Person Perspective with respect to mental and neuronal states could be developed (see also 1.1.1). This epistemic dichotomy, in turn, provided the framework for the alternative between idealism/constructivism and empiricism/realism in epistemology (see below for further details), which consecutively resulted in the 'epistemic mind problem' (see below as well as 1.1.1).

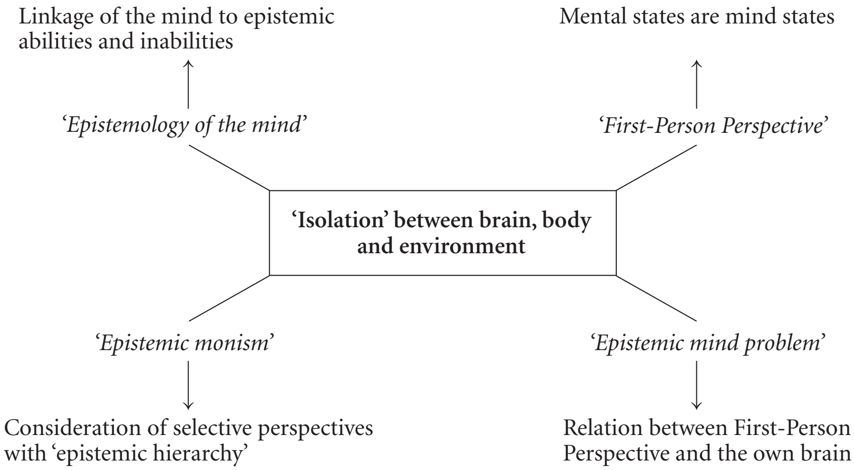
Yet, the characterization of 'First-Person Epistemology' as an 'epistemology of the mind' remains incompatible with the 'epistemic-empirical relationship' i.e. 'neuroepistemology'. Instead of relating epistemic abilities and inabilities in the First-Person Perspective to a mind, they can rather be accounted for by a certain dynamic organization of neuronal states i.e. by the brain itself (see 2.3.1 and 2.4.1). Accordingly, direct linkage between the brain and epistemic abilities and inabilities in First-Person Perspective is possible. 'First-Person Epistemology' subsequently requires an 'epistemology of the brain' rather than an 'epistemology of the mind' – 'First-Person Epistemology' presupposes 'neuroepistemology' as an 'epistemology of the brain'. From a historical point of view, 'neuroepistemology' and 'epistemology of the brain' may be regarded as extensions of the 'epistemological turn' in philosophy. The 'epistemological turn' describes an epistemological re-orientation by virtue of its policy of taking up epistemological and ontological questions with reference to the conditions under which things can become objects for us. Accordingly, our knowledge i.e. cognition does not conform to the objects but rather conversely the objects conform to the knowledge i.e. cognition we have of them. Kant expressed this idea in his famous 'Copernican revolution': 'Up to now it has been assumed that all our cognitions must conform to the objects; but all attempts to find something about them a priori through concepts that would extend our cognition have, on this presupposition, come to nothing. Hence let us once try whether we do not get farther with the problems of metaphysics by assuming that the objects themselves must conform to our cognition, which would agree better with the requested possibility of an a priori cognition of them, which is to establish something about objects before they are given to us.' (Kant 1998: 110). As such Kant related cognitions to the human mind i.e. our own mind and presupposes thereby epistemology as an 'epistemology of the mind'. 'Neuroepistemology' goes even one step beyond by tracing the origin of the cognitions back to our own brain which, in orientation on the 'Copernican revolution', may be called the 'Neural revolution': Whereas Kant conforms 'objects to cognitions' 'neuroepistemology' as an 'epistemology of the brain' conforms 'cognitions to the brain'. This is reflected in the 'epistemic-empirical relationship', as investigated in Chapter 2, which reveal the way 'cognitions conform to the brain'. The transcendental strategy with the 'epistemological turn' in philosophy, as related to Kant, becomes thus complemented by a neurotranscendental approach and subsequently a 'neuroepistemological turn' in neurophilosophy (see also Kitcher 1990 who pursues an analogous interpretation of Kant with respect to cognitive psychology as 'transcendental psychology'). Schopenhauer may be considered as an ancestor of such a 'neurotranscendental turn' with the consecutive development of 'neuroepistemology' and 'epistemology of the brain'. According to Schopenhauer, time, space and causality as the central categories of our epistemic apparatus are not independent from the brain since they 'go through the machinery of the brain' and are nothing but 'brain functions': 'This proves that the whole of the material world with its bodies in space, extended and, by means of time, having causal relations with one another, and everything attached to this – all this is not something existing independently of our mind, but something that has its fundamental presuppositions in our brain-functions by means of which and in which alone is such an objective order of things possible. For time, space, and causality, on which all those real and objective events rest, are themselves nothing more than functions of the brain; so that, therefore, this unchangeable order of things, affording the criterion and the clue to their empirical reality, itself comes first from the brain, and has its credentials from that alone.' (Schopenhauer 1966, Vol. II, 8). According to Schopenhauer, Kant already pointed this out 'though he does not mention the brain, but says the 'faculty of knowledge" (Schopenhauer 1966, Vol. II, 8) because he 'abstracted the share of the brain-functions (although not under this name).' (Schopenhauer 1966, Vol. I, 418). He subsequently reinterpreted Kant's 'critique of pure reason' as a 'critique of brain function'. Due to the fact that it does not concern the brain as observed in Third-Person Perspective i.e. the others' brains with its physical abilities and inabilities but rather the brain as experienced in First-Person Perspective i.e. the own brain with its epistemic abilities and inabilities, such a version of the 'critique' should be further specified with regard to our own brain as a 'critique of the own brain'. A 'critique of the own brain' investigates the epistemic abilities and inabilities of our brain and relates them to the psychophysiological functions (see Chapter 2), the dynamic principles (see 3.1.1), the dynamic states (see 3.1.2), the code (i.e. the 'brain code'; 3.1.3) and the respective environmental context (see below and 3.1.4) of the brain; it therefore provides an 'epistemology on a neurological (or better: dynamical) basis' (Kuhlenbeck 1965: 137).

The characterization of 'First-Person Epistemology' as an 'epistemology of the brain' presupposes a novel epistemological framework. Unlike in an 'epistemology of the mind', mind, brain and environment can no longer be separated i.e. 'isolated' from each other in an 'epistemology of the brain'. In an 'epistemology of the brain' the 'isolation' of the mind is replaced by 'embedment' of the brain. Since epistemic abilities and inabilities in the First-Person Perspective can be related to the brain itself, assumption of a mind as distinguished from the brain is no longer necessary. Furthermore, since the 'epistemic-empirical relationship' requires the brain to be integrated within the environment (see 2.3.1), brain and environment can no longer be separated from each other. Accordingly, 'First-Person Epistemology' as an 'epistemology of the brain' necessarily presupposes an epistemological framework, which can account for the 'intrinsic' integration between brain, body and environment i.e. 'embedment'. This epistemological framework is provided by an 'embedded epistemology'. 'Embedded Epistemology' can be defined by an epistemic characterization of the 'intrinsic' relationship between brain, body and environment (see also Figure 14). As such 'embedded epistemology' must be distinguished from 'isolated epistemology'. 'Isolated epistemology' can be defined by the epistemic characterization of either the mind, as being independent from both the brain and the environment, or the brain, as being independent from the environment. The first case results in an 'epistemology of the mind' which often characterizes 'First-Person Epistemology' (see above). The second case results in an ‘epistemology of the (isolated) brain’ which often characterizes ‘Third-Person Epistemology’.

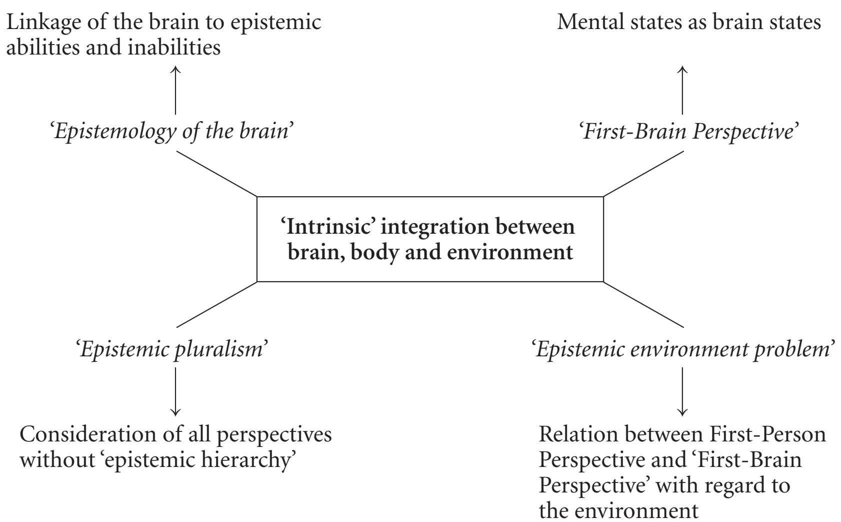
The ‘intrinsic’ relationship between brain, body and environment shows distinct dynamic configurations (see 3.3.3 for definition), which account for different epistemic abilities and inabilities. For example, the epistemic abilities and inabilities, characterizing the First-Person Perspective (see 2.3.1 and 2.4.1), may reflect a particular dynamic configuration that may be distinguished from the one accounting for Second- and Third-Person Perspective (see 2.4.2 and 2.4.3). The brain is ‘intrinsically’ integrated within body and environment. The different dynamic configurations within this relationship are the correlate of different epistemic abilities and inabilities. Since ‘perspectives’ are characterized by specific epistemic abilities and inabilities, they can be defined by distinct dynamic configurations within the ‘intrinsic’ relationship between brain, body and environment. Epistemically, the brain as an ‘embedded brain’ can subsequently no longer be characterized by physical abilities and inabilities (see 1.1.1) but rather epistemic abilities and inabilities. Empirically, the epistemic abilities and inabilities of the brain cannot be reduced to physical states and thus to physical abilities and inabilities (see 3.1.2 and 3.3.3). Instead, epistemic abilities and inabilities are accounted for by dynamic states, which reflect the dynamic configurations in empirical respect (see 3.1.2). If epistemic abilities and inabilities are related to distinct dynamic configurations within the ‘intrinsic’ relationship between brain, body and environment, neither perspective can be eliminated, reduced or subordinated in favour of another one. Consequently, there should be no ‘epistemic hierarchy’ between First-, Second- and Third-Person Perspective. Moreover, due to complementary and mutually exclusive epistemic abilities and inabilities in the different perspectives (see 2.4.3 and 3.2.3), all perspectives should be included and considered in the epistemological framework. ‘Epistemic pluralism’ as an inclusion of all different perspectives with their respective epistemic abilities and inabilities should be presupposed. ‘Embedded epistemology’ can subsequently be characterized by ‘epistemic pluralism’ and the concurrent absence of ‘epistemic hierarchy’ (see also Figure 14b). Accordingly, ‘embedded epistemology’ includes all three types of epistemologies i.e. ‘First-, Second-, and Third-Person Epistemology’.

The different perspectives (i.e. First-, Second-, and Third-Person Perspective) necessarily depend on each other i.e. they are necessary conditions for each other (see 2.4.3, 3.2.2 and 3.2.3) One may therefore refer to ‘epistemic dependence’ between the different perspectives which characterizes ‘embedded epistemology’. The sequence ‘First, Second and Third’ implies a numerical-sequential metaphor (Metzinger 1995: 29). The numerical sequence invokes a certain order among the perspectives. For example, there could be an order of relevance with the First-Person Perspective being the most relevant. Such an order of relevance may suggest interdependence between the different perspectives with less relevant perspectives being dependent on more relevant ones. This may for example be reflected in the dependence of the Second- and Third-Person Perspective on the First-Person Perspective (see 3.2.3). If the perspectives are dependent on each other, they must refer to a common frame of reference in both regards epistemically and ontologically. Subsequently, by pointing out the necessity of a common epistemological and ontological framework for all three perspectives the numerical-sequential metaphor may be regarded as an epistemic-ontological metaphor. This common epistemological and ontological framework shall be provided by 'embedded epistemology' and 'embedded ontology' (see 3.3.3). The complementary, mutually exclusive and interdependent epistemic abilities and inabilities between First- and Third-Person Perspective have already been recognized by Kant (1998: 193–194, 219–223) in his comparison between 'intuition' and 'understanding'. 'Intuition' may be assumed to refer to experience (i.e. 'phenomenal experience') with an immediate relation to the object and thus to First-Person Perspective. Whereas 'understanding' refers to judgment (i.e. 'physical judgment' in our case; see 2.2.3) with a mediate relation to the object and thus to the Third-Person Perspective. The linkage between 'intuition' and 'understanding' is possible since they are interdependent on each other: 'Neither of these properties is to be preferred to the other. Without sensibility no object would be given to us, and without understanding none would be thought. Thoughts without contents are empty, intuitions without concepts are blind.' (Kant 1998: 193–194).

'Isolated epistemology', in contrast, can neither be characterized by 'epistemic pluralism' and absence of 'epistemic hierarchy' nor 'epistemic dependence' (see also Figure 14a). Even if the different perspectives are considered, they are often separated from each other. Due to their separation, the mutually exclusive and complementary epistemic abilities and inabilities were overlooked. This made consideration of the dependence between the different epistemic perspectives impossible, which resulted in 'epistemic independence' and restriction of 'First-Person Epistemology' to an 'epistemology of the mind'. The different perspectives could also be subordinated or even eliminated in favour of each other, resulting in 'epistemic monism' as well as the presence of 'epistemic hierarchy'. For example, the First-Person Perspective is often either subordinated to the Third-Person Perspective or, even stronger, its existence as such is denied. In this case 'isolated epistemology' is restricted to 'Third-Person Epistemology' as an 'epistemology of the (isolated) brain'. This epistemic dichotomy between 'First- and Third-Person Epistemology' within the framework of 'isolated epistemology' is reflected in the two main epistemological positions, idealism/constructivism on one hand and empiricism/realism on the other. Both idealism and constructivism distinguish the First-Person Perspective from the Third-Person Perspective and separate and detach the latter from the former. These positions can therefore be regarded as paradigmatic examples of 'First-Person Epistemology' within the framework of an 'isolated epis-



a. 'Isolated epistemology'



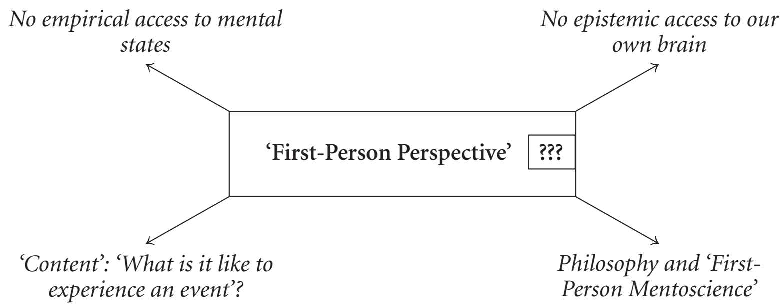
b. 'Embedded epistemology'

Figure 14. Characterization of different types of epistemologies

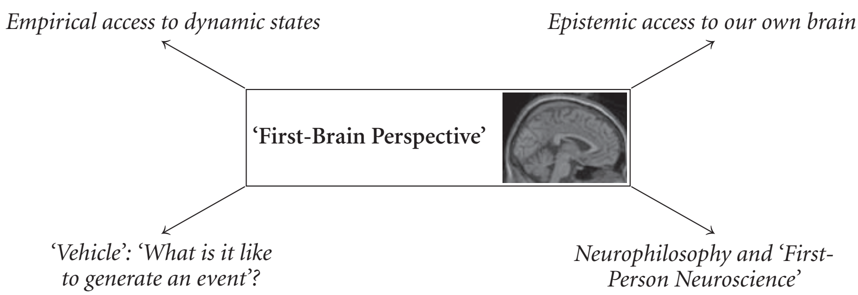
temology'. Moreover, idealism and constructivism attribute epistemic abilities to a mind either explicitly or implicitly so that they presuppose an 'epistemology of the mind'. They consecutively neglect the 'intrinsic' relationship between brain, body and environment which makes the assumption of a mind superfluous (see above). Empiricism and realism, in contrast, can be characterized by subordination of the First-Person Perspective under the Third-Person Perspective. These positions can therefore be regarded as paradigmatic examples of 'Third-Person Epistemology' within the framework of an 'isolated epistemology'. Moreover, empiricism and realism attribute epistemic abilities to the neuronal states as physical states of the brain which therefore remains detached from the environment and must be considered as an 'isolated brain' (within the framework of 'isolated epistemology'). These positions consecutively neglect the 'intrinsic' relationship between brain and environment which makes the assumption of the brain as an 'isolated brain' superfluous. The presupposition of an 'isolated brain' is then replaced by the one of the brain as an 'embedded brain' (within the framework of 'embedded epistemology') where epistemic abilities and inabilities are related to dynamic states rather than neuronal states (see 3.1.2).

The 'First-Brain Perspective'

'First-Person Epistemology' can be regarded as an 'epistemology of the brain' that allows indirect access to our own brain as a brain in First-Person Perspective. Due to the characterization of 'First-Person Epistemology' as an 'epistemology of the brain', the First-Person Perspective can be accounted for by the brain itself. Due to the possibility of indirect access to our own brain, the brain can refer to itself, revealing 'indirect epistemic self-reference' (see 3.3.4 for further details). If the First-Person Perspective can be accounted for by the brain while, at the same time, the brain can refer to itself, the First-Person Perspective must only be regarded as the indirect medium for the epistemic self-reference of the brain. Epistemically, the self-reference of the brain might then better be accounted for by the 'First-Brain Perspective' instead of the First-Person Perspective (see also Figure 15). The 'First-Brain Perspective' can be defined by a 'point of view from within the brain itself' (see also 2.3.1 and 3.1.2) thereby accepting the brain as an 'embedded brain'. As such the 'First-Brain Perspective' must be distinguished from both First- and Third-Person Perspective which is well described in the following quote indicating the requirements for the 'right point of view' (brackets in the quote are included by me): 'Neither the mental nor the physical point of view will do this purpose. The mental (i.e. First-Person Perspective) will not do because it simple leaves out the physiology, and has no room for it. The physical (i.e. Third-Person Perspective) will not do because while it includes the behavioural and functional manifestations of the mental, this doesn't enable it, in view of the falsity of conceptual reductionism, to reach to the mental concepts themselves. The right point of view (i.e. 'First-Brain Perspective') would be one which, contrary to present conceptual possibilities, included both subjectivity and spatiotemporal structure from the outset, all its descriptions implying both these things at once, so that it would de-



a. 'First-Person Perspective'



b. 'First-Brain Perspective

Figure 15. Characterization of First-Person Perspective and 'First-Brain Perspective'

scribe inner states and their functional relations to behaviour and to one another from the phenomenological inside and the physiological outside simultaneously – not in parallel. The mental and physiological concepts and their reference to this same inner phenomenon would then be seen as secondary and each partial in its grasp of the phenomenon: each would be seen as referring to something that extends beyond its ground of application' (T. Nagel 2000: 457–458; see also 3.3.3 for a more or less similar quote by T. Nagel with respect to the assumption of a 'neutral vantage point').

Presupposing a 'First-Brain Perspective' in this sense, the famous sentence by Descartes 'I think therefore I am' (see also 2.4.1 and 3.2.3) should be revised: 'My body neuronalizes therefore my brain mentalizes'. The 'I' no longer refers to a mind, as implicitly presupposed by Descartes, but rather to a 'spatial centre' that reflects the individual body (see 2.1.2 and 2.4.1). 'Thinking' indicates a particular organization of neuronal states, which can be described as 'neuronalizing' (or better 'dynamicising' which is not used here because of illustrative and contrastive purposes), accounting for the 'intrinsic' integration of the brain within the body (see 2.4 and 3.3). Due to this particular organization of neuronal states, the brain, i.e., my brain can be characterized by 'autoepistemic limitation' that causes i.e. generates the experience of mental states i.e. 'mentalizing'. The 'therefore' can subsequently be described as 'causa formalis' and 'causa finalis' rather than 'causa efficiencs' (see 3.3.2 for definition of both types of causality). 'By mentalizing' 'my brain' refers to events within the environment which implies that the organization underlying its neuronal activity is oriented on these events (see 2.3.1).

How can the First-Person Perspective and the 'First-Brain Perspective' be characterized in functional, phenomenal, epistemic and ontological regard?

Functionally, the First-Person Perspective reflects an event as experienced in mental states whose generation is accounted for by dynamic states and thus the 'First-Brain Perspective'. The First-Person Perspective reflects the epistemic content of an experience i.e. the event itself while the 'First-Brain Perspective' is the underlying epistemic vehicle of the experience i.e. the generator of the event. The functional difference between 'First-Brain Perspective' and First-Person Perspective subsequently consists in the difference between vehicle and content of experience.

Phenomenally, the First-Person Perspective refers to the experience of events in mental states as characterized by 'What is it like to experience that particular event?' The 'First-Brain Perspective', in contrast, refers to the generation of events in dynamic states i.e. brain states. Analogous to mental states, brain states i.e. dynamic states may be characterized by 'What is it like to generate that particular event'? The phenomenal difference between 'First-Brain Perspective' and First-Person Perspective subsequently consists in the difference between experience and generation of events. Analogously, one may also refer to the 'Second- and Third-Brain Perspective'. Since the epistemic abilities and inabilities of both Second- and Third-Person Perspective can indeed be related to particular types of functional organizations of the brain (see 2.4.2. and 2.4.3), the assumption of 'Second- and Third-Brain Perspective' may be plausible. One may subsequently complement the terms 'Second- and Third-Person Perspective' by the ones of 'Second- and Third-Brain Perspective'.

Epistemically, First-Person Perspective and 'First-Brain Perspective' refer to the same epistemic capability of the brain as an 'embedded brain' though they describe it differently i.e. complementary once as an epistemic ability and once as an epistemic inability. The First-Person Perspective describes the epistemic ability to experience events in mental states while the 'First-Brain Perspective' characterizes (this as) an epistemic inability i.e. 'autoepistemic limitation' as the inability to experience our own brain (events) as brain (events) (see 2.3.1). Since 'autoepistemic limitation' and mental states are tied together, epistemic ability and inability necessarily imply each other. Accordingly, First-Person Perspective and 'First-Brain Perspective' refer to an identical epistemic capability by describing it as either an ability or inability – both perspectives must therefore be regarded as complementary in epistemic respect. The reference to an identical epistemic capability and thus the complementary character of the First-Person Perspective and the 'First-Brain Perspective' are no longer given in the case of the 'isolated brain' within the framework of an 'isolated epistemology'. The First-Person Perspective cannot be accounted for by the brain itself in this case since the brain is not characterized by events anymore but rather stimuli. The 'First-Brain Perspective' can then no longer refer to events but only stimuli and thus to the First-Person Perspective which refers to events. Disruption of the common epistemic reference i.e. events implies subsequently epistemic dissociation and separation between First-Person Perspective and 'First-Brain Perspective' as well as resolution of their complementary character in epistemic respect.

Ontologically, First-Person Perspective and 'First-Brain Perspective' presuppose the same underlying ontological correlate. The First-Person Perspective can be related to the brain as an 'embedded brain' rather than a mind as 'isolated' from the brain. The 'First-Brain Perspective' reflects the 'dynamic brain' which, in turn, presupposes the brain as an 'embedded brain'. Subsequently, both 'First-Brain Perspective' and First-Person Perspective presuppose the identical ontological correlate i.e. the brain as an 'embedded brain' (see 3.3.2 for further definition) – both perspectives must therefore be regarded as identical in ontological respect. This is no longer true in the case of an 'isolated brain' within the framework of an 'isolated epistemology'. The presupposition of the brain as an 'isolated brain' (see 3.3.1) requires an empirical definition of the brain as a 'physical brain'. In this case, 'event coding' is replaced by 'stimulus coding' (see 2.3.1 and 3.1.2) where brain states are organized in orientation on stimuli rather than events. Unlike the First-Person Perspective, the 'First-Brain Perspective' then no longer refers to events but stimuli. Moreover, brain states, as characterized by 'stimulus coding', remain unable to generate events (see 2.3.1 and 3.1.2); the brain as a 'physical brain' remains necessarily unable to account for the events as experienced in mental states in the First-Person Perspective. The brain as a 'physical brain' can subsequently no longer be regarded as the ontological correlate underlying the First-Person Perspective. Instead, a mind as being non-physical is assumed to which the experience of mental states can be attributed (see above). Accordingly, First-Person Perspective and 'First-Brain Perspective' dissociate from each other in ontological respect within the framework of an 'isolated epistemology' the former being attributed to a mind and the latter being related to the brain.

Finally, the necessary conditions for the possible distinction between First-Person Perspective and 'First-Brain Perspective' shall be elucidated. 'Autoepistemic limitation' may be regarded as a necessary condition for the possibility of introducing the First-Person Perspective and its concurrent functional and phenomenal distinction from the 'First-Brain Perspective'. The determination of the brain as an 'isolated brain', on the other hand, can be regarded as a necessary condition for the possibility of the epistemic and ontological distinction between First-Person Perspective and 'First-Brain Perspective'. Finally, the presupposition of an 'isolated epistemology' may be regarded as a necessary condition for the possibility of dissociation and disruption between First-Person Perspective and 'First-Brain Perspective', making any linkage or relation between both perspectives impossible. Due to 'autoepistemic limitation' (see 2.3.1), the brain remains unable to directly access its own brain states as brain states i.e. the brain has no direct epistemic access to itself. Instead, the brain recognizes itself only indirectly through mental states and events within the environment. As a result, the First-Person Perspective was described exclusively by mental states while brain states were not included in its functional and phenomenal characterization. Due to the detachment of the brain as an 'isolated brain' from the (events within the) environment, the experience of events within the environment in mental states could no longer be related to the brain. The First-Person Perspective was epistemically related to events and ontologically to a mind (or a 'mental brain'; see 3.3.1). The 'First-Brain Perspective', if assumed at all, was epistemically related to stimuli (see above) and ontologically to the brain as a 'physical brain' and 'isolated brain'. As such the 'First-Brain Perspective' was equated more or less with the Third-Person Perspective (see 2.4.3 and 3.2.3) while, at the same time, it was distinguished from the First-Person Perspective in both epistemic and ontological regard. Due to 'isolation' between brain and environment within the framework of an 'isolated epistemology', the First-Person Perspective was attributed to a mind and as such distinguished from the 'First-Brain Perspective', here referring to the brain. Both perspectives were dissociated and disrupted i.e. 'isolated' from each other without the possibility of any epistemic or ontological linkage. For that reason, even the idea of a possible relation and linkage between First-Person Perspective and 'First-Brain Perspective' could not be raised any longer.

The 'epistemic mind problem'

The 'First-Person Epistemology' can be characterized as an 'epistemology of the brain'. One may subsequently assume that the brain should be epistemically accessible in the First-Person Perspective. Otherwise, we would remain unable to characterize 'First-Person Epistemology' as an 'epistemology of the brain'. Similar epistemic access to our own and other brains is prevented by the different epistemic referents (event, stimulus) and modes (experience, judgment) in the distinct perspectives: Whereas the First-Person Perspective refers to events in the mode of experiences i.e. 'phenomenal experience' the Third-Person Perspective refers to stimuli in the mode of judgments i.e. 'physical judgment' (see 2.4.3 and 3.1.3). The brains of others can thus be accessed in the Third-Person Perspective in terms of stimuli i.e. neuronal states through 'physical judgment'. The own brain, in contrast, can only be accessed in First-Person Perspective and thus in terms of events in 'phenomenal experience'. However, the First-Person Perspective can be characterized by 'autoepistemic limitation' (see 2.3.1). Due to 'autoepistemic limitation', we remain unable to detect and recognize our own brain states as brain states. Since our own brain remains hidden for us i.e. epistemically inaccessible, it cannot be accessed directly in the First-Person Perspective. However, impossibility of direct access does not necessarily exclude indirect access to our own brain in First-Person Perspective. The empirical ground for such an indirect access is provided by the possibility of linkage between 'brain code' and 'mental code'; both 'brain code' and 'mental code' refer to identical events within the environment (see 3.1.3): If both codes refer to an identical event, the experience of mental states in First-Person Perspective necessarily reflects brain states i.e. dynamic states. Although rather indirectly (through the experience of events within the environment in mental states), the brain with its brain states as dynamic states is thus epistemically accessible in First-Person Perspective.

Due to the possibility of indirect epistemic access to our own brain states as brain states through mental states (see also 3.3.3), the 'epistemic mind problem' is solved and transformed. If we experience our own brain states i.e. dynamic states in the events of mental states, indirect epistemic access to our own brain and its dynamic states is provided through our mental states. The first part of the 'epistemic mind problem', consisting in the epistemic accessibility of our own brain as a brain in First-Person Perspective (see 1.1.1), can subsequently be regarded as solved: The experience of mental states in First-Person Perspective reflects the experience of events within the environment (see 2.3.1, 3.1.3 and 3.3.2). These events reflect particular dynamic states in 'First-Brain Perspective' because brain states as dynamic states are oriented on 'observable and to-be effectuated events within the environment'. As a result, we have epistemic access though indirectly to our brain states as brain states through experience of events in mental states. The 'epistemic mind problem' concerns then no longer the question for the epistemic relation between the First-Person Perspective and our own brain. Instead, it concerns the relationship between the First-Person Perspective and the 'First-Brain Perspective' with respect to the environment: If both First-Person Perspective and First-Brain Perspective refer to an identical environment, they must necessarily refer to an identical event (within the environment) because the events as experienced in the former reflect those on which the latter is oriented on – identity of environments between both perspectives implies identity of events. The focus is thus shifted to the problem of the relationship between the environments in First-Person Perspective and 'First-Brain Perspective'. The second part of the 'epistemic mind problem', consisting in the epistemic reference of mental states (see 1.1.1), is subsequently transformed into an 'epistemic environment problem': The epistemic reference of mental states is supposed to consist in an identical environment to which both First-Person Perspective and 'First-Brain Perspective' refer.

'First-Person Neuroscience'

The 'First-Brain Perspective' can be characterized by dynamic states. The dynamic states themselves can be investigated only indirectly by the linkage between mental states, as experienced in First-Person Perspective, and neuronal states, as recognized in Third-Person Perspective (see also 3.1.2). The empirical investigation of brain states i.e. dynamic states makes an inclusion of mental states and First-Person Perspective necessary. First- and Third-Person Perspective should subsequently be linked systematically to each other in the empirical investigation of brain states as dynamic states. This 'indirectness' in the inquiry of dynamic states is one of the main epistemic challenges in neuroscience and neurophilosophy (see also Bechtel et al. 2001: 15–16). Due to the absence of a sensorium for our own brain states with the consecutive 'autoepistemic limitation' (see 2.3.1), the investigation of our own brain must rely on indirect epistemic access. Accordingly, specific methodological strategies for circumventing this principal epistemic problem of the 'indirectness' in the inquiry of our own brain must be developed. The 'First-Person Neuroscience', as developed in the following, aims at providing such methodological strategies. Methodological approaches for the linkage between First- and Third-Person Perspective in the empirical investigation of brain states may be provided by a so-called 'First-Person Neuroscience' (see also Lutz et al. 2002; Varela & Shear 1999a; Northoff 2000b, 2001b): 'Thus, for example, a large-scale integration mechanism in the brain such as neural synchrony in the gamma band should be validated also on the basis of its ability to provide insight into first-person accounts of mental contents such as duration. The empirical questions must be guided by first-person evidence' (Varela 1996: 343). This, however, contrasts with most current empirical approaches that investigate the brain only in Third-Person Perspective. Empirical investigations of brain states focuses exclusively on neuronal states and presuppose therefore only the Third-Person Perspective. This approach may subsequently be called 'Third-Person Neuroscience'. 'Third-Person Neuroscience' can be defined by empirical investigations of brain states in the Third-Person Perspective. It is therefore necessarily restricted to neuronal states and cannot account for dynamic states, which remain inaccessible in Third-Person Perspective (see 3.1.2). 'First-Person Neuroscience', in contrast, can be defined by the empirical investigation of brain states in orientation on systematic epistemic linkage between First- and Third-Person Perspective; this accounts for empirical linkage between mental and neuronal states. As a result 'First-Person Neuroscience' focuses on the development of methods for the systematic linkage between First- and Third-Person data: 'Third, it would be futile to stay with first-person descriptions in isolation. We need to harmonize and constrain them by building the appropriate links with third-person studies. ... To make this possible we seek methodologies that can provide an open link to objective, empirically based description.' (Varela & Shear 1999: 2). The necessity to consider experience in First-Person Perspective in the empirical investigation of the mind has already been pointed out by Hume: 'And tho' we must endeavour to render all our principles as universal as possible, by tracing up our experiments to the utmost, and explaining all effects from the simplest and fewest causes, 'tis still certain we cannot go beyond experience; ...None of them go beyond experience, or establish any principles which are not founded on that authority' (Hume 1978: XVII–XVIII). Observation in Third-Person Perspective, as presupposed in physics and 'Third-Person Neuroscience', remains insufficient by itself in the empirical investigation of the mind since the latter can be accessed only by experience: 'Hume sought to adapt the experimental method of Newton to the investigation of the powers and principles of the human mind launched by Locke. Here I have said 'adapt' rather than 'adopt', because Hume did not think that physical experiments could be performed on the mind. Rather, he thought that the mind's workings are accessible to introspection, and that by careful introspective study of one's own conscious states, one would be able to discover general principles that apply to those states; much as by carefully studying the operations of physical objects Newton had discovered general principles applying to them, such as the laws of motion and gravitation. The result of this essentially introspective study of the mind was to be a truly empirical science of human nature' (Dicker 1998: 2–3).

'First-Person Neuroscience' in this sense presupposes methods for the systematic examination and evaluation of mental states by themselves and their contents as experienced in First-Person Perspective. Such methods include, for example, phenomenology and introspective psychology which may be regarded as steps towards the development of a 'science of experience' (see also Varela 1996: 336 as well as 338–339 for the distinction between introspectionism and phenomenological analysis). Linkage between First- and Third-Person data in 'First-Person Neuroscience' depends on and thus presupposes a reliable and detailed account of the First-Person data by themselves and thus a 'science of experience'. The better the First-Person data are accounted for the better and more promising their linkage to Third-Person data. Often, methods for evaluation of mental states and those for their linkage to Third-Person data have been subsumed under the term 'First-Person Methodologies' (Varela & Shear 1999a, b). Moreover, 'First-Person Neuroscience' is often equated with 'Second-Person Neuroscience'. A 'Second-Person Neuroscience' focuses on those mental states that can be detected in Second-Person Perspective by means of 'phenomenal judgment' (see also 2.4.2). For example, investigation of neural correlates of consciousness may be considered as a paradigmatic example of 'Second-Person Neuroscience' or 'neurophenomenology' (Varela 1996; Northoff 2003a). However, not all mental states, as experienced in First-Person Perspective, are conscious and can consequently be detected and recognized in Second-Person Perspective (see 2.4.2 and 3.2.2). 'Second-Person Neuroscience' is therefore not necessarily identical to 'First-Person Neuroscience' since the latter covers a broader spectrum of mental i.e. unconscious and conscious states than the former which remains restricted to conscious states (see also 3.2.2 for further discussion of consciousness and unconsciousness). An example of 'First-Person Neuroscience' as distinguished from 'Second-Person Neuroscience' consists in the investigation of the neural and dynamic states underlying psychodynamic processes. For example, certain psychodynamic parameters, which were altered in catatonic patients, correlated significantly with their decreases in orbitofrontal cortical activation during emotional stimulation (see Northoff et al. 2003b, d). Finally, it should be noted that the term 'phenomenal', as presupposed here and in Chapter 2, includes both conscious and unconscious states (see also Varela & Shear 1999b: 3) in order to account for the full range of mental states as experienced and judged in First- and Second-Person Perspective. Despite these differences in the range of mental states, 'Second-Person Epistemology' is often not differentiated from 'First-Person Neuroscience' (see, for example, Lutz et al. 2002; Varela 1996). In the following use of the term 'First-Person Neuroscience', 'Second-Person Epistemology' is included for pragmatic purposes. It should also be noted that we presuppose a rather broad meaning of the term 'neuroscience'. It includes all disciplines involved in the direct or indirect empirical investigation of the brain ranging from psychology over neurocomputation to neurogenetics.

Empirically, 'First-Person Neuroscience' provides the linkage between mental and neuronal states from which the type of organization of neuronal states and thus dynamic states can be inferred (see also Figure 16). Mental states refer to the experience of events within the environment. Dynamic states reflect the organization of neuronal states in orientation on 'observable and to-be effectuated events within the environment'. Neuronal states themselves reflect stimuli. Linkage between mental and neuronal states allows for the consideration of different stimuli in relation to one particular event within the environment. If one considers the stimuli i.e. neuronal states in orientation and guidance on events as experienced in mental states one may infer their organization and thus dynamic states. Dynamic states are, even though rather indirectly through linkage between neuronal and mental states, empirically accessible. Methodologically, the linkage between neuronal and mental states is provided by 'disciplined circularity' or a so-called 'neuro-phenomenological circulation' (Varela 1996: 341) between neuronal and mental states where both can be considered as 'mutual or reciprocal constraints' for each other in neuroscientific investigation. This, in turn, provides indirect access to dynamic states and thus to mental states. There may be different methodological strategies for linking neuronal and mental states in an empirical investigation.

First, the contents of mental states can be related to neuronal states. For example, different types of emotions i.e. positive, negative, disgust, happiness, etc. may be related to distinct spatio-temporal activation patterns in the prefrontal cortex (see Northoff et al. 2000a, 2002, 2003b, c, d). However, the problem that arises here is that the contents, as determined and categorized in Third-Person Perspective for empirical investigations of mental states, may not necessarily be identical with the ones as experienced in First-Person Perspective.

Second, the neuronal states underlying the subjective experience of mental states may indirectly be accounted for by the combination of different methods of analyses. One such methodological approach that provides linkage between First- and Third-Person Perspective in empirical investigation of brain states, can be characterized as 'double analysis'. In 'double analysis', the same data are analyzed with regard to both objectively and subjectively correct answers. For example, subjects have to decide whether certain presented items are blue or black. They may make correct decisions about the color of these items. In addition, they may make some mistakes by pointing out the wrong color. Data about neuronal states, obtained during the process of decision, may be grouped and analyzed in two different ways. First, all items classified correctly as blue, may be compared with those classified correctly as black. This type of analysis would be a 'Third-Person analysis' since only items classified as objectively correct, according to Third-Person Perspective, are grouped together. Second, all items classified as blue (thus also including the ones wrongly classified as blue) may be compared with all those classified as black (thus also including the ones wrongly classified as black). This type of analysis would be a 'First-Person analysis' since all items classified as subjectively correct, according to First-Person Perspective, are grouped together. Results from both types of analysis may be compared with each other. Differences between the results from both analyses may reflect the difference between subjective and objective classification and thus between First- and Third-Person Perspective. For example, we investigated neural correlates of emotional experiences. While comparing positive and negative emotions in orientation on objective categories did not lead to a measurable difference in the ventromedial prefrontal cortex comparison between positive and negative emotions in orientation on subjective experience showed parametric i.e. linear dependence of neural activity in the ventromedial prefrontal cortex on the subjective emotional valence (Heinzel et al. 2003). The more negative the subjective experience, the less activation in the ventromedial prefrontal cortex. Accordingly, neural activity in the ventromedial prefrontal cortex may be determined by subjective experience of emotions in First-Person Perspective rather than objective emotional categories in Third-Person Perspective.

Third, different characteristics of the subjective experience itself may serve as a guide and orientation for the analysis of data regarding neuronal states. The characteristics of subjective experiences may be revealed in a so-called 'phenomenological analysis' (Varela 1996). Relying on 'introspection' and 'phenomenological analysis', so-called 'phenomenological cluster' (Lutz et al. 2002) may be elucidated. For example, different 'phenomenological clusters' were revealed by means of subjective questioning i.e. introspection during the time course of visual illusions.

These different temporal 'phenomenological cluster' then served as the guide for analysing different brain rhythms in the respective 'subjective' time intervals. Different time intervals and thus different 'phenomenological clusters' could indeed be characterized by different brain rhythms (theta, alpha, beta, gamma) (Lutz et al. 2002). Another example of such a 'phenomenological analysis' is the analysis of fMRI data in orientation on the phenomenological concepts of temporality i.e. 'phenomenal time' (Lloyd 2002). He observed that the multivariate distance and changes between brain images is approximately linearly related to their temporal distance. The more closer acquired in time the more similar the images. Thus, the changes between the different images occur gradually over time. Lloyd argues that these results are consistent with Husserl's description of time consciousness in that they reflect the inexorable temporal flux of the conscious state. Analogous to the way that each moment of our phenomenological experience of time builds on foundation of the previous moment (i.e. 'phenomenal time'; see 2.2.1), the series of fMRI images appears to form a continuously evolving temporal pattern of global activity.

Fourth, in addition to indirect empirical investigations i.e. observations of dynamic states as brain states in 'First-Brain Perspective', brain states may be simulated in so-called neural networks (see also 3.1.2). The real 'First-Brain Perspective' is thus replaced by a simulated 'First-Brain Perspective'. Unlike dynamic states as brain states, simulation in the neural networks provides direct empirical access to the parameters characterizing dynamic states and thus to the dynamic states themselves. Meanwhile, in contrast to dynamic states as brain states, the simulated dynamic states cannot be related to mental states and thus to 'observable and to-be effectuated events within the environment' which leaves their 'biological validity' and natural possibility open. Ideally, empirical investigation of brain states in relation to mental states and simulation of dynamic states may be combined with each other (see, for example, Northoff et al. 2000 for an initial but very preliminary combination). Their reciprocal insufficiencies are then compensated for and they can mutually validate each other.

Epistemically, 'First-Person Neuroscience' provides the systematic linkage between First- and Third-Person Perspective. As a result, the 'First-Brain Perspective' (see Figures 15 and 16) can be accessed indirectly (see above) which, in turn, provides the 'conceptual equipment to understand how subjective and physical features could both be essential aspects of a single entity or process' (Nagel 2000: 444). This linkage between First- and Third-Person Perspective presupposes 'epistemic pluralism' and thus consideration of all perspectives. Otherwise, in the case of 'epistemic monism', either perspective is subordinated or eliminated which would make any kind of linkage impossible. The possibility of 'First-Person Neuroscience' subsequently presupposes 'embedded epistemology' (see Figures 14 and 15). While in contrast, 'First-Person Neuroscience' remains incompatible within the framework

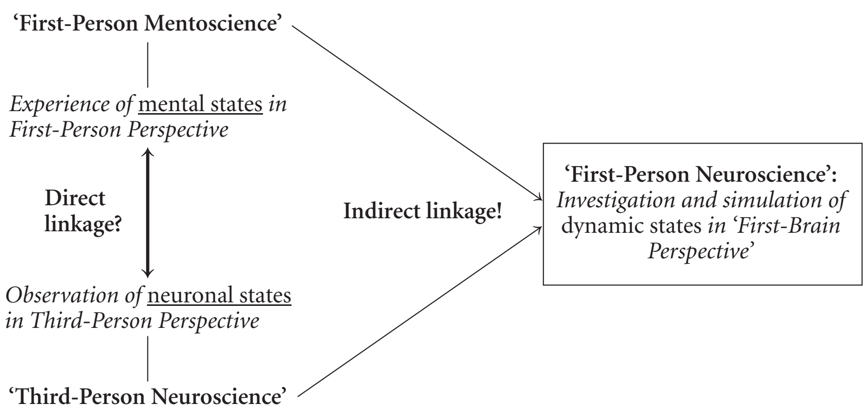


Figure 16. Indirect linkage between mental and neuronal states through dynamic states in 'First-Person Neuroscience'

of 'isolated epistemology' which can be characterized by 'epistemic monism' rather than 'epistemic pluralism'. 'First-Person Neuroscience' must consequently be distinguished from 'Third-Person Neuroscience' in epistemic respect because the latter excludes the First-Person Perspective and thus experience itself. Moreover, the linkage between First- and Third-Person Perspective presupposes mutually exclusive i.e. non-identical epistemic abilities and inabilities in the different perspectives. In the case of identical (or subordinated) epistemic abilities and inabilities, any linkage between the different perspectives would be superfluous. Even in the reverse case of separation i.e. 'epistemic independence' between perspectives, 'First-Person Neuroscience' would remain impossible because under these circumstances any linkage between different perspectives is not possible either. Since 'isolated epistemology' is characterized by either identification/subordination or separation between perspectives, it remains incompatible with 'First-Person Neuroscience'. Instead, 'First-Person Neuroscience' would be transformed into a 'First-Person Mentoscience' (see also 3.3.1) within the framework of 'isolated epistemology'. Such a 'First-Person Mentoscience' would no longer relate experience of mental states in First-Person Perspective to the brain itself and thus its 'First-Brain Perspective' but rather to a mind as principally distinguished from the brain and its 'First-Brain Perspective'. Accordingly, the possibility of 'First-Person Neuroscience' in the present sense necessarily presupposes 'embedded epistemology' while it remains impossible as such within the framework of 'isolated epistemology'.

Ontologically, 'First-Person Neuroscience' provides necessary linkage between neuronal i.e. physical and mental states in a third type of state i.e. dynamic states common to and underlying both which is nicely described in the following quote: '… We may hope and ought to try as part of a scientific theory of mind to form a third conception that does directly entail both the mental and the physical, and through which their actual necessary connection with one another can therefore become transparent to us. Such a conception will have to be created; we won't just find it lying around' (Nagel 1998: 352). The linkage (i.e. connection) is necessary because dynamic states are (a sufficient condition for) mental states while neuronal states are a necessary (though not sufficient) condition for the possibility of dynamic states (see 3.1.2). Dynamic states as mental states reflect the functional organisation of neuronal states; neuronal and mental states are subsequently necessarily linked to each other in dynamic states. However, since there is no direct epistemic access to dynamic states (and the First-Brain Perspective) (see 3.1.2), this necessary linkage can only be detected a posteriori. Accordingly, the linkage between mental and neuronal states in dynamic states can ontologically be considered as necessary and epistemically as a posteriori and thus as an 'a posteriori necessary truth' (see also 1.4.4 as well as Nagel 2000: 434, 436). This assumption of a necessary a posteriori linkage between neuronal and mental states in dynamic states must be distinguished from mere 'psychophysiological correlations', which consider mental states only as 'higher-order physical states' with subsequent 'physical causality' (see, for example, Searle 2000). Whereas these 'psychophysiological correlations' are a posteriori as well, they do not presuppose necessity i.e. a necessary linkage between neuronal and mental states.

'Epistemology of events and environments'

'Embedded epistemology' can be characterized as an 'epistemology of the brain' which presupposes the brain as an 'embedded brain'. Presupposition of the brain as an 'embedded brain' implies inseparability between 'object and subject of recognition': Neither can the 'object of recognition' be detached from the 'subject of recognition' nor can the 'subject of recognition' be isolated from the 'object of recognition'. This inseparability between the 'subject and object of recognition' makes the development of a novel epistemic framework necessary. 'Subject and object of recognition' as two separate epistemic entities, reflecting mind (as an 'internal reality') and world (as an 'external reality') respectively (see above and below), are replaced by 'events' and 'environment' as two distinct epistemic aspects of the 'intrinsic' relationship between brain, body and environment. Subsequently, the shift from 'isolated epistemology' to 'embedded epistemology' is accompanied by transformation of 'subject and object of recognition' into 'events and environment'.

It should be noted that the terms 'events' and 'environment' cannot be regarded as two separate and different epistemic entities within the framework of an 'embedded epistemology'. If they are regarded as such they will degenerate into 'subject and object of recognition' which makes an 'embedded epistemology' as distinguished from 'isolated epistemology' impossible. Accordingly, 'embedded epistemology' can be characterized as an 'epistemology of events and environments'. In a first step, the inseparability between 'subject and object of recognition' within the framework of 'embedded epistemology' will be demonstrated. This is followed by the definition of the novel terms 'events' and 'environments' in epistemic regard. Finally, the characteristics of an 'epistemology of events and environments' are demonstrated. Throughout, the relationship of this approach to other epistemological positions is discussed which will be categorized into idealism versus empiricism and constructivism versus realism.

'Subject and object of recognition'

Though the terms 'events' and 'environment' may possibly be equated with the terms 'subject and object of recognition' within the framework of an 'isolated epistemology', this remains no longer possible in 'embedded epistemology'. Due to the brain as an 'embedded brain', the environment is 'intrinsically' linked to brain and body so that the 'environment' itself can no longer be separated, detached or 'isolated' from both. Epistemically, the 'environment' as supposed to reflect the 'object of recognition' remains therefore inseparable from the 'subject of recognition' as supposed to be related to brain and body. Moreover, the 'subject of recognition' is part of the 'environment' and must thus be considered as an 'object of recognition' by itself. This is, for example, reflected in the possibility of the Second-Person Perspective where the own 'subject of recognition' becomes the 'object of recognition' (see 2.4.2 and 3.2.2). Detachment, isolation and separation of the 'object of recognition' from the 'subject of recognition' remain therefore impossible. The 'object of recognition' is not 'pure' because it necessarily contains traces of the 'subject of recognition' and is dependent on the 'subject of recognition'. The assumption of the 'object of recognition' as 'impure' implies that, unlike in empiricism, there is no environment as an 'external world'. Even stronger such an 'external world' conceals the 'environment' itself (see below for definition) by transforming the human and cultural environment into a purely 'objective world' as a 'physical world' (see Merleau-Ponty 1958: 27–28). Accordingly, the assumptions of a 'pure' 'object of recognition' and an 'external world' as necessary conditions for the possibility of empiricism can no longer be maintained.

Due to the presupposition of the 'environment' as 'embedded' (see below), brain and body are 'intrinsically' linked to the environment so that the two can no longer be detached and 'isolated' from the environment. Epistemically, brain and body, which subserve the generation of 'events' as supposed to be experienced by the 'subject of recognition', remain therefore inseparable from the 'object of recognition' as supposed to be accounted for by the environment. Moreover, the environment as the 'object of recognition' can become a 'subject of recognition' and must thus be considered as a 'subject of recognition' by itself. This is, for example, reflected in the fact that 'objects of recognitions', reflecting the environment, can become 'subjects of recognitions' by means of the formation and constitution of events within their brain and body. Detachment, isolation and separation of the 'subject of recognition' from the 'object of recognition' remain therefore impossible. The 'subject of recognition' is not 'pure' because it necessarily contains traces of the 'object of recognition' and is dependent on the 'object of recognition'. The assumption of the 'subject of recognition' as 'impure' implies that, unlike in idealism, there is no mind as an 'internal world'. Even stronger such an 'internal world' conceals brain and body as the underlying epistemic vehicle for the constitution and generation of mental states by transforming and duplicating human events into 'mental events' (Merleau-Ponty 1958: 45–46). These 'mental events' are then attributed to a mind with a purely 'subjective world' as a 'mental world' while, at the same time, neglecting the brain itself i.e. the own brain. Accordingly, the assumptions of a 'pure' 'subject of recognition' and an 'internal world' as necessary conditions for the possibility of idealism can no longer be maintained.

Due to the inseparability between 'subject and object of recognition', the distinction between the 'internal and external world' can no longer be maintained either. There is no 'internal world' with 'internal states' as 'internal events' which, as 'isolated events', are detached from the environment. Furthermore, there is no 'external world' with 'external states' as an 'external environment' which, as an 'isolated environment', remains detached from brain and body. Accordingly, 'internal and external world' cannot be distinguished from each other, which, in addition, makes the term 'world' itself questionable. If the distinction between the 'internal and external world' cannot be maintained any longer, the assumption of unilateral dependence between both worlds in either empiricism or idealism remains impossible as well. Unlike in empiricism, the 'internal world' cannot be assumed to be unilaterally dependent on the 'external world'. Unlike in idealism, the 'external world' cannot be assumed to be unilaterally dependent on the 'internal world'. In addition to these unilateral approaches, any correlative approach, which presupposes a bilateral but 'extrinsic' relationship between 'internal and external world', must necessarily fail too. Even if 'internal and external world' are correlated through 'form' and 'content', such an 'extrinsic' correlation cannot account for the necessary conditions for the possibility of both 'internal and external world'. A correlation, which by definition remains 'extrinsic', is not sufficient to account for the 'intrinsic' epistemic relationship between 'subject and object of recognition' and thus between 'internal and external world'. This 'intrinsic' epistemic relationship must however be considered as a necessary condition for the possibility of the distinction between 'subject and object of recognition' and thus for their 'extrinsic' correlation (see below). Though he shows the necessary conditions i.e. the 'internal world' for the possibility of an 'external world' and thus their 'extrinsic' correlation, Kant (1998) nevertheless fails to demonstrate the necessary conditions for the possibility of the 'internal world' itself. He, consecutively, cannot see that both 'internal and external world' can be traced back to a common source i.e. the 'intrinsic' relationship between brain, body and environment which reflects the necessary condition for the possibility of both worlds and consecutively for his own assumptions. Thus, Kant makes the first step but at the same time neglects the second one which would lead him to the ground on which both 'internal and external world' are generated. Finally, the term 'world' suggests the possibility of being able to possess either an 'external world' outside myself or an 'internal world' inside myself. If, however, something i.e. the 'world' can be possessed, it can no longer be regarded as the 'broader and foundational framework' (see 3.3.3 for definition) within which such a possession becomes possible: 'The world is not an object such that I have in my possession the law of its making; it is the natural setting of, and field for, all my thoughts and all my explicit perceptions' (Merleau-Ponty 1958: xi–xii). 'Embedded epistemology', which presupposes an 'intrinsic' relationship between 'internal and external world', should therefore abandon both terms and thus the term 'world' altogether. Both terms i.e. 'internal and external world' should be replaced by the ones of 'events' and environment' so that 'embedded epistemology' may be characterized by an 'intrinsic' epistemic relationship between 'events' and 'environments' and thus as an 'epistemology of events and environments'. However, one may argue that the epistemic dichotomy between 'internal and external world' reappears in a modified version when distinguishing between 'events' and 'environments'. Though both terms 'events' and 'environments' must be distinguished they do not reflect an epistemic dichotomy in the traditional sense (i.e. being mutually exclusive) since the former partially includes the latter and vice versa (see below). Unlike in the case of the differentiation between 'internal and external world', the distinction between 'events' and 'environments' does not refer to principally different and mutually exclusive 'epistemic contents' but to distinct aspects in the epistemic coordinates of the 'intrinsic' relation between experiencing and observing person (see below). The epistemic distinction between 'events' and 'environments' can therefore not be regarded as a modified version of the traditional epistemic dichotomy between 'internal and external world'. Instead, 'events' and 'environments' reflect the basic epistemic structure in an 'embedded epistemology' so that one may characterize them as 'epistemic units' and 'epistemically primitive'. They must consecutively be regarded as fundamental or 'foundational' (see 3.3.3 for definition) for all other epistemic notions that are therefore 'epistemically non-primitive' and 'secondary abstractions' as for example 'subject and object of recognition'. One may go even one step further and trace these 'foundational' 'epistemic units' back to a common source which provides the 'intrinsic' epistemic linkage between 'events' and 'environments'. This common source implies the search for the ontological correlate underlying these 'epistemic units'. The ontological source is accounted for by the 'dynamic configurations' in the 'intrinsic' relationship between brain, body, and environment (see 3.3.3) which as such can be considered as the necessary conditions for the possibility of 'events' and 'environments' as well as their 'intrinsic' epistemic linkage.

'Events' and 'environments'

Empirically, the term 'event' refers to 'observable and to be-effectuated events within the environment' (see 2.3.1 and 3.1.3). It can be defined epistemically by 'changes' in the 'environment' as the respective 'context': 'Events' can be determined by their spatio-temporal position, which however does not reflect an 'absolute' position in a physical sense but rather a 'relative' position in a phenomenal sense (see 2.1.1 and 3.1.3). As a result 'events' cannot be detached from their respective 'context' and are therefore necessarily and intrinsically embedded – replacement of 'events' as 'embedded events' by 'isolated events' with detachment from the respective 'context' remains therefore impossible. 'Events' in this sense have to be distinguished from 'events' in the physical sense as, for example, suggested by Quine (1985). Similar to the present definition, he too defines 'events' as 'spatiotemporal unities'. However, unlike in our definition, he presupposes space and time rather in a physical sense than phenomenal sense. 'Events' in this sense are consecutively detached from their respective context so that they must be regarded as 'isolated events' rather than 'embedded events'. Moreover, 'events' in the sense of Quine must be further specified as 'external events'. This characterization must however be refuted since the definition of 'events' as 'embedded events' undermines any distinction between 'internal and external events' as forms of 'isolated events'. Finally, it should be noted that our epistemic notion of 'event' differs principally from the one discussed in analytic philosophy. There the term 'event' is defined as an ontological term as distinguished from 'substances', 'things' or 'persons'. 'Events' in this sense are regarded as an own and separate category of ontological entities (see also Stoecker 1992). In the present context, however, 'events' as an ontological category are replaced by 'dynamic relations' with 'co-constitution and co-occurrence' (see 3.3.3 for further details). 'Dynamic relations' are regarded as the necessary ontological presupposition for the epistemic possibility of 'events' and 'environments'. Accordingly, characterizing 'events' as an ontological category must be viewed as an instance of 'false ontologisation' (see 1.4.2) where an originally epistemic term is falsely classified as ontological. Any ontological characterization of 'events' as either 'physical events' or 'mental events' must therefore be considered as false in three senses. First, 'events' are epistemic notions and should thus not be confused with ontological specifications. Second, since 'events' are 'epistemically primitive' and the basic 'epistemic units' (see above), any specification as either physical or mental must be considered a 'secondary abstraction' that blurs the definition and notion of 'event' itself. Third, any further specification of 'events' would no longer be compatible with the necessary epistemic condition of their possibility i.e. their 'intrinsic' relationship with the 'environments' which then would be transformed into a mere 'extrinsic' relationship (see below as well as 3.3.2 for the distinction between 'intrinsic' and 'extrinsic').

Epistemically, the term 'event' is necessarily related to the context' which reflects the 'environment'. 'Events' as experienced by the experiencing person are therefore necessarily related to the observing person and thus the 'environment'. Due to the necessary consideration of the environment as the context, 'events' have to be distinguished from 'facts' in epistemic regard. In contrast to 'events', 'facts' no longer include the context and thus the epistemic coordinates of the relation between the experiencing and the observing persons. 'Facts' are 'events' minus the context: The context, which constitutes 'events' as 'events' (see above), is stripped off in 'facts'. For example, 'events', as experienced in 'phenomenal experience' in the First-Person Perspective, are stripped off their context in 'physical judgment' of 'facts' in the Third-Person Perspective (see 2.4.3). Accordingly, characterization of 'phenomenal experience' and mental states by 'phenomenal or mental facts' (see Nagel 1986; Chalmers 1996) in the First-Person Perspective is wrong for two reasons. First, it neglects the 'context' which remains constitutive for 'phenomenal experience' in First-Person Perspective. Second, it confuses 'facts' in 'physical judgments' (in the Third-Person Perspective) with 'events' in 'phenomenal experience' (in the First-Person Perspective). In these cases, one may consecutively speak of 'false analogisation' of 'phenomenal experience' with 'physical judgment' with the consecutive confusion between 'events' and 'facts'.

The necessary relation of 'events' to the 'context' implies a dynamic component and thus 'change' as being crucial in their epistemic formation. Since the epistemic coordinates in the relation between the experiencing and observing person are constantly changing, the 'context' and 'events' must necessarily be defined as 'dynamic' rather than 'static' and consecutively by 'change' or 'transition' (see also Lombard 1986 who however applies the characterization of 'change' to 'ontological things' rather than 'epistemic relations' as in our case). Due to the epistemic definition of 'context' by the epistemic coordinates in the relation between experiencing and observing person, 'events' can neither be defined by properties i.e. exemplification of properties (Kim 1976). Instead, the epistemic relation between experiencing and observing person ontologically presupposes 'ontological relations' (i.e. 'dynamic configurations') rather than 'ontological properties' (i.e. mental and/or physical properties) (see 3.3.3). This however rules out any (ontological and epistemic) definition of 'events' by either 'properties' or 'exemplification of properties'. Furthermore, this shift from 'ontological properties' to 'ontological relations' requires a different model of causality i.e. dynamic causality (see 3.3.2 and 3.3.3), which makes it impossible to attribute a 'causal role' to 'events' in the classical sense (see, for example, Davidson 1980). Finally, the epistemic definition of 'events' by 'context' and 'change' makes any assumption of a necessary relationship between 'substances' and 'events' impossible. Meixner (1997: 87) deems 'events' and 'substances' as basic ontological entities. In addition to his ontological characterization of 'events', his assumption that 'events' are representing 'substances' (Meixner 1997: 324, 344) must be rejected. Since, due to their static and context-independent nature, the assumption of 'substances' can no longer be made, any relationship between 'substances' and 'events' becomes impossible as well.

The term 'environment' refers to the epistemic coupling i.e. 'selective-adaptive coupling' (see 3.3.2 for definition) between the experiencing and the observing person. The experiencing person i.e. its brain and body may be regarded as the respective 'context' for the observing person; i.e. the 'environment' includes the epistemic coordinates of the relation between experiencing and observing persons. The observing person and thus the environment is therefore necessarily coupled and linked i.e. 'intrinsically' related to the experiencing person – and one may speak of an 'embedded environment' in epistemic respect. Moreover, due to the fact that the term 'environment' includes the 'context' with the epistemic coordinates of the relation between experiencing and observing persons, it can no longer be equated with an 'external environment' as an 'isolated environment' and consecutively an 'external world' (see above). The 'environment' as such has to be distinguished from any 'reality' either subjective or objective. While 'objective reality', as presupposed in empiricism and realism, implies independence from the experiencing person 'subjective reality', as postulated in idealism/constructivism, assumes independence from the environment. Since the term 'environment' in the present sense includes the epistemic coordinates of the relation between experiencing and observing persons as the respective context (see above), neither form of independence (i.e. as presupposed in 'subjective and objective reality' respectively) remains possible. If, however, neither form of independence is possible, the assumption of both 'subjective reality' and 'objective reality' has to be rejected within the framework of an 'epistemology of events and environments'. Moreover, both 'subjective reality' and 'objective reality' presuppose 'reality' and thus a 'world in itself' (see Merleau-Ponty 1958: 36, 46). Presupposing such an account of 'reality' (as a world in itself) we would not experience the 'human world' i.e. our 'environment' (as a 'natural and concrete world' or 'phenomenological world'; Merleau-Ponty 1958: xxii, 381) but rather 'what we ought to experience' i.e. a 'world in itself' (as an artificial and abstract world'). According to Merleau-Ponty, there is however no 'world in itself' neither subjectively nor objectively. The only 'world' that exists is the 'environment' in the present sense. Accordingly, the notion of 'reality' reflecting either an 'internal or external world' has to be rejected.

In conclusion, the terms 'events' and 'environments' reflect distinct aspects in the epistemic coordinates between the experiencing and the observing person: Whereas the term 'event' demonstrates the 'change' and 'context' in their epistemic relation, the term 'environment' focuses on the specific epistemic 'coupling' between both (see above). 'Coupling' is necessarily dependent on 'change' and 'context' and vice versa so that both terms e.g. 'events' and 'environments' must be considered as complementary, considerably overlaping, and necessarily dependent on each other. The terms 'events' and 'environments' therefore describe distinct epistemic aspects rather than different 'epistemic contents'. Since they do not describe different 'epistemic contents', they do not reflect an 'epistemic dichotomy' in the traditional sense (i.e. mutually exclusive) as, for example, 'internal and external world'. Instead of only modifying the latter terms, as in constructivism and realism, our terms 'events' and 'environments' radically undermine any 'epistemic dichotomy' by revealing the 'intrinsic' epistemic linkage between experiencing and observing persons. This 'intrinsic' epistemic linkage between experiencing and observing person may be described as an 'epistemic relation'.

'Epistemology of events and environments'

'Embedded epistemology' can be characterized by a focus on 'events' and 'environments' as the basic 'epistemic units' and thus as an 'epistemology of events and environments'. This 'epistemology of events and environments' can be determined by the following characteristics.

First, an 'epistemology of events and environments' necessarily presupposes an 'intrinsic' relationship between brain, body and environment. 'Events' are 'changes' in the 'environment' as the respective 'context'. 'Events' are reflected in 'phenomenal experience' which, in turn, is subserved by the brain as an 'embedded brain'. Since the brain as an 'embedded brain' is defined by integration within body and environment, 'events' necessarily presuppose an 'intrinsic' relationship between brain, body and environment. The 'environment' can be defined by the inclusion of the epistemic coordinates of the relation between experiencing and observing persons. This allows for 'selective-adaptive coupling' (see 3.3.2 for definition). Such 'selective-adaptive coupling' necessarily presupposes bilateral dependence as well as an' intrinsic' relationship between brain, body and environment since otherwise any coupling would remain impossible (see 3.3.2). Accordingly, the 'environment' in the present epistemic sense necessarily presupposes an 'intrinsic' relationship between brain, body and environment in ontological respect. One may subsequently regard the 'intrinsic' relationship between brain, body and environment as the necessary ontological condition for the epistemic possibility of 'events' and 'environment'. Accordingly, 'embedment', which reflects this 'intrinsic' relationship (see 1.3), remains crucial and constitutive for an 'epistemology of events and environment'.

Second, an 'epistemology of events and environments' can be characterized by bilateral dependency as well as 'co-occurrence and co-constitution' (see below the quote by Schopenhauer as well as 3.3.2 and 3.3.3 for definition of such a relationship) between 'events' and 'environments'. 'Events' refer to 'changes' within the 'environment' as the respective 'context'. 'Events' as 'embedded events' are thus necessarily dependent on the 'environment' since their detachment would lead to the transformation of 'embedded events' into 'isolated events'. 'Environments' refer to the epistemic coupling between experiencing and observing persons. This epistemic coupling is reflected in the 'phenomenal experience' of 'events' as distinguished from 'facts' (see above). If the experiencing person can no longer experience 'events', epistemic coupling between experiencing and observing persons would remain impossible (see, for example, 2.3.1). The impossibility of epistemic coupling implies the detachment of the observing person from the experiencing person (and the dissociation and separation of the 'object of recognition' from the 'subject of recognition'; see above) with the subsequent transformation of the 'embedded environment' into an 'isolated environment'. The 'environment' as an 'embedded environment' thus remains necessarily dependent on 'events'. Due to this bilateral dependence, one may characterize the relationship between 'events' and 'environment' by 'co-occurrence and co-constitution' (see 3.3.3 for exact definition). Both 'events' and 'environment' occur at the same time and are constituted simultaneously since both are necessarily dependent on 'embedment' (see above). Whereas Berkeley recognized the possibility of 'co-occurrence' he neglected both 'bilateral dependence' and 'co-constitution' which is reflected in the following quote (Berkeley 1710: 48): 'For, though we hold indeed the objects of sense to be nothing else but ideas which cannot exist unperceived; yet we may not hence conclude they have no existence except only while they are perceived by us, since there may be some other spirit that perceives them though we do not... It does not therefore follow from the foregoing principles that bodies are annihilated and created every moment, or exist not at all during the intervals between our perception of them'. Kant recognized both 'co-occurrence' and 'bilateral dependence' but neglected the 'co-constitution'. He claimed for the necessity to consider sensory data as sensible objects, i.e., intuition (see above) and cognitive functions of the mind, i.e., understanding (see above). Both sensory data and cognitive functions are reciprocally dependent on each other: The sensory data cannot be cognised without conceptualisation by the cognitive functions whereas the latter remain 'empty' without the former (see above as well as Kant 1998: 193–195). The linkage between both and thus their co-occurrence is ultimately accounted for by the categories. However, these do not provide co-constitution between sensory data and cognitive functions because the categories themselves can be derived from the latter and thus from the understanding. In order to be able to account not only for co-occurrence but for co-constitution, a different approach or re-interpretation of the categories might be necessary. Following Kant, it is Schopenhauer who pointed out the 'co-constitution' which in his terms concerns 'intellect' and 'matter' as 'inseparable correlatives':

> 'The fundamental mistake of all systems is the failure to recognize this truth, namely that the intellect and matter are correlatives, in other words, the one exists only for the other; both stand and fall together; the one is only the others' reflex. They are in fact really one and the same thing, considered from two opposite points of view; and this one thing – here I am anticipating – is the phenomenon of the will or of the thing-in-itself. ... With me, on the other hand, matter and intellect are inseparable correlatives, existing for each other, and therefore only relatively. Matter is the representation of the intellect; the intellect is that in the representation of which alone matter exists.
>
> (Schopenhauer 1996, Vol. II, 15–16)

Third, an 'epistemology of events and environments' can be characterized by the impossibility of either identification or reciprocal subordination/elimination between 'events' and 'environments'. Whereas 'events' are 'changes' in the environment as the respective 'context' (see above), different 'environments' reflect distinct ways of epistemic coupling between experiencing and observing persons. The term 'event' thus refers to the output i.e. the result of a process, which is described by the term 'environment'. On the contrary, 'changes' in the 'environment' reflect specific transitions in the epistemic coupling between experiencing and observing persons which in turn generates 'events'. The 'environments' may subsequently be regarded as the 'vehicle' for the generation of 'changes' and thus for 'events' as 'contents'. Accordingly, the terms 'events' and 'environments' can neither be identified nor eliminated or subordinated – instead they must be considered as complementary epistemic notions. Due to the impossibility of either identification or elimination/subordination between 'events' and 'environment', the 'phenomenological reduction', as suggested by Husserl, must necessarily fail. The phenomenological reduction, as assumed by Husserl as a detachment from the world, aims at complete detachment of 'events' from the 'environment'. Since however 'events' and 'environments' are distinct but bilaterally dependent on each other, completely detaching the former from the latter remains necessarily impossible. 'Vehicle' and 'content' cannot be separated i.e. detached from each other:

> 'The most important lesson which the reduction teaches us is the impossibility of a complete reduction. This is why Husserl is constantly re-examining the possibility of the reduction. If we were absolute mind, the reduction would present no problem. But since, on the contrary, we are in the world, since indeed our reflections are carried out in the temporal flux on the which we are trying to seize, there is no thought which embraces all our thought'.
>
> (Merleau-Ponty 1958: xv)

Fourth, an 'epistemology of events and environments' can be characterized by the impossibility of 'pure' events and 'pure' environments'. 'Pure' events' refer only to 'changes' within the environment and exclude the 'context' of these 'changes'.

However, 'changes' within the 'environment' are always changes in relation to a particular 'context'. The 'change' is thus 'relative' whereas 'absolute' 'change' remains impossible and contradictory to our definition of 'events' as intrinsically 'embedded'. Due to the exclusion of the 'context', 'pure' events would be 'isolated events' which remain impossible within the framework of an 'embedded epistemology'. Moreover, due to the impossibility of 'pure' events, any assumptions of an 'internal world' with a 'subject of recognition', both being well distinguished from an 'external world' and an 'object of recognition' respectively, remain impossible. Accordingly, idealistic forms of epistemology as an 'epistemology of internal worlds' have to be rejected. Conversely, 'pure' environments only refer to one part of the epistemic coupling i.e. the observing person while neglecting the other one i.e. the experiencing person. As a result the epistemic coordinates of the relation between the experiencing and observing persons are not considered. Epistemic coupling without considering one of its parts i.e. the experiencing person remains impossible and thus contradictory to our definition of 'environments' as intrinsically 'embedded'. Due to the exclusion of the experiencing person (as their respective 'context'), 'pure' environments remain impossible within the framework of an 'embedded epistemology'. Moreover, due to the impossibility of 'pure' environments, any assumptions of an 'external world' with an 'object of recognition', both being well distinguished from an 'internal world' and a 'subject of recognition' respectively, remain impossible. Accordingly, empiristic forms of epistemology as an 'epistemology of external worlds' have to be rejected.

Fifth, 'direct contact' to both 'events' and 'environments' remains impossible. We experience 'events' as 'observable and to-be effectuated events within the environment'. However, due to 'autoepistemic limitation', we 'locate' them in ourselves as mental states rather than in our dynamic relation with the environment i.e. as 'changes' in the 'environment' as the respective 'context'. We therefore only have indirect access to 'events' through mental states whereas direct access to them as 'dynamic relations' is precluded (see also 2.3.1 and 3.1.2 for empirical support). The impossibility of 'direct contact' to 'events' precludes constructivistic forms of epistemology. Similar to our approach, constructivism rejects the possibility of 'pure' 'events'. Constructivism nevertheless proposes the possibility of 'direct contact' to the 'events' as 'isolated' which is here denied. Accordingly, an 'epistemology of events and environments' cannot be considered as a form of constructivism. Moreover, we observe other persons (and thus the 'environment') but because the 'environment' is necessarily coupled to the experiencing person itself we can only observe them through our own experience (of 'events'). Therefore, we only have indirect access to 'environments' through our own experience (of 'events') whereas direct access to them as purely observed is precluded (see also 2.2.3 and 2.4.3 for empirical support). Due to the impossibility of 'direct contact' to 'environments', realistic forms of epistemology are precluded. Similar to our approach, realism rejects the possibility of 'pure' environments. However, realism suggests the possibility of 'direct contact' to the 'environments' as 'isolated' which again is denied here. Accordingly, an 'epistemology of events and environments' cannot be considered as a form of realism.

Sixth, presupposition of 'pure' 'events' and 'environments' as well as the simultaneous assumption of the possibility of 'direct contact' may be regarded as necessary conditions for the possibility of neglecting an 'epistemology of events and environments'. Both idealism and empiricism presuppose 'events' and 'environments' as 'pure'. This however implies the presupposition of 'isolated events and environments' thereby transforming them into 'subject and object of recognition' (see above). These definitions lead to the assumption that 'reality' is a 'world in itself' (see above), which can be possessed in either an objective i.e. physical mode, as in empiricism, or a subjective i.e. mental mode, as in idealism. As a result 'embedded events' and 'embedded environments' were transformed into an 'internal world' with mental states and an 'external world' with physical states respectively. Consequently, the focus shifted from 'events' and 'environments' to the type of worlds i.e. 'internal and external worlds' and the type of states i.e. mental and physical states which were attributed to the 'subject and object of recognition' respectively. The development of an 'epistemology of events and environments' was consecutively prevented by the assumption of an epistemological dichotomy between 'internal and external world' with the consecutive development of idealism and empiricism. The epistemological dichotomy between 'internal and external world' was undermined by the development of constructivism and realism that followed. Unlike in idealism and empiricism, the step and inference from 'isolated events and environments' to 'internal and external worlds' is no longer made and is therefore replaced by the assumption of 'direct contact' with either 'isolated events', as in constructivism', or 'isolated environments', as in realism. Consequently, the focus shifted from 'internal and external words' to the type of 'contact' e.g. 'direct' or 'indirect'. As a result, the development of an 'epistemology of events and environments' was prevented by the focus on the type of contact with the consecutive development of constructivism and realism. It should be noted that while this focus on the contact is a necessary conditions for the possibility of neglecting the 'epistemology of events and environments' they are not the necessary conditions for the possibility of neglecting 'embedded epistemology'. A necessary condition for the possibility to neglect 'embedded epistemology' consists in the neglect of 'embedment' (see above), which, in turn, would result in the development of an 'isolated epistemology'. However, the necessary conditions for the neglect of the 'epistemology of events and environments' are closely related to the ones for the neglect of 'embedded epistemology' the latter providing the 'broader and foundational framework' (see 3.3.3 for definition) for the former.

Seventh, the simultaneous impossibility of both 'pure events and environment' and 'direct contact' must be considered as a necessary condition for the possibility of scepticism. We do not only remain unable to access 'pure events and environments' but, in addition, due to the lack of 'direct contact', we remain unable to know anything at all which is for example reflected in the sceptical position by Hume: 'The skeptical doubt, both with respect to reason and the senses, is a malady, which can never be radically cur'd, but must return upon us every moment, however we may chace it away, and sometimes may seem entirely free from it. 'Tis impossible upon any system to defend either our understanding or senses; and we may expose them farther when we endeavour to justify them in that manner. As the skeptical doubt arises naturally from a profound and intense reflection on those subjects, it always encreases, the farther we carry our reflections, whether in opposition or conformity to it.' (Hume 1978: 218). Consequently, an 'evil deceiver' in the sense of Descartes cannot be excluded completely so that we may be deceived entirely in our knowledge about the 'internal and external world'. However, Hume neglects the following. First, the impossibility of 'pure' 'events and environments' does not necessarily exclude the possibility of 'impure' 'events and environments' (see above). Second, the impossibility of 'direct contact' to 'events and environments' does not necessarily exclude the possibility of 'indirect contact' (see above). If one considers this, we may be able access 'events and environments' though only in an 'impure' form (i.e. 'events' can only be experienced in relation to a specific 'environment' and the latter can be observed only in terms of the former; see above). In this case, we are able to know something though in a rather 'indirect' way. Taken together, these assumptions are no longer compatible with an absolute scepticism in the sense of Hume which consequently remains possible only when neglecting both. However, the possibility of an 'evil deceiver' can still not be excluded entirely. We nevertheless cannot be sure whether the 'impure events and environments', as accessed rather 'indirectly', are not mere deceptions of an 'internal and external world'. The epistemic relation between the 'events'/'environments', as indirectly accessed by us (which Kant (1998) would call appearances or 'phenomena'), and a possible 'internal and external world' as the 'world' as it is (which Kant (1998) would call the world itself or 'noumenon') remains unclear and is therefore open to epistemic illusion and thus to an 'evil deceiver'. Whereas, we cannot be deceived about the 'events' and 'environments' themselves i.e. our experiences and observations and thus about our own 'intrinsic' epistemic integration within the environment. Analogous to the 'evil deceiver' with regard to the knowledge about the 'internal and external world', one may therefore speak of an 'angel integrator' with regard to our experience and observation of 'events and environments'. The 'angel integrator' thus limits (and relativizes) the range of scepticism and the 'evil deceiver' to knowledge about the 'internal and external world'. The 'absolute scepticism', as suggested by Hume with respect to the 'internal and external world', must be transformed into 'relative scepticism' since it does not concern 'events' and 'environments'. The 'evil deceiver' must thus be considered in conjunction with the 'angel integrator' i.e. both are complementary because they concern distinct epistemic notions.

3.2.2 'Second-Person Epistemology' and consciousness

'Second-Person Epistemology'

The term 'Second-Person Epistemology' can be defined through the epistemic abilities and inabilities in Second-Person Perspective. The Second-Person Perspective has often been neglected in philosophy. Due to its intermediate position between First- and Third-Person Perspective, it may have been overlooked or subordinated under either perspective. However, the Second-Person Perspective shows epistemic features that distinguish it clearly from both First- and Third-Person Perspective (see 2.4.2). One may subsequently distinguish 'Second-Person Epistemology' from both 'First- and Third-Person Epistemology'. The possibility of the distinctive characterization of 'Second-Person Epistemology' necessarily presupposes a distinction between the different perspectives i.e. 'epistemic pluralism' and absence of 'epistemic hierarchy'. At the same time, the Second-Person Perspective remains necessarily dependent on the First-Person Perspective (see 2.4.2) so that 'Second-Person Epistemology' presupposes 'epistemic dependency'. Due to its characterization by 'epistemic pluralism', 'epistemic dependency' and absence of 'epistemic hierarchy', 'Second-Person Epistemology' necessarily presupposes 'embedded epistemology' (see 3.2.1). It meanwhile remains incompatible with 'isolated epistemology' which is marked by 'epistemic monism', 'epistemic independence' and presence of 'epistemic hierarchy'.

Whereas the First-Person Perspective experiences mental states (see 2.4.1) the Third-Person Perspective observes and judges physical states (see 2.4.3). The transition between the experience of mental states i.e. 'intra-subjective experience' and the judgment of physical states i.e. 'inter-subjective communication' remains unclear because there is no direct linkage, which results in an 'epistemic gap'. However, since the Third-Person Perspective necessarily depends on the First-Person Perspective, some linkage either direct or indirect must be possible. The Second-Person Perspective accounts for the indirect linkage between First- and Third-Person Perspective (see also 2.4.2). Reflecting judgments of mental states i.e. 'intra-subjective communication', the Second-Person Perspective may provide 'epistemic continuity' (see 2.4.3) between 'intra-subjective experience' and 'inter-subjective communication' and thus indirect epistemic linkage between First- and Third-Person Perspective. 'Second-Person Epistemology' can be identified by judgments about mental states as it can be seen in so-called 'phenomenal judgments'. These 'phenomenal judgments' must be distinguished from both 'phenomenal experience' in First-Person perspective and 'physical judgment' in Third-Person Perspective (see 2.2.2 and 2.4.2). 'Phenomenal judgments' provide the basis for the possibility of the description of mental states i.e. phenomenology. The term 'phenomenology' can be understood in two senses. First, it refers to the general description of the 'what' and 'how' of experience (see also Gadenne 1996: 14): What contents do we experience in our mental states? How do we experience these contents? Experience in this sense reflects both unconscious and conscious experience. Second, the term 'phenomenology' refers to a specific method necessary to describe experiences of mental states. Husserl (1952, 1956) and Varela (1996) have suggested that this method is a 'special type of reflection' which provides a 'return to the world as it is experienced in its felt immediacy' (Varela 1996: 333). A 'science of experience' is developed that allows for going 'back to the things themselves'. Since this special type of reflection presupposes consciousness, the 'science of experience' is necessarily related to consciousness. In the following, the term 'phenomenology' shall be used in the first sense i.e. as a general description of the experiences of events rather than in the second sense i.e. as a special method. As a result, phenomenology in the present sense as 'epistemic phenomenology' (see above) includes both unconscious states, as presupposed in First-Person Perspective, and conscious states as revealed in Second-Person Perspective.

Since the Second-Person Perspective is able to detect and judge contents i.e. the respective events within the environment, it still has access to mental states which is no longer the case in Third-Person Perspective. However, in contrast to the First-Person Perspective, the Second-Person Perspective remains unable to experience the respective events by itself. The switch from First-Person Perspective to Second-Person Perspective may therefore be described as a detachment from experiences of mental states while their contents i.e. the respective events remain still accessible. The switch from Second-Person Perspective to Third-Person Perspective, on the other hand, may be described as a detachment from both experience and contents of mental states i.e. their respective events become inaccessible. The transition from 'phenomenal experience' over 'phenomenal judgment' to 'physical judgment' may therefore be accounted for by switches between the three perspectives i.e. First-, Second- and Third-Person Perspective. Due to its intermediate position, 'phenomenal judgment' may be considered as the node or mediator between 'phenomenal experience' and 'physical judgment'. Since it is linked to both, 'phenomenal judgment' may be able to modulate 'phenomenal experience' and 'physical judgment'. For example, 'phenomenal judgment' i.e. conscious awareness (see 3.2.2) of our own emotional experiences may lead to some distance from and decrease in the emotional intensity of 'phenomenal experience' of that emotion. Therapeutically, this is exploited in psychoanalysis. Philosophically, this is reflected in Spinoza's account of passions and ideas (1985, Part V, prop. 3): 'An affect which is a passion

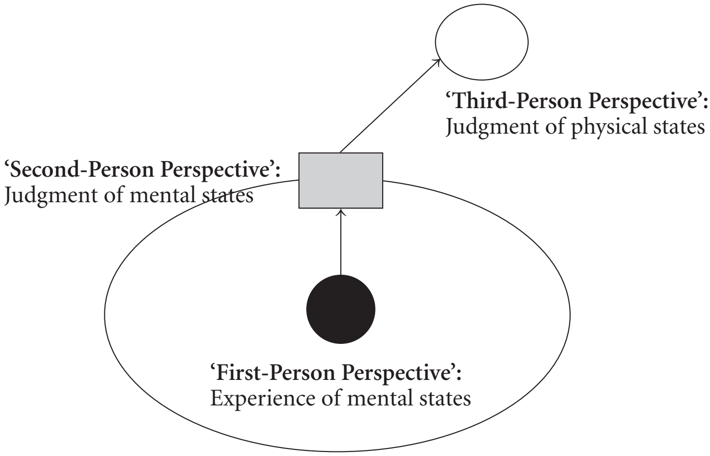


Figure 17. Points of view of and switch between the different perspectives

ceases to be a passion as soon as we form a clear and distinct idea of it'. What Spinoza calls 'affect' and 'passion' may be accounted for by emotional experience in First-Person Perspective in the present context; while 'clear and distinct idea' may be translated into 'conscious awareness' in Second-Person Perspective with the consecutive 'rationalization' of the emotion in thoughts.

The First-Person Perspective can be characterized by a specific spatial position that reflects a 'centre' i.e. 'spatial centre' (see 2.4.1 for further details) from which 'phenomenal experience' can be made. A judgment of 'phenomenal experience' i.e. 'phenomenal judgment' can thus be considered as a description of this 'centre'. The description of the 'centre' can, however, not be done from the 'inside' of the 'centre' itself since experience and judgment could then no longer be distinguished from each other. Accordingly, there must be a switch in the spatial position between First- and Second Person Perspective (see also Figure 17) as it is also reflected in the term 'perspective' which implies a visual-spatial metaphor (Metzinger 1995: 29). It invokes a 'point of view' or 'centre' from which the person encounters the world. This 'point of view' or 'centre' implies a spatial dimension that accounts for the possibility to distinguish between 'centre', 'non-centre' and 'outside the centre'. The spatial position of the Second-Person Perspective cannot be located 'outside' the 'centre' either. In this case, the Second-Person Perspective would no longer have access to 'phenomenal experience' which would make any 'phenomenal judgment' impossible. This for example characterizes 'physical judgment' in Third-Person Perspective (see 2.4.3). Accordingly, the spatial position of the Second-Person Perspective must be located on the border between the 'inside' and the 'outside' of the 'centre', distinguishing it from both First- and Third-Person

Perspective. This position may be characterized as 'eccentric' (Varela and Shear 1999a: 7). Due to this 'eccentric position', the Second-Person Perspective can account for 'phenomenal judgments' which provide the bridge between 'phenomenal experience' and 'physical judgment' i.e. between First- and Third-Person Perspective: While in First-Person Perspective the 'centre' itself is experienced, it is detected and recognized in Second-Person Perspective by mans of 'phenomenal judgment'. It is only in Second-Person Perspective that we can know about the 'centre' as a 'centre'. The Third-Person Perspective, in contrast, can rather be characterized by the absence of any kind of 'centre'. Accordingly, knowledge about the 'centre' as such remains impossible in Third-Person Perspective. As a result of these different 'spatial positions', the different perspectives show different relations to persons. The First-Person Perspective describes the 'I' of the experiencing person as characterized by 'phenomenal experience'. The Second-Person Perspective describes the relation between the 'I' and 'Me' of the experiencing person by providing 'phenomenal judgments' about the own 'phenomenal experience'. In addition, the Second-Person Perspective can also provide 'phenomenal judgments' about the 'phenomenal experiences' of other persons in relation to the ones of the own person though rather indirectly through special methods (see above and 3.2.1). Consequently, the Second-Person Perspective can reflect also though rather indirectly the relation between the 'I' of the own person and the 'I' of another person i.e. the 'Thou'. In the case of assumption of a 'Second-Person Perspective' in epistemology, it has thus been characterized by this dialogical situation between the 'I' and the 'Thou'. This however presupposes 'phenomenal judgment' as demonstrated above. Accordingly, the epistemic relation between 'I' and 'Thou' may be regarded as a particular instance or subset of the more general notion of the 'Second-Person Perspective' which includes both epistemic relations the one between 'I' and 'Me' as well as the one between 'I' and 'Thou'. In contrast, the Third-Person Perspective has no access anymore to any person at all either the own or the other (as a person) and remains thus detached from the 'I', the 'Me' and the 'Thou' because it provides only 'physical judgments' but no 'phenomenal judgments'.

Finally, we will elucidate the question for the necessary conditions for the possibility of switches between the different perspectives. Epistemically, the complementary and mutually exclusive epistemic abilities and inabilities of the different perspectives make switches between the different perspectives necessary because we would otherwise remain unable to fully exploit our epistemic abilities. The possibility of switching to another perspective may thus compensate for the epistemic inabilities in our perspectives. One may re-interpret the 'categories', suggested by Kant, as necessary epistemic conditions for the possibility of switching between perspectives. They may link First- and Third-Person Perspective in order to provide the transition from 'intuition' to 'understanding' i.e. the 'conceivability of intuition' by means of which one can 'think an object of intuition' (see Kant 1998: 212–

213, 219–223, 225–226). 'Categories' in this sense can no longer be regarded as 'a priori laws of the phenomena of nature' but rather as 'epistemic laws' by means of which the 'events within the environment' are detected and recognized in different ways in different epistemic perspectives. Subsequently, 'categories' can no longer be regarded as a priori to 'intuition' and 'understanding' i.e. as 'prior to experience'. Instead, they are rather integral and 'intrinsic' to 'phenomenal experience', 'phenomenal judgment' and 'physical judgment' which makes switching between all three possible. Kant was therefore right by presupposing some kind of 'synthesis', as being closely linked to the 'categories', for the organisation of epistemic abilities: 'By synthesis in the most general sense, however, I understand the action of putting different representations together with each other and comprehending their manifoldness in one cognition. Such a synthesis is pure if the manifold is given not empirically but a priori (as is that in space and time). Prior to all analysis of our representations these must first be given, and no concepts can arise analytically as far as the content is concerned. The synthesis of a manifold, however, (whether it be given empirically or a priori) first brings forth a cognition, which to be sure may initially still be raw and confused, and thus in need of analysis; yet the synthesis alone is that which properly collects the elements for cognitions and unifies them into a certain content; it is therefore the first thing to which we have to attend to if we wish to judge about the first origin of our cognition.' (Kant 1998: 210–211). However, instead of organizing our cognitions a priori, as suggested by Kant, the 'synthesis' may rather allow for transition and thus switch between the different perspectives. In order to indicate this switch between perspectives, Merleau-Ponty (1958: 309) suggests replacing the term 'synthesis' with the term 'transition synthesis': 'If we want to talk about synthesis, it will be, as Husserl says, a 'transition synthesis', which does not link disparate perspectives, but brings about the 'passage' from one to the other'.

Ontologically, changes in the events within the environment, that reflect changes in 'ontological relation' (see 3.3.3), make switches between the different perspectives necessary. Different epistemic perspectives reflect different dynamic configurations within the 'intrinsic' relationship between brain, body and environment. Changes in events within the environment are accompanied by shifts in the 'intrinsic' relationship between brain, body and environment. If, however, the 'intrinsic' relationship between brain, body and environment shifts, dynamic configuration as well as the respective epistemic abilities and inabilities are changed. Changes in the events within the environment therefore have to be accompanied by switches between the different perspectives.

Empirically, changes in the dynamic states i.e. in 'state parameters' (see 3.1.2) make switches between the different perspectives necessary. Different epistemic abilities and inabilities i.e. the different perspectives are accounted for by different dynamic states i.e. different 'state parameters'. Changes in dynamic states i.e. 'state parameters' are subsequently accompanied by changes in epistemic abilities and inabilities i.e. switches between different perspectives. For example, events within the environment may change the focus from the observation of other persons to the experience of the own person and thus from Third-Person Perspective to First-Person Perspective. Since dynamic states are oriented on 'observable and to-be effectuated events within the environment' (see 3.1.2), a change in events will lead to changes in dynamic states i.e. 'state parameters'. These changes in dynamic states account for the generation of different epistemic abilities and inabilities, reflecting the switch from Third- to First-Person Perspective.

Consciousness

Consciousness can be regarded as the main epistemic tool of 'Second-Person Epistemology'. Due to consciousness, we are able to describe and judge our own mental states as experienced in First-Person Perspective (i.e. FPP). Consciousness thus provides access to our own 'phenomenal experience' since it is necessary for any 'phenomenal judgment' in Second-Person Perspective (i.e. SPP).

What is consciousness?

Functionally, consciousness may be accounted for by the simulation of original 'goal-orientation' and its subsequent linkage to the actual 'goal-orientation' (see 2.4.2). If there were only simulation without linkage, access to phenomenal-qualitative states would be blocked, resulting in the absence of consciousness. If there were only linkage without simulation, a difference between conscious and unconscious events would no longer be possible. Unconsciousness would be predominant while consciousness would be absent.

Phenomenally, consciousness may be characterized by 're-experience and re-living' of a particular 'observable or to-be effectuated event within the environment'. Due to 're-experience and re-living', the event can be judged, resulting in so-called 'phenomenal judgment'. These have to be distinguished from both 'phenomenal experience' and 'physical judgments' (see 2.2.2 and 2.2.3 as well as 2.4.2).

Epistemically, consciousness may be characterized by SPP, as distinguished from both FPP and TPP. Being characterized by 'phenomenal judgment', consciousness provides 'intra-subjective communication' which is characteristic for SPP. Consciousness in Second-Person Perspective' must therefore be distinguished from both 'phenomenal experience' in First-Person Perspective and 'physical judgment' in Third-Person Perspective. Since consciousness indicates 're-experience and re-living', it cannot be accounted for by 'intra-subjective experience' itself i.e. 'phenomenal experience' in FPP. Given that consciousness still has access to 'intra-subjective' phenomenal-qualitative states, it cannot be accounted for by 'inter-subjective communication' i.e. 'physical judgment' in TPP which has no access at all to 'phenomenal experience' in FPP. Finally, it should be noted that 'phenomenal judgments' (in SPP) about a certain 'phenomenal experience' (in FPP) might change that 'phenomenal experience'. Whereas this change itself remains unconscious the content of the 'phenomenal judgment' enters into consciousness. This has already been pointed out by Locke (1690, Book II, Chapter IX): 'We are further to consider concerning perception, that the ideas we receive by sensation are often, in grown people, altered by the judgement, without our taking notice of it'.

What is the relation between qualia and consciousness?
In philosophical discussions qualia are usually defined by consciousness, meaning that if there is no consciousness, there are no qualia which would result in so-called 'zombies' (see, for example, Chalmers 1996). These approaches presuppose the epistemic characterization of consciousness by the First-Person Perspective because qualia can be characterized by the latter. Accordingly, Searle (2000: 561) points out: 'Qualia is just a plural name for conscious states' i.e. qualia and consciousness are co-extensive. Intrinsic linkage between qualia, consciousness and First-Person Perspective however is not compatible with our phenomenal and epistemic definition of consciousness. Phenomenally, consciousness is no longer related to phenomenal-qualitative states and thus to qualia in the traditional sense. Instead, we rather characterize consciousness by non-phenomenal but qualitative states and thus 'non-phenomenal qualia' (see 2.4.2). Epistemically, consciousness is no longer characterized by 'intra-subjective experiences' in First-Person Perspective. Instead, we portray consciousness as 'intra-subjective communication' and Second-Person Perspective.

We distinguish consciousness by means of 'non-phenomenal qualia', 'intra-subjective communication' and Second-Person Perspective (see above). In contrast, we illustrate qualia by means of phenomenal-qualitative states, 'intra-subjective experience' and First-Person Perspective (see 2.3.2 and 2.4.2). If qualia and consciousness are different from each other, as it is suggested in the present account, one has to assume both unconscious and conscious qualia. For example, feelings/emotions, as paradigmatic examples of qualia (Northoff 1995b, 2003a), may remain unconscious and could therefore be distinguished from conscious feelings/emotions. There is indeed strong empirical evidence for both unconscious and conscious feelings/emotions. Kihlström et al. (1999) provide several lines of empirical i.e. neuropsychological evidence for the distinction between implicit i.e. unconscious and explicit i.e. conscious feelings/emotions. Lane et al (1998) demonstrates that distinct levels of awareness of emotions are related to distinct degrees of intensity of neural activity in the anterior cingulate. Critchely et al. (2000) shows distinct neural substrates for conscious i.e. explicit (activation of hippocampus) and unconscious i.e. implicit (activation of amygdala) processing of emotional information. Consciousness in the present sense is subsequently no longer defined by qualia i.e. phenomenal-qualitative states. Instead, consciousness can only be regarded as a special form or subset of qualia i.e. 'non-phenomenal qualia' as conscious qualia. Qualia themselves, on the other hand, may provide a broader framework since they can remain either unconscious or become conscious. The distinction between qualia and consciousness subsequently presupposes the distinction between unconsciousness and consciousness. Similar to Block (1996), who distinguishes between 'phenomenal consciousness' and 'access consciousness', we consider both phenomenal and non-phenomenal states as intra-subjective states. However, unlike Block, we do not relate both to FPP by neglecting the difference between 'intra-subjective experience' and 'intra-subjective communication'. Instead, we distinguish between FPP and SPP, the former accounting for 'intra-subjective experience' and the latter being associated with 'intra-subjective communication'. Block's 'phenomenal consciousness' is then replaced by unconsciousness whereas 'access consciousness' is equated with consciousness as being non-phenomenal but qualitative.

What is unconsciousness?

Functionally, unconsciousness can be characterized by actual and non-simulated 'goal-orientation' as distinguished from consciousness as simulated 'goal-orientation' (see above).

Phenomenally, unconsciousness can be characterized by phenomenal-qualitative states i.e. qualia (see 2.3.2) and 'phenomenal experience' as distinguished from consciousness with non-phenomenal states and 'phenomenal judgment' (see above).

Epistemically, unconsciousness can be characterized by 'intra-subjective experience' and FPP (see also 2.4.2) as distinguished from consciousness as 'intra-subjective communication' and SPP (see above).

If unconsciousness can be distinguished from consciousness in functional, phenomenal and epistemic respect, the question for transition and linkage between both arises. Some initially unconscious 'goal-orientations' or events may become conscious while others do not. In some cases, 'phenomenal experience' will be followed by 'phenomenal judgment' which, epistemically, is accounted for by the switch from FPP to SPP. While in other cases, there will be no such switch. The exact epistemic mechanisms and conditions for the possibility or impossibility of that switch between perspectives remain however unclear. Certain events within the environment may favor the switch between First- and Second-Person Perspective so that there may be increased conscious awareness of the respective event. A functional criterion may consist in the degree of compatibility between the different 'goal-orientations': For example, certain past events in memory may either block or facilitate access to consciousness (see 2.4.2). A phenomenal criterion might consist in the intensity of 'phenomenal experiences': While intense 'phenomenal experiences' may facilitate the switch from First-Person Perspective to Second-Person Perspective in order for the respective event to become conscious this may not be the case in less intense 'phenomenal experiences'. It is most likely that the majority of our 'phenomenal experiences' remain unconscious. Since they remain unconscious, 'phenomenal experiences' cannot be detected and recognized directly by means of 'phenomenal judgment' i.e. consciousness. Instead, they may rather be detected indirectly through investigation of potentially underlying neuronal activity. There is indeed strong empirical evidence for neuronal activity during unconscious states. For example, neural activity in the primary input/output areas (see also 2.4.1), such as primary auditory cortex or motor cortex, is usually not accompanied by consciousness (see Colder & Tanenbaum 1999). It also needs to be noted that activities in other areas (e.g. in the hippocampus) may not induce consciousness either (see Eichenbaum 1999; Eldridge et al. 2000). Only neural activity in areas like the prefrontal and parietal cortex, which account for linkage and integration of simulated 'goal-orientation' within actual 'goal-orientation' may be related to consciousness. Accordingly, consciousness may reflect only some part i.e. the 'tip of the iceberg' of neuronal activity within the brain while the rest of it apparently remains unconscious on a phenomenal and epistemic level: 'Images may be conscious or unconscious. It should be noted that, however, not all the images the brain constructs are made conscious. There are simply too many images being generated and too much competition for the relatively small window of mind in which images can be made conscious - the window, that is, in which images are accompanied by a sense that we are apprehending them and that, as a consequence, are properly attended. In other words, metaphorically speaking, there is indeed a subterranean underneath the conscious mind and there are many levels to that subterranean. One level is made of images not attended, the phenomenon to which I have just alluded. Another level is made of the neural patterns and of the relationships among neural patterns, which subtend all images, whether they eventually become conscious or not. Yet another level has to do with the neural machinery required to hold records of neural patterns in memory, the kind of neural machinery which embodies innate and acquired implicit dispositions' (Damasio 1999: 319). The same expressed here on an empirical level is also reflected in epistemic respect by Schopenhauer's consideration of knowledge. He considers knowledge as necessarily tied to consciousness whose origin i.e. unconsciousness (or the 'will' in his context) remains necessarily inaccessible to us which makes direct recognition of the world itself impossible (see also Gardner 1999):

> That we cannot comprehend the world on the direct path, in other words, through the uncritical, direct application of the intellect and its data, but are ever more deeply involved in absolute riddles when we reflect on it, points to the fact that the intellect, and so knowledge itself, is already something sec-

> ondary, a mere product. It is brought about by the development of the inner being of the world, which consequently till then preceded it; and it finally appeared as a breaking through into the light from the obscure depths of the striving without knowledge, and the true nature of such striving exhibits itself as will in the self-consciousness that simultaneously arises in this way. That which precedes knowledge as its condition, whereby that knowledge first of all became possible, and hence its own basis, cannot be immediately grasped by knowledge, just as the eye cannot see itself. (Schopenhauer 1966, Vol. II, 287)

If consciousness indeed only reflects the 'tip of the iceberg' then all philosophical approaches that rely predominantly on consciousness are too narrow in scope. For example, phenomenology, as established by Husserl, relies predominantly on consciousness in its method of 'phenomenological reduction' by means of which it seeks to establish epistemic access to the phenomena themselves. From an epistemic point of view, phenomenology has to be recognized for finding a middle way between idealism, as relying on First-Person Perspective, and empiricism, as relying on Third-Person Perspective (see also 3.2.1). This was achieved by focusing on consciousness and subsequently on Second-Person Perspective. However, similar to both idealism and empiricism, it presupposes 'epistemic monism' and neglects the phenomenal and epistemic difference between First- and Second-Person Perspective. Due to 'epistemic monism', phenomenology remains unable to account for the 'epistemic dependence' of the Second-Person Perspective on the First-Person Perspective. Due to the neglect of the difference between First- and Second-Person Perspective, phenomenology remains unable to account for the difference between consciousness and unconsciousness. The predominant reliance on consciousness and Second-Person Perspective should therefore be resolved within the broader and foundational framework of 'epistemic phenomenology' (see above for definition). In contrast to Husserl's phenomenology, 'epistemic phenomenology' in the present sense includes unconsciousness, consciousness, and non-consciousness and thus all three perspectives i.e. First-, Second-, and Third-Person Perspective (Northoff & Heinzel 2003).

Why has consciousness been attributed such an importance?
In philosophical discussion consciousness was intrinsically linked to qualia, mental states and First-Person Perspective (see above). Consciousness was therefore considered to be the characteristic hallmark for the distinction between mental and physical states i.e. 'mental and physical properties' (see 3.3.3). If there is no consciousness, 'mental properties' remain impossible, resulting in 'zombies' without any mental states, qualia, and First-Person (Zombie) Perspective. The question for consciousness was thus linked to the 'ontological mind-brain relationship problem' (see 1.1.1). Accordingly, consciousness has often been regarded as the 'ul-

timate knot' of the mind-brain problem. Moreover, due to the fact, that qualia, consciousness and First-Person Perspective were intrinsically linked to each other, the idea of the phenomenal and epistemic relevance of unconsciousness could not even be raised in a philosophical discussion. Accordingly, mental life was equated with consciousness, which subsequently became the focus of philosophical discussion. In contrast, investigation of unconsciousness was delegated to psychology i.e. psychodynamics.

Unlike in traditional philosophical discussions, we do not characterize mental states by means of consciousness exclusively: mental states may either remain unconscious or become conscious (see above). Consciousness can only be considered as one special form or subset of mental states but no longer as their defining and constitutive core. The definition of mental states is subsequently broadened by including both unconscious and conscious states; this must be considered as crucial in discussions about the mind-brain problem. Since mental states were defined exclusively by consciousness, consciousness was regarded as the 'ultimate knot' of the mind-brain problem. Nevertheless, if the definition of mental states is broadened by including both consciousness and unconsciousness consciousness can neither be regarded as their defining and constitutive core (see above) nor the 'ultimate knot' of the mind-brain problem. 'False positive importance' of consciousness for the mind-brain problem is thus avoided. At the same time, 'false negative importance' of consciousness for the mind-brain problem is avoided as well. Consciousness can be considered as a special subset of mental states and it should still be taken into account in discussions concerning the mind-brain problem. Due to its distinctive phenomenal and epistemic features it can thus not be neglected entirely or even be denied. Because of the broader definition of mental states, which covers both unconscious and conscious states, the epistemic and ontological framework for the discussion of the mind-brain problem is now expanded. This is, for example, reflected in the possible development of 'embedded epistemology' (see 3.2.1) as well as 'embedded ontology' (see 3.3.3). Within this broader epistemic and ontological framework, the problem of consciousness and the 'ontological mind-brain relationship problem' become decoupled from each other which paves the way for their solution (see 3.3.3).

The possibility of 'false identification' of mental states with consciousness may be traced back to our epistemic design. Epistemic detection of phenomenal-qualitative states, as accounted for by 'phenomenal judgment' in SPP, was falsely equated with 'phenomenal experience' in FPP. Since, due to 'autoepistemic limitation', we i.e. our own brains remain unable to directly experience or detect/recognize our own states as brain states and thus unconscious states (on a phenomenal level) (see above and 2.3.1), we were almost forced into 'false identification' by our own brains. Only the methods for indirect detection and recognition, as, for example, 'First-Person Neuroscience' (see 3.2.1), can provide access to unconscious states. Accordingly, epistemic accounts should consider both direct and indirect methods by means of which 'false identification' of mental states with consciousness and consecutive attribution of 'false positive importance' to consciousness can be avoided.

3.2.3 'Third-Person Epistemology' and thought/language

'Third-Person Epistemology'

'Third-Person Epistemology' can be defined by characterizing the epistemic abilities and inabilities in the Third-Person Perspective. Even though the Third-Person Perspective refers to physical states (see 2.4.3), it does not presuppose the brain as a 'physical brain' and thus neither as an 'isolated brain'. On the contrary, as demonstrated in 'epistemic-empirical relationship' (see 2.4.3), the possibility of the Third-Person Perspective necessarily presupposes that the organization of neuronal states adjusts to 'observable and to-be effectuated events within the environment'. 'Third-Person Epistemology' therefore preconceives the brain as an 'embedded brain' (see 3.3.2). Since 'Third-Person Epistemology' presupposes the brain as an 'embedded brain', it requires an epistemological framework, which can account for the 'intrinsic' integration between brain, body and environment. 'Embedded epistemology' justifies this. This is further supported by the consideration of 'epistemic dependency' (as a characteristic hallmark of 'embedded epistemology'; see 3.2.1) with 'Third-Person Epistemology' being dependent on 'First- and Second-Person Epistemology' (see below for further details). Meanwhile, 'Third-Person Epistemology' remains incompatible with 'isolated epistemology' which on the contrary presupposes an 'isolated brain' and 'epistemic independence'. This 'Third-Person Epistemology' within the framework of an 'embedded epistemology' has to be distinguished from a 'Third-Person Epistemology' on the basis on an 'isolated epistemology'. The latter type of 'Third-Person Epistemology' could no longer account for 'epistemic dependence' of 'Third-Person Epistemology' on both 'First- and Second-Person Epistemology'. The contents of 'physical judgment' in 'Third-Person Epistemology' would remain devoid of any meaning (see below) because a linkage to 'phenomenal experience' (in First-Person Perspective) and 'phenomenal judgment' (in Second-Person Perspective) would be impossible. Since it remains devoid of meaning, this type of 'Third-Person Epistemology' could no longer account for the possibility of 'inter-subjective communication'. Moreover, due to the fact that this type of 'Third-Person Epistemology' presupposes the brain as an 'isolated brain' and thus a 'physical brain' (see above and 3.3.2), it could be characterized as a 'physical epistemology'. As such it has to be distinguished from a 'Third-Person Epistemology' within the framework of an 'embedded epistemology' which, presupposing an 'embedded brain' as a 'biological brain' (see 3.3.3), can be regarded as a 'biological epistemology' (see also 3.1.2 and 3.3.3 for the distinction between 'physical' and 'biological').

'Third-Person Epistemology' in the present sense must be distinguished from both 'First- and Second-Person Epistemology'. Unlike 'First-Person Epistemology', 'Third-Person Epistemology' focuses on physical i.e. neuronal states rather than mental states. The Third-Person Perspective has no access to mental states but it is well able to detect and recognize physical i.e. neuronal states (see 2.4.3). In contrast to 'Second-Person Epistemology', 'Third-Person Epistemology' focuses on 'physical judgment' rather than 'phenomenal judgment' (see 2.4.2). Finally, unlike both 'First- and Second-Person Epistemology', 'Third-Person Epistemology' focuses on inter-subjective states and thus on other persons and the environment rather than on intra-subjective states and the own person with its specific events. It can therefore account for 'facts' in other persons rather than for the 'events' of the own person. 'Third-Person Epistemology' remains thus essential for providing inter-subjective communication. Due to the 'epistemic dependency' of the Third-Person Perspective on the First-Person Perspective (see below), 'inter-subjective communication' is made possible by indirect epistemic access to the other person 'events' as 'facts' through the 'phenomenal experience' and the respective 'events' as experienced by the own person. Strictly speaking, 'Third-Person Epistemology' does not presuppose an 'epistemology of a (an isolated) brain' but rather an 'epistemology of (embedded) brains'. As such it provides the epistemic means for 'inter-subjective communication' between different persons and their 'embedded brains'.

Despite their distinction, 'Third-Person Epistemology' nevertheless remains dependent on 'First- and Second Person Epistemology'. It reflects 'epistemic dependency' as a crucial hallmark of 'embedded epistemology'. 'Third-Person Epistemology' is necessarily dependent on 'First-Person Epistemology'. The First-Person Perspective can be characterized by the experience of events while the Third-Person Perspective accounts for stimuli rather than events (see 2.3.1 and 2.4.3). Unlike events, stimuli exclude the actual context i.e. the time ('When'), place ('Where') and occurrence ('How') of changes in the environment (see 2.3.1 and 3.1.3). However, despite its orientation on stimuli without including the actual context, the Third-Person Perspective remains able to relate its observations to a context i.e. its time ('When'), place ('Where') and occurrence ('How') (in a phenomenal sense not in a physical sense; see Chapters 2.1 and 2.2 as well as 3.2.1). The Third-Person Perspective can therefore refer to other persons 'facts'. Their context is derived (and inferred) from the experience of events in the own First-Person Perspective which provides the context for the observation of others 'facts' in Third-Person Perspective. Due to 'epistemic dependence', 'events', as experienced in First-Person Perspective, are a necessary condition for the possibility of observing, detecting, and recognizing 'facts' in Third-Person Perspective. Without these meaningful events, there would be nothing to detect and recognize in Third-Person Perspective i.e. it would remain 'empty' and meaningless. The 'Third-Person Epistemology' is subsequently necessarily dependent on the 'First-Person Epistemology' so that the former should be investigated through the eyes of the latter: 'I conclude that epistemology must, most fundamentally, be done in the first-person present, whether in the singular or the plural, both at the level of justifying particular judgments and in second-order reflection on epistemic norms' (Stevenson 1999: 497). This is also reflected in the methodological strategy of empirical investigations as, for example, in 'First-Person Neuroscience' (see 3.2.1) and psychology which both presuppose a first-person account being 'intentional and semantic': 'Just like any other sciences, the practice of psychology requires a descriptive apparatus or system of which it is presupposed that descriptions and presuppositions may be put forward that refer to and are about, and thus may be true or false about the things being observed. Hence, it is part of the background presuppositions for psychology – as it is for any of the special and natural sciences – that beliefs and knowledge, as well as descriptions and propositions about the objects being observed, whatever their nature, are intentional and semantic' (Praetorius 2000: 281). Likewise, the 'Third-Person Epistemology' is necessarily dependent on the 'Second-Person Epistemology'. Second-Person Perspective allows for detection as well as recognition of the own phenomenal states by means of 'phenomenal judgment'. If physical states, as observed in Third-Person Perspective, are related to meaning, as experienced in the phenomenal states in First-Person Perspective, the latter have to be detected and recognized as such in Second-Person Perspective. Otherwise, phenomenal and physical states cannot be linked to each other (see also 2.4.3). Accordingly, the possibility of 'Third-Person Epistemology' necessarily depends on 'Second-Person Epistemology'.

The neglect of 'epistemic dependence' with a consecutive presupposition of 'epistemic independence' between the different perspectives opens the door for the elimination/subordination of either epistemology, resulting in 'isolated epistemology' (see 3.2.1): Elimination/subordination of 'First-Person Epistemology' in favour of 'Third-Person Epistemology' may result in 'physical epistemologies' like 'neural realism'/'neural empiricism'. Conversely, elimination/subordination of 'Third-Person Epistemology' in favour of 'First-Person Epistemology' may result in 'mental epistemologies' like 'neural constructivism'/'neural idealism' (see also 3.2.1). This is nicely reflected in the following quote that describes the same with respect to psychology: 'What a psychology hoping to be scientific does not need anymore of is a naturalistic epistemology which attempts to get rid of human cognition, its variety, and dependence on both logical conditions, psychological dispositions and socio-economical circumstances, or which attempts to reduce persons to objects indistinguishable from what are describable solely in terms of physics and the dispositions applying to physical things, or to organisms describable solely in biological terms and according to the dispositions applying to organisms. But neither does a scientific psychology need a constructivist epistemology which attempts to get rid of the objectivity of the wide variety of ways in which persons may cognize and talk about themselves, their acts and the world existing independently of this acting, cognition, and talking, but which attempts to reduce both this world, cognition, acting and talking to mere products of our mind indistinguishable from fantasies, imagination, and myths. As argued throughout this text, both these epistemologies are deeply flawed and nonsensical; a psychology which will make do with either epistemology as a foundation for its research and theorizing will necessarily be equally flawed and nonsensical – no more a science than a superstition‘ (Praetorius 2000). Until now, we only considered the dependence of 'Third-Person Epistemology' on 'First-and Second-Person Epistemology'. However, 'First- and Second-Person Epistemology' may also be dependent on 'Third-Person Epistemology' so that one may speak of 'bilateral dependency'. 'First-Person Epistemology' refers to 'intra-subjective experience' that can neither be detected and recognized by itself nor communicated to others (see also 2.4.1). In order to detect and recognize at least some of these 'intra-subjective experiences' the First-Person Perspective necessarily depends on the Second-Person Perspective, which provides 'intra-subjective communication' (see 2.4.2). In order to communicate the 'intra-subjective experiences' to other persons, the First-Person Perspective necessarily relies on the Third-Person Perspective accounting for 'inter-subjective communication' (see 2.4.3). Accordingly, 'First- and Second Person Epistemology' necessarily depend on the 'Third-Person Epistemology' with respect to the possibility of inter-subjective accessibility and communication.

Thought and language

Since 'Third-Person Epistemology' can be characterized by 'inter-subjective communication', thought and language must be regarded as its main epistemic tools.

What are thoughts?

Functionally, thought may be accounted for by the simulation of original 'act-orientation' (see 2.4.3) and may thus be regarded as a 'mental action' that accounts for 'action on probation' without actual execution. It is important to mention that 'thought' in the present sense is restricted to 'mental actions' but at the same time does not include feelings, imaginations, sensory qualities, etc. Instead, we delimit thought as a 'mental action' to categorization, distinction, composition, compounding, naming, abstraction and discernment. This is important to note because other definitions of thought may be broader. This is, for example, the case in Descartes (1641, second meditation) who presupposes a rather broad definition of thought and 'thinking':

> Let it be so; still it is at least quite certain that it seems to me that I see light, that I hear noise and that I feel heat. That cannot be false; properly speaking it is what is in me called feeling; and used in this precise sense that is no other thing than thinking.

Accordingly, the term 'think' in his famous sentence 'I think therefore I am' (see also 2.4.1 and 3.2.1) includes different epistemic abilities the ones related to First-, Second-, and Third-Person Perspective. This is not the case in the present approach where thought in the more narrow definition is rather associated with the Third-Person Perspective, which remains dependent on the First-Person Perspective (see below). Thoughts defined as such may be characterized by (i) rationality; (ii) close relationship to action; and (iii) necessity.

First, thoughts can be characterized by rationality. Functionally, thoughts may be characterized as 'rational' if there is functional consistency between simulated and actual 'goal-orientation'. They may, however, appear as 'irrational' when simulated 'goal-orientation' and actual 'goal-orientation' are neither consistent nor compatible with each other. Phenomenally, 'rationality' of thoughts is dependent on 'phenomenal experience' which, in turn, presupposes 'embedment' (see 2.3.1). Therefore, 'rationality' is necessarily embedded and it reflects experience of 'consistency' and 'compatibility' between 'mental actions' and the respective environmental context:

> Rationality is precisely proportioned to the experiences in which it is disclosed. To say that there exists rationality is to say that perspectives blend, perceptions confirm each other, a meaning emerges. But it should not be set in a realm apart, transposed into absolute spirit, or into a world in the realist sense.
>
> (Merleau-Ponty 1958: xxii)

The notions of 'consistency' and 'compatibility' (see 2.4.2 for the latter with respect to memory) are closely related to 'similarity'. The higher the 'similarity' between simulated and actual 'goal-orientation', the more consistent and compatible they are with each other and the more rational the thoughts appear. 'Rational' and 'irrational' thoughts are subsequently two extremes of the same continuum ranging from total 'similarity' to complete 'dissimilarity' (see Johnson-Laird et al. 2000; Ramsey 1991: 291–292 for empirical support). Accordingly, 'rationality' no longer reflects an a priori i.e. logic property of thought; there is neither a pre-given 'rationality' nor a pre-existing logos. Instead, the a posteriori degree of 'similarity' between simulated i.e. past and actual i.e. present actions determines the rationality of thoughts which is also reflected in the following quote: 'I have stressed how fundamental the notion of similarity or of kind is to our thinking, and how alien to logic and set theory. I want to go on now to say more about how fundamental these notions are to our thinking, and something also about their non-logical roots.' (Quine 1969: 121). The a priori determination of the rationality of thoughts through logical rules may have contributed to the detachment of thoughts from actions and consecutively from the respective environmental context. Due to this detachment 'rational' thoughts from brain, body, and environment, a mind was assumed to which they could be attributed. This resulted in an 'epistemology of the mind' (see 3.2.1) and an 'ontology of the mind' (see 3.3.3).

Second, thoughts can be characterized by their close relationship to actions. Whereas 'rational' thoughts with 'consistency', 'compatibility' and similarity' may make the transition from thoughts as 'actions on probation' to 'real actions' possible 'irrational' thoughts may make 'real actions' impossible. The close relationship between 'rational' thoughts and actions (and feelings) has already been expressed by Spinoza (1985, Part III, prop. 1): 'Our mind acts at times and at times suffers: in so far as it has adequate ideas, it necessarily acts; and in so far it has inadequate ideas, it necessarily suffers'. What Spinoza calls 'ideas' may be called 'thoughts' in the present context. The term 'adequate' may be explained by 'consistency', 'compatibility', 'similarity', and 'rationality' while 'inadequate' may reflect 'inconsistency', incompatibility', 'dissimilarity', and 'irrationality'. Moreover, Spinoza points out the reciprocal dependence between thoughts and actions with thoughts guiding actions and actions shaping thoughts (1985, Part V, prop. 1): 'Therefore, as the order and connection of ideas in the mind is according to the order and connection of the affections of the body, it follows, vice versa, that the order and connection of the affections of the body is according to the order and connection in the mind of the thoughts and ideas of things'. What Spinoza calls 'affections of the body' may be interpreted by 'actions' as 'to-be effectuated events within the environment' by the body; 'ideas of the mind' may be accounted for by 'thoughts of the embedded brain' within the present context.

Third, thoughts may be characterized by necessity i.e. non-contingence. 'Necessity' of thoughts may reflect accordance and integration between thought contents and the actual environmental context, which, ontologically, may be accounted for by 'selective-adaptive coupling' (see 3.3.2). It is important to note that 'necessity' can neither be traced back to the mind nor the environment itself. Unlike in idealistic approaches, 'necessity' is not provided by a mind or subject being inherent in either brain, body or environment. There is nothing else than brain, body and environment – the 'necessity' results from their relationship itself. Unlike in empiristic approaches, 'necessity' is not a 'constant conjunction of like objects' or 'inference from one object to another' (Hume 1748, section VIII, part II, 75). In this approach, 'necessity', while neglecting its relation to brain and body, is delegated almost entirely to the environment. However, 'necessity' is not a mere conjunction of or inference from coincidental occurrences of objects within the environment. Instead, 'necessity' results from 'selective-adaptive coupling' within an 'intrinsic' relationship between brain, body and environment. 'Necessity' of thoughts therefore reflects an 'optimal fit' and good 'matching' (see 3.3.2. for definitions of these terms) between particular thoughts and their respective environmental context.

What is the relationship between thoughts and emotions?
Psychologically, thoughts are closely related to emotions as it is, for example, reflected in 'decision making' (see 2.3.3). Emotions may select and guide our thoughts so that one may speak of so-called 'hot thoughts'. Accordingly, there is a direct interaction between emotions and thoughts (see also 2.4.3). If, in contrast, emotions are dissociated from thoughts, one may speak of so-called 'cold thoughts'. The interaction between emotions and thoughts has often been neglected in philosophical discussions. Either, thoughts were regarded as independent from emotions as well as any subjective experience. Or emotions were subordinated to thoughts and determined as 'pre-cognitive' as it is reflected in cognitive theories of emotions (see 2.3.2). Subsequently, philosophical discussion presupposed 'cold thoughts' rather than 'hot thoughts'. The contents of thoughts were often supposed to reflect an 'objective' world one that is independent from the 'subjective' experience of emotions in mental states and their respective events within the environment. 'Cold thoughts' were thus detached from their respective environmental context and can therefore be characterized as 'isolated thoughts'. However, considering the various interactions between emotions and thoughts (see 2.4.3), a presupposition of thoughts as 'cold thoughts' remains empirically rather implausible. Accordingly, the contents of thoughts can no longer be dissociated from the emotions and thus detached from the respective events within the environment. Instead, our thoughts as 'embedded thoughts' may be guided and selected by emotions. Meanwhile the converse also remains true. Emotions may be determined by thoughts with respect to particular events in the environment. There seems to be a reciprocal relationship between emotions and thoughts both being necessarily dependent on each other. Finally, detachment i.e. 'isolation' between emotions and thoughts may lead to alterations in both thoughts and emotions. The dependence between emotions and thoughts is also expressed by Spinoza (1985, Part V, prop. 2): 'If we detach an emotion of the mind or the affect from the thought of an external cause and connect it with other thoughts, then the love or hatred towards the external cause and the fluctuations of the mind which arise from these affects will be destroyed'. The less emotions are involved in thoughts the more the thoughts may be characterized as necessary and non-contingent. On the other hand, the more emotions are involved the less we may be inclined to characterize the respective thoughts as necessary but rather as contingent. 'Hot' thoughts may thus be characterized as predominantly contingent while 'cold' thoughts may rather be designated as necessary.

What is the relationship between thoughts and 'embedment'?
Phenomenally, thoughts are experienced as detached from any of bodily and environmental context i.e. as 'isolated thought'. This is nicely reflected in the following quote: 'What goes on in your head when you have a thought? This question is posed here as if context, environment, and circumstance did not matter but, of course, they do' (Edelman & Tononi 2000: 200). However, considering the close relationship between actions and thoughts (see above and 2.4.3), phenomenal experience of thoughts as 'isolated thoughts' must be regarded as an illusion and subsequently remains empirically implausible. This illusion may be due to our inability to detect and recognize our own brain states as brain states i.e. 'autoepistemic limitation' (see 2.3.1). Instead, thoughts should rather be characterized as 'embedded thoughts' that are integrated within and linked to the respective bodily and environmental context.

In addition, thoughts seem to provide access to other individuals as well as the 'objective' world. Functionally, behaviour and movements, as observed in others, are linked to our own simulated 'goal-orientations' (see 2.2.3 and 2.4.3). By means of this linkage, we can infer others' thoughts, intentions and mental states. Phenomenally, we do not realize that it is our own simulated 'goal-orientation' by means of which we infer other people's thoughts, intentions and mental states. Instead, we confuse our own simulated 'goal-orientation' with the one from the other person and make no principal difference anymore between our own and the other persons 'goal-orientation'. We therefore have the impression that our thought contents directly reflect the ones of the other person. Epistemically, the phenomenal confusion between the own and other persons thought contents may be reflected in the possibility to assume an 'objective' world, as distinguished from a 'subjective' world. The assumption of such an 'objective' world implies 'naïve realism' (see also Metzinger 1993, 1995). It is 'naïve' because there is direct inference from the own 'subjective' world to the 'objective' world the former becoming equated with the latter. it is 'realism' because the 'objective' world is supposed to be the real i.e. existing world as it is. Accordingly, the principal possibility of epistemological conceptions of empiricism and realism, which presuppose an 'objective' world (and 'naive realism'), may ultimately be traced back to the phenomenal confusion between our own and others' thought contents.

What is the relationship between thoughts and language?
Thoughts are often characterized by 'inter-subjective communication' and Third-Person Perspective. This is paradigmatically reflected in the assumption of a close relationship between thought and language. Thoughts are closely related to actions (see above as well as 2.2.3 and 2.2.3). If language is supposed to be closely linked to thoughts, one may also assume intrinsic similarities between language and actions.

This actually seems to be the case as empirical evidence, which is briefly described in the following, shows.

First, there is an anatomical overlap between movements and language in the observation/execution matching system i.e. in particular in Broca's area (see 2.2.3). Second, there is a relationship between the meaning of words and the 'goal-orientation' of actions with regard to neurophysiological substrates (see Frederici et al. 2000; Xiong et al. 2000). Third, words reflect actions (see also Keijzer 1998; Thelen & Smith 1994: 323–324; Lakoff & Johnson 1999): 'Even more remarkably, Johnson shows how the modal verbs such as can, may, must, should, could, might – verbs that have perfectly legitimate logical structure in the language and can be expressed as propositional structure – can also be understood in a more root, experiential sense. These verbs of possibility, necessity, and permission carry with them the meanings of overcoming barriers, impulsion, and other force-related acts on the environment. Johnson maintains these understandings as prelinguistic. The concept of must or can need not be learned from language, but from everyday acts of force, of moving limbs and body around barriers, of grabbing things within reach, of controlling forceful interactions between your bottom and the chair, and so on' (Thelen & Smith 1994: 324). Analogous to 'physical movements' that express actions, language as 'mental movements' may be regarded as the expression of simulated actions i.e. thoughts. However, since expressions can be either verbal or non-verbal, thoughts are not necessarily linked to language. Thoughts may subsequently also be expressed non-verbally. Empirically, this is for example the case in babies (Thelen & Smith 1994) and specific individuals (see, for example, A. Einstein about his thoughts cited in Edelman & Tononi 2000: 201). Accordingly, the assumption of a so-called 'language of thought' (Fodor 1983, 1995) remains empirically problematic.

The dissociation of thoughts from the bodily and environmental context and the necessary linkage between thoughts and language may have contributed to the detachment of the Third-Person Perspective from the First-Person Perspective. The First-Person Perspective was no longer considered a necessary condition for the possibility of thoughts and language. TPP was separated from FPP and characterized by special abilities i.e. thoughts and language that were neither available in FPP nor dependent on SPP. The special phenomenal and epistemic characterization of TPP lead to the assumption that thoughts and language as 'isolated thoughts and language' are completely independent and detached from perception and action (and ultimately from brain, body, and environment). As a result thoughts and language appeared as completely novel abilities. However, this conception remains empirically implausible (see above). Empirically, this is, for example, reflected in the close relationship between thoughts on one hand and action and perception on the other implying 'embedded thoughts and language' (see above): 'Language, logic, consciousness, imagination, and symbolic reasoning are not 'above' the processes of motivated perception, categorization, and action that we have been describing. Rather they are part and parcel of these processes, seamless in time and mechanism. Above all, we maintain, higher cognition is developmentally situated. It grows from and carries with it the history of its origins. In particular, cognition is embodied and socially constructed' (Thelen & Smith 1994: 321). The conception of language as a novel ability is likewise not compatible with the dynamic organisation of the brain but must be considered as an illusion. This is revealed in the following quote, which reflects the perspective of the brain itself i.e. a 'First-Brain Perspective' (see also 3.1.2 and 3.2.1 for definition of the 'First-Brain Perspective'):

> John's language, introspections, and oversimplistic physicalism incline him to identify my organisation too closely with his own limited perspective. He is thus blind to my fragmentary, opportunistic, and generally alien nature. He forgets that I am in large part a survival-oriented device that greatly predates the emergence of linguistic abilities, and that my role in promoting consciousness and linguaform cognition is just a recent sideline. This sideline is, of course, a major root of his misconceptions. Possessed as John is of such a magnificient vehicle for the compact and communicable expression and communication of knowledge, he often mistakes the forms and conventions of that linguistic vehicle for the structure of neural activity itself.
>
> (Clark 1997, epilogue)

3.3 'Ontology of the brain': 'Embedded brain', 'embedded ontology' and 'self-reference' of the brain

> 'If the brain is well organized and trained, then it may be like a fertile, well-seeded soil, which generates a hundred times more than it initially received.'
>
> LaMettrie

'Ontology of the brain' investigates the ontological definition of the brain as well as the presupposed ontological framework. The ontological definition of the brain has rarely been discussed in philosophy. Reasons for this might be methodological and epistemic issues. Due to the lack of methodological tools, when bridging the gap from empirical hypothesis to ontological concepts (see 1.4), the brain has rather been neglected in philosophical discussions. Instead, ontology focused on the mind and its logical conditions as supposed to include natural conditions and as such the brain. Accordingly, the ontological investigation of the brain has often been considered as superfluous and non-philosophical. Based on neurophilosophical methodology (see 1.4), we start our ontological investigation with the brain itself. As a result we will focus on the development of 'Neuroontology' which can be defined by the ontological definition of the brain itself e.i. independent from the mind. Natural ontological conditions of the brain are revealed. These can then be distinguished from purely logical conditions, as investigated in ontology, which do not necessarily refer to the human brain. 'Neuroontology', by providing a direct linkage between the empirical hypothesis and ontological concepts with respect to the brain, may therefore contribute to both philosophy and neuroscience. 'Neuroontology' may contribute to neuroscience by revealing functional principles and organisational characteristics of the brain which have been neglected so far. In addition to neurophilosophical methodology, 'neuroontology' strongly relies on both 'neuroepistemology' (see Chapter 2) and 'epistemology of the brain' (see 3.2). Considering epistemic abilities and inabilities of the brain may reveal the necessary epistemic conditions for the possibility and impossibility of the development of certain types of ontology. This may contribute to the philosophical discussion by accounting for the possibility of both different types of ontology and the neglect of the brain itself in philosophy.

'Neuroontology' may be considered as the core of the 'ontology of the brain'. 'Ontology of the brain' covers a broader ontological framework than 'neuroontology': While 'neuroontology' focuses on the ontological determination of the brain itself, 'ontology of the brain' investigates the ontological framework for the possible ontological determination of the brain. By developing novel ontological frameworks that are compatible with the natural ontological determination of the brain it may consequently contribute to philosophy. Furthermore, 'ontology of the brain', by raising the problem of 'self-reference' of the brain, may reveal the necessary and sufficient conditions for its own principal possibility. Since the necessary and sufficient conditions for the principal possibility of 'ontology of the brain' may overlap with those for the principal possibility of philosophy, the problem of 'self-reference' of the brain may be relevant for philosophy as well. This may contribute to philosophy by revealing and elucidating its own necessary and sufficient conditions. In orientation on this concept of ontology, we first discuss the ontological determination of the brain, which reflects 'neuroontology'. We will discuss two different ontological definitions of the brain the 'isolated brain' and the 'embedded brain'. This is followed by a discussion of the ontological frameworks, which are presumed in both definitions; that reflects the 'ontology of the brain'. Whereas the brain as an 'isolated brain' presupposes an 'isolated ontology' the brain as an 'embedded brain' makes the development of a novel ontological framework i.e. an 'embedded ontology' necessary. This 'embedded ontology' can be characterized by the rejection of 'physical ontology' and 'mental ontology', both of which must be considered as forms of an 'isolated ontology'. 'Embedded ontology' is compatible with the empirical as well as epistemic characterization of the brain. In addition to the development of a novel ontological framework, the necessary and sufficient conditions for the principal possibility of 'neuroontology' and 'ontology of the brain' will be investigated by raising the problem of 'self-reference' of the brain. If 'self-reference' of the brain is impossible, 'neuroontology' and 'ontology of the brain' will also remain principally impossible. Accordingly, the problem of 'self-reference' remains crucial for the principal possibility (and validity) of 'neuroontology' and 'ontology of the brain' as well as for neurophilosophy and philosoply.

3.3.1 'Neuroontology': Brain as an 'isolated brain'

'Neuroontology' is a novel discipline (Northoff 2000b) which can be defined by the ontological definition of the brain itself. Although the ontological definition of the brain itself is rarely determined explicitly in philosophical discussions, it nevertheless appears implicitly in distinct contexts (see below). A brain may be separated from both body and environment. Such a brain may ontologically be described as an 'isolated brain', which can be characterized by the absence of 'intrinsic' integration within body and environment. In view of that, different forms of the ontological definition of the brain as an 'isolated brain' may be distinguished from each other. Ontologically, the brain as an 'isolated brain' may be characterized as a 'structural brain', 'functional brain', or 'mental brain'. Each of these ontological characterizations of the brain shall be briefly explained and then investigated with respect to their empirical, empirical and ontological plausibility.

The brain as a 'structural brain'

The brain may be defined ontologically by its anatomical structures that determine the brain as a brain. One may therefore define the brain as a 'structural brain'. Though the importance of both psychophysiological functions and mental states is not denied, they cannot be considered as 'constitutive' for the brain. Mental states and psychophysiological functions may either be reduced to or identified with the anatomical structures so that, at best, they may be necessary but not sufficient conditions for the brain as a 'structural brain'. Anatomical structures, in contrast, are 'constitutive' for the brain as a brain and must therefore be regarded as both necessary and sufficient condition for the ontological definition of the brain as a 'structural brain'. Since the anatomical structures of the brain can be characterized by 'physical properties', the 'structural brain' may be determined as a 'physical brain' in ontological regard. As such it must be distinguished from both 'informational brain' and 'mental brain' (see below). The philosophical definition of the brain as a 'structural brain' relies predominantly on the observation of the relation between brain identity and personal identity. Even if a person no longer shows mental states and psychophysiological functions, its personal identity is nevertheless preserved as long as the anatomical structures of its brain and thus the brain itself are maintained (see Mackie 1976: 200–203). This is further illustrated in Parfit's 'physical spectrum' (Parfit 1989: 230–293; Northoff 2001b, 2003c). Gradual exchange of single cells (as the microscopic analogue of anatomical structures) leads to changes in brain identity with consecutive alteration in personal identity. While the personal identity may be preserved in the case of alterations in mental states and/or psychophysiological functions related to the brain, personal identity can no longer be maintained in the case of changes in the anatomical structures of the brain. If, however, personal identity changes with anatomical structures, the identity of the brain i.e. brain identity must be altered as well (see Northoff 2001b, 2003c, e). Brain identity can subsequently be defined by anatomical structures, which are 'constitutive' i.e. necessary and sufficient conditions for the brain as a brain. Mental states and psychophysiological functions, on the other hand, may be regarded, at best, as necessary but not sufficient conditions for the brain's identity and consecutively for personal identity. Neglecting the 'constitutive' role of anatomical structures for the identity of the brain implies (i) the possibility of dissociation between brain identity and personal identity, and/or (ii) the introduction of another i.e. non-anatomical, non-functional and non-mental 'constitutive' characteristic for the brain's identity. Neither assumption however remains plausible. In the case of an altered brain identity, personal identity changes as well so that there is, at least, a necessary if not sufficient relation between the two (see Northoff 2001b, 2003c). Introducing another 'constitutive' characteristic for the identity of the brain as, for example, the notion of 'information', remains rather inconsistent with empirical, epistemic and ontological evidence (see below). Since both assumptions are implausible, the 'constitutive' role of anatomical structures in the identity of the brain cannot be denied. Accordingly, the brain itself must be defined by anatomical structures.

Ontologically, defining the brain as a 'structural brain' and thus as 'physical brain' implies materialism (with respect to the ontological mind-brain relationship) and 'physical ontology'. However, both assumptions materialism and 'physical ontology' remain implausible (see below). Accordingly, there is no ontological evidence for an ontological definition of the brain as a 'structural brain' i.e. 'physical brain'. The materialism may either be reductive/eliminative or non-reductive. In the case of eliminative and reductive materialism, mental states and psychophysiological functions can no longer be considered as necessary conditions for the brain. Considering the close relationship between the functional organisation of the brain and mental states (see 2.3.1) this remains rather implausible in both empirical and ontological regard (see also 3.1.3, 3.3.2 and 3.3.3 for detailed explanation). In the case of non-reductive materialism, mental states and psychophysiological functions may be regarded as necessary though not sufficient conditions for the brain. Then, the question for the ontological linkage between anatomical structures and mental states/psychophysiological functions may be raised. This may be answered by the introduction of emergentism, supervienence or epiphenomalism, which are, however, implausible by themselves (see 3.3.3). Finally, since anatomical structures can solely be defined by 'physical properties', the 'structural brain' as a 'physical brain' presupposes 'physical ontology'. However, both 'physical brain' and 'physical ontology' remain incompatible with the 'dynamic brain', the 'embedded brain', and 'embedded ontology' (see 3.3.2 and 3.3.3).

Epistemically, defining the brain as a 'structural brain' implies a restriction to the Third-Person Perspective because it focuses exclusively on 'physical properties'. 'Physical properties' can be accounted for in Third-Person Perspective (see 2.4.3), which makes the inclusion of First-Person Perspective superfluous. Both assumptions, neglect of First-Person Perspective and restriction to Third-Person Perspective, remain however implausible (see below). Accordingly, there is no epistemic evidence for an ontological definition of the brain as a 'structural brain'. We demonstrated that the First-Person Perspective shows specific epistemic abilities and inabilities that must be distinguished from the ones that portray Second- and Third-Person Perspective (see 2.4.1, 2.4.2 and 3.2.1). Accordingly, the First-Person Perspective can neither be eliminated nor subordinated in favour of the Third-Person Perspective (see 3.2.3). A restriction to Third-Person Perspective remains therefore impossible in epistemic and empirical respect. Methodologically, the brain itself requires consideration in First- and Third-Person Perspective (i.e. 'First- and Third-Person Neuroscience'; see 3.2.1) and consecutively both phenomenal(dynamic) and physical characteristics. Any ontological account which reduces the brain to 'physical properties' remains therefore incompatible in epistemic respect.

Empirically, the definition of the brain as a 'structural brain' implies the complete determination of mental states and psychophysiological functions by means of anatomical structures. This however remains incompatible with both principles of dynamic brain organisation (see 3.1.1) and the characterization of the brain as a 'dynamic brain' (see 3.1.2 and 3.3.2). Accordingly, there is no empirical evidence for the ontological definition of the brain as a 'structural brain'. If mental states and psychophysiological states are completely determined by anatomical structures, several principles of the dynamic organisation of the brain (see 3.1.1) could not be maintained. The 'principle of double realization' and the 'principle of anatomo-structural similarity' remain impossible since the functions would be determined exclusively by anatomical structures. Moreover, the 'principle of economy' would be superfluous because different functions would be determined by different anatomical structures. Similarly, the 'principle of complex modulation' remains no longer necessary because modulation is not needed to determine a function in the anatomical structures. Finally, the 'principle of functional primacy' would have to be replaced by a 'principle of structural primacy'. The exclusive and complete determination of psychophysiological and mental states by anatomical structures also remains incompatible with the characterization of the brain as a 'dynamic brain' (see 3.1.2). The 'structural brain' can then be compared with a cognitive or, at best, a connectionist system but no longer with a dynamic system and thus the 'dynamic brain'. In that case, the principal difference between brain and computer, which can be regarded as cognitive or connectionist systems (see 3.1.2), would no longer exist. Moreover, a one-to-one relationship between structure and function must be assumed which makes any dynamic state and self-organisation impossible. If this, however, is the case and self-organisation and dynamic states remain impossible, the 'brain code' can no longer be characterized by 'event coding' but rather by 'stimulus coding'. Finally, a 'structural brain' presupposes 'mental representation' as an 'isolated representation' which remains incompatible with 'embedded representation' (see 3.1.2).

The brain as a 'functional brain'

The brain may be defined ontologically by its functions that determine the brain as a brain. One may thus define the brain as a 'functional brain'. Although the importance of both anatomical structures and mental states (see 3.3.1) is not denied, they cannot be considered as 'constitutive' for the brain. They may either be reduced to or identified with the functions so that, at best, one may regard them as necessary but not sufficient conditions for the brain as a 'functional brain'. Functions, in contrast, are 'constitutive' for the brain as a brain and must therefore be regarded as both necessary and sufficient condition for the ontological definition of the brain as a 'functional brain'. If the term 'functional' refers to physiological functions, the 'functional brain' may be determined as a 'physical brain' - this because physiological functions can be reduced to 'physical properties'. If the term 'functional' refers to computational functions, the 'functional brain' may be defined as an 'informational brain'. If the term 'functional' refers to psychological functions as mental states, the 'functional brain' may be determined as a 'mental brain'. The philosophical definition of the brain as a 'functional brain' relies predominantly on (i) the possibility to dissociate between anatomical structure and psychophysiological function; and (ii) similarity between brain and computer with respect to functional architecture. Changes in both physiological and psychological functions of the brain may occur independent from its anatomical structure. For example, amnesia, reflecting disturbance in the psychological memory function, may not necessarily be accompanied by changes in the anatomical structure. The anatomical structure may remain fully intact despite the changes in either physiological or psychological function (see Northoff 2001b). Accordingly, Zemnach (1987) speaks of a 'functional-molar brain', distinguishing it from the 'structural brain'. It should however be noted that the terms 'structure' and 'function' are not clearly defined. 'Anatomical structures' may only refer to those structures that are macroscopically visible. In this case, there might not be any overlap with physiological functions. However, this may be the case when including microscopic structures like single cells, channels, membranes etc. in the definition of 'anatomical structures'. The boundary between 'anatomical structure' and 'physiological function' may subsequently be blurred (see also Northoff 1995a, 2001b) which results in definition of the brain as a 'physical brain'. A 'psychological function' could be defined by those functions for which neither an anatomo-structural nor a physiological correlate can be principally detected. The 'psychological function' can then be clearly distinguished from both 'anatomical structures' and 'physiological functions'. The 'psychological function' can in this sense no longer be distinguished from mental states since these cannot be detected within the anatomo-structural and physiological characteristics of the brain. One can therefore introduce the 'psychological function' as a 'mental function' i.e. 'mental psychological function' which initiates the definition of the brain as a 'mental brain' (see below). The 'psychological function' may also be defined by those functions for which an anatomo-structural or physiological correlate has not been detected as of now, though such finding remains principally possible. Finally, in case a 'psychological function' can be presented as a 'non-mental function', they have to be subsumed under either a 'anatomical structure' or a 'physiological function'. Accordingly, an exact definition and distinction between 'anatomical structure', 'physiological function', 'psychological function', and mental states remains rather problematic. Dennett (1987: 235) compares the functional architecture of the brain with the one of the computer. The computer can be described by means of computational relations between input, internal state, and output as well as by the distinction between hard- and software. Analogously, the brain receives input and transforms this into internal states and consecutively into output. As a result, while the anatomical structures may be regarded as 'hardware', the psychophysiological function as determined by the computational relationship between input, internal state, and output may be considered as software. Accordingly, a function is defined in terms of computational relation so that one may speak of 'computational function'. Since the 'computational function' determines the brain, one may define the brain as a 'functional brain' or 'computational brain'.

Ontologically, the definition of the brain as a 'functional brain' implies monism as materialism and 'physical ontology' in case one presupposes the 'function' as a 'physiological function'. Presupposition of 'computational function', on the other hand, rather results in a dual-aspect theory and 'informational ontology'. Both ontological assumptions, however, remain implausible (see below). Accordingly, there is no ontological evidence for the ontological definition of the brain as a 'functional brain'. If one characterizes 'function' by means of 'physiological function' or 'psychological function' as a 'non-mental function' (see above), the brain as a 'functional brain' can be characterized ontologically by 'physical properties' exclusively. The assumption of 'physical properties' presupposes 'physical ontology' which results in materialism. Both assumptions, 'physical ontology' and materialism remain, however, implausible in ontological regard (see 3.3.3). If one defines 'function' by means of 'computational functions' (see above), one has to assume an 'informational ontology' as distinguished from 'physical ontology'. However, if one wants to avoid defining 'informational ontology' by 'mental ontology', the ontological distinction between 'informational ontology' and 'physical ontology' remains rather difficult. Not being able to distinguish between these two forms of ontology subsequently results in 'physical ontology' and materialism, which are both implausible. In case the distinction between 'informational ontology' and 'physical ontology' was successful, one would have to assume a dual-aspect theory, which, however, remains implausible as well (see 3.3.3). Accordingly, either approach i.e. non-distinctive or distinctive characterization of 'informational ontology' remains implausible in ontological regard. If one defines 'function' by means of 'psychological function' as 'mental function', the brain as a 'functional brain' could no longer be distinguished from the brain as a 'mental brain'. The definition of the brain as a 'mental brain' results, however, in several ontological inconsistencies as well so that this concept also remains implausible (see below).

Epistemically, the definition of the brain as a 'functional brain' implies a restriction to either Third-Person Perspective or First-Person Perspective. While 'functional' in the sense of 'physiological function' and 'computational function' presupposes the restriction to Third-Person Perspective, 'functional' in the sense of 'psychological function' as 'mental function' presupposes the restriction to First-Person Perspective. Both epistemic assumptions, however, remain implausible (see below). Accordingly, there is no epistemic evidence for an ontological definition of the brain as a 'functional brain'. As demonstrated above, the restriction to the Third-Person Perspective with consecutive neglect of the First-Person Perspective must be considered as implausible. Neglect of the First-Person Perspective implies impossibility of 'First-Person Neuroscience' (see 3.2.1) with the consecutive restriction of the investigation of the brain to 'Third-Person Neuroscience'. The converse assumption with restriction to First-Person Perspective and consecutive neglect of the Third-Person Perspective also remains implausible. The Third-Person Perspective is presupposed in 'physical observations' (see 2.4.3 and 3.2.3) and thus in any science. Without the Third-Person Perspective, 'Third-Person Neuroscience' (see 3.2.1) would subsequently be principally impossible. Restriction of the brain to either perspective remains therefore implausible in epistemic regard.

Empirically, the definition of the brain as a 'functional brain' implies the non-necessity of the principles of the dynamic organisation of the brain (see 3.1.1) in the case that 'functional' is determined by 'physiological functions'. 'Functional' in the sense of 'computational function' requires that the brain as a 'dynamic system' (see 3.1.2) is replaced by cognitive/connectionist characterizations. Both assumptions, however, remain implausible (see below). Accordingly, there is no empirical evidence for an ontological definition of the brain as a 'functional brain'. The principles of the dynamic organisation of the brain (see 3.1.1) do not describe particular properties that account for 'physiological function'. They rather describe the organisation of 'physiological properties'. The organisation itself accounts for 'physiological function' which must subsequently be distinguished from 'physiological properties' themselves. This, however, is often neglected by equating 'physiological function' with 'physiological properties'. 'Physiological properties' are then considered as a sufficient condition for 'physiological functions'. This is for example presupposed when depicting the brain as a network in which its spatiotemporal 'vectors' are defined by 'microphysiological properties' (see, for example, Churchland 1985: 8–28, 1988: 39–41). In this case, the dynamic organisation of the brain is no longer necessary for the brain as a brain i.e. it is superfluous. Independent from the respective kind of organisation, the same 'physiological properties' must consecutively lead to the same 'physiological functions'. This, however, is not consistent with the human brain where different types of dynamic organisation result in different 'physiological functions' while the 'physiological properties' remain the same (see, for example, 2.3.1). Accordingly, the dynamic organisation of the brain cannot be considered as non-necessary or superfluous in the case of the human brain. The notion of 'functional' in the sense of 'computational function' remains inconsistent with the characterization of the brain as a 'dynamic system' (see 3.1.2 and 3.1.4). A 'computational function' presupposes a clear distinction between input, internal state and output (see 3.1.2). This however is not the case in the human brain. Due to the 'principle of complex modulation' (see 3.1.1), the distinction between input, internal state and output becomes blurred. At the same time as the input determines the output the former is modulated by the latter. Moreover, the distinction between hard- and software (see above) can no longer be maintained in the case of the human brain. Due to the 'principle of functional primacy', the hardware i.e. the anatomical structure becomes determined by the software i.e. the psychophysiological function. At the same time, the hardware predisposes the software for a certain types of dynamic organization. Finally, the 'computational function' presupposes cognitive/connectionist systems (see 3.1.2); the brain, however, should rather be regarded as a 'dynamic system'. In the case of the brain being a cognitive/connectionist system, 'event coding' as well as 'dynamic transients' would remain impossible. The characterization of the human brain by means of 'computational functions' remains therefore implausible.

The brain as a 'mental brain'
The brain may ontologically be defined by mental states, which determine the brain as a brain. One could therefore define the brain as a 'mental brain'. Although the importance of both anatomical structures and psychophysiological functions is not denied, they cannot be considered as 'constitutive' for the brain as such. They are, at best, necessary but not sufficient conditions for the brain as a 'mental brain'. Mental states, in contrast, are 'constitutive' for the brain as a brain and must therefore

be regarded as both necessary and sufficient conditions for the ontological definition of the brain as a 'mental brain'. Since mental states cannot be accounted for by either 'physical or functional properties', the brain as a 'mental brain' must be distinguished from both 'physical and informational brain'. The philosophical definition of the brain as a 'mental brain' relies predominantly on two observations, both leading to contradictory inferences. On one hand, mental states cannot be detected within the neuronal states of the brain, with the result that mental states appear to be independent from the brain. On the other, mental states remain absent when the brain is absent so that mental states seem to be dependent on the brain. If one wants to maintain both observations while avoiding contradictory inferences one may assume (i) an ontological difference between mental and neuronal states; and (ii) the existence of mental states within the brain itself. Due to ontological differences between mental and neuronal states, mental states cannot be detected within the neuronal states of the brain i.e. the first observation can be maintained. The inference from this observation (the assumption that mental states are independent from the brain) can no longer be maintained because mental states have to be located within the brain itself. If the assumption that mental states are independent from the brain has to be rejected, there is no longer any contradiction between both observations. The brain may then be characterized by mental states, which are ontologically different from neuronal states. This results in the ontological definition of the brain as a 'mental brain'. Although both 'mental brain' and 'physical brain' must be distinguished from each other in ontological regard, they do not necessarily exclude each other. For example, the 'physical brain' may be regarded as a necessary but not sufficient condition for the 'mental brain'. Accordingly, both types of brains may co-exist with each other.

However, the definition of the term 'mental' remains problematic. First, the term 'mental' may characterize some 'mental substance' as an 'ontological substance' that is 'non-physical' in nature. For example, Descartes assumes a 'mental substance' which interacts with the brain as a 'neuronal i.e. physical substance' via the pineal gland. Another, more recent example, is the theory by Eccles, who postulates an interaction between a 'mental substance' and the brain as a 'physical substance' via vesicles in the supplementary motor area. The 'mental substance' must necessarily be distinguished from the brain as a 'physical substance', resulting in ontological dualism between the mind and the brain. This concept of a 'mental substance' remains rather implausible in ontological, epistemic and empirical regard (see below).

Ontologically, the 'mental substance' is, by itself, not defined in positive terms. Instead, it is often defined in solely negative terms i.e. as a 'non-physical substance' as distinguished from the 'physical substance'. The positive ontological characteristics of this 'mental substance' remain rather unclear i.e. it remains mysterious (see

3.3.3). Accordingly, there is no (positive) ontological evidence for the assumption of a 'mental substance' as ontologically distinguished from a 'physical substance'.

Epistemically, neither perspective can be related to a 'mental substance' since they do not reflect ontological substances but rather states i.e. certain epistemic abilities and inabilities. Nevertheless, it is often claimed, that the 'mental substance' is closely related to the First-Person Perspective while the 'physical substance' is more likely associated with the Third-Person Perspective (see also 3.3.3). The First-Person Perspective can be characterized by 'phenomenal experience' (see 2.3.1 and 3.2.1), as distinguished from 'physical observations' in the Third-Person Perspective (see 2.4.3 and 3.2.3). Mental states are subsequently distinguished from neuronal states. This, however, remains a purely epistemic distinction from which no ontological inferences e.g. a 'mental substance' can be drawn without committing an 'ontological fallacy' (see also 2.4.1). Accordingly, there is no epistemic evidence for any 'mental substance' in an ontological sense.

Empirically, such a 'mental substance' has never been demonstrated. One may concede that the current methods for an empirical investigation may be insufficient and inappropriate. If, for example, the 'mental substance' is related to the First-Person Perspective, a 'Third-Person Neuroscience' (see 3.2.1) must necessarily remain insufficient since it is based on the Third-Person Perspective exclusively. However, even a 'First-Person Neuroscience' would remain insufficient because it relies on the 'First-Brain Perspective. Instead, only 'First-Person Mentoscience' and 'First-Mind Perspective' could account for a 'mental substance'. There is, however, no empirical support whatsoever for the possibility of both a 'First-Person Mentoscience', as distinguished from 'First-Person Neuroscience', and a 'First-Mind Perspective', as distinguished from the 'First-Brain Perspective'. Accordingly, there is no empirical evidence for any 'mental substance' in an ontological sense.

Second, the term 'mental' may characterize some 'mental properties' as being 'non-physical' in nature. The distinction between 'mental properties' as 'non-physical properties' and 'physical properties' results in dual-aspect theories of mind and brain. However, the concept of 'mental properties' remains rather implausible in ontological, epistemic and empirical regard (see below).

Ontologically, the 'mental properties' are usually not defined in positive terms by themselves. Instead, they are defined in solely negative terms as 'non-physical' which distinguishes them from 'physical properties'. A more recent definition of 'mental properties' refers to the notion of 'information' (Chalmers 1996), which, in contrast, can be considered as an ontological characterization in positive terms. However, since the definition of 'information' apparently refers to 'physical properties', the exact distinction between 'informational properties' and 'physical properties' remains unclear (see 3.3.3 for more extensive discussion of Chalmers concept). Accordingly, there is no ontological evidence for the assumption of 'mental properties', as ontologically distinguished from 'physical properties'.

Epistemically, neither perspective can be related to 'mental properties' since they do not reflect ontological properties but rather states i.e. certain epistemic abilities and inabilities. It is, nevertheless, often claimed, that 'mental properties' are closely related to the First-Person Perspective while 'physical properties' are rather associated with the Third-Person Perspective. The First-Person Perspective can be characterized by 'autoepistemic limitation' being the epistemic inability to recognize the own brain states as brain states (see 2.3.1). The own brain states are experienced as mental states, as it is reflected in 'phenomenal experiences'. This epistemic inability can be traced back to a certain type of organization of the 'physical/neuronal states' i.e. 'physical properties' of the brain. A different organization of the same 'physical properties' results in different epistemic abilities and inabilities. Accordingly, it is rather the type of organization than the 'physical properties' themselves, as observable in Third-Person Perspective, that remains crucial for experiencing mental states in First-Person Perspective. However, if one confuses the organization itself (i.e. the one of 'physical properties') with novel properties i.e. 'mental properties', one may be able to distinguish between 'mental properties' and 'physical properties' in ontological regard. This confusion between organization and properties implies an 'ontological fallacy' (see 1.4.2 and 2.4.1) since 'ontological properties', i.e. 'mental properties' are inferred from an epistemic ability, i.e. the ability to experience mental states in First-Person Perspective. Accordingly, there is no epistemic evidence for any 'mental properties' in an ontological sense.

Empirically, such 'mental properties' have never been demonstrated. One may concede that the current methods for empirical investigations may be insufficient and inappropriate. If, for example, 'mental properties' are related to the First-Person Perspective, a 'Third-Person Neuroscience' (see 3.2.1) must necessarily remain insufficient because it is based on the Third-Person Perspective exclusively. A 'First-Person Neuroscience', on the other hand, may be sufficient because it relies on the 'First-Brain Perspective. If the brain has indeed 'physical and mental properties', the 'First-Brain Perspective' should be able to detect both types of properties. In this case, the term 'First-Person Neuroscience' should be reformulated as either 'First-Person Mento-Neuroscience' or 'First-Brain Science'. However, there is no empirical support for a possible detection of 'mental properties' in 'First-Brain Perspective'. Instead of 'mental properties', the 'First-Brain Perspective' is more likely to detect dynamic states, which characterize the brain as a 'dynamic brain'. Moreover, it detects a certain type of organization of 'physical properties' in the brain, which account for 'event coding' and 'dynamic transients' as well as for the identity between 'neural code' and 'mental code' (see 3.1.3). Accordingly, there is no empirical evidence for any 'mental properties' in an ontological sense.

Third, the term 'mental' may characterize 'mental properties' which, although distinguished from 'physical properties', can be traced back to a common ontological foundation, which underlie and account for both types of 'ontological properties'. For example, T. Nagel (1979: 199, 1986: 30) connects 'mental and physical properties' ('physico-mental intimacy') within a so-called 'fundamental essence'. This 'fundamental essence' itself can be characterized by 'proto-mental properties', resulting in a panpsychistic theory with regard to the mind-brain relationship. However, the ontological conjunction between 'mental and physical properties' within a 'fundamental essence' remains rather implausible in ontological, epistemic and empirical regard (see below).

Ontologically, the classification of 'fundamental essence' remains problematic. It can neither be characterized by 'physical properties' nor by 'mental properties' since the distinction between both types of properties and the 'fundamental essence' would be blurred. Therefore T. Nagel presupposes so-called 'proto-mental properties'; however, their distinctive ontological characterization remains unclear. Besides, he would have to assume 'proto-physical properties' whose distinction from 'physical properties' may be even more difficult. The assumption of 'proto-mental and proto-physical properties' may be replaced by the notion of 'information', as suggested by Chalmers (1996). In this case, 'information' cannot be regarded as an ontological analogon of 'mental properties'. Rather, 'information' itself may be considered as a 'fundamental essence' giving rise to both 'physical and mental properties'. Then, however, the step from 'information' as the 'fundamental essence' to 'physical and mental properties' remains problematic. One may consequently assume some type of emergentism, supervenience or epiphenomenalism (see 3.3.3). This may result in the conflation of different types of ontology since, in addition to 'physical and mental ontology', one has to presuppose an 'informational ontology'. The theory of three different kinds of ontology remains rather problematic. There is thus no ontological evidence for the assumption of a 'fundamental essence' as being ontologically distinguished from both 'physical and mental properties'.

Epistemically, neither perspective can be related to either i.e. 'mental properties' (see above) or 'fundamental essence'. Since the 'fundamental essence' has to be considered as the common foundation, it cannot be related to either perspective. It should rather provide some epistemic source on which the different perspectives with their respective epistemic abilities and inabilities are based. Such an epistemic source would be, for example, reflected in a 'neutral vantage point' (see also 3.3.3 as well as Hornsby 1997: 79; Nagel 1998: 351) from which the different perspectives and the different types of ontology could be characterized. However, there is no epistemic support for the assumption of such a 'neutral vantage point' since the different perspectives show complementary and mutually exclusive epistemic abilities and inabilities. Moreover, it remains impossible for us to transcend the respective epistemic limitations in the different perspectives. This makes the assumption of any 'neutral vantage point' principally impossible. In view of that, there is no epistemic evidence for the assumption of a 'fundamental essence' as being ontologically distinguished from both 'physical and mental properties'.

Empirically, the 'fundamental essence' may be accounted for by dynamic states (see 3.1.2) which then may give rise to 'physical and mental properties'. In this case, three different types of organisation would have to be distinguished from each other: the one for 'physical properties', the one for 'mental properties' and the one for the 'fundamental essence'. Such a conflation of the types of organisation would be accompanied by a conflation of codes. In addition to the 'neural code' and the 'mental code', a third code used for the characterization of the 'fundamental essence' would have to be assumed. According to the respective ontological assumptions (see above), one may call this third code either 'proto-mentoneural code' (see above Nagel) or 'informational code' (see above Chalmers). The relation between these three codes remains difficult to account for. If they are assumed to be identical, the need for their distinction is questionable. In this case, empirical support for a 'fundamental essence', as distinguished from 'mental and physical properties', remains impossible. One could also distinguish the three codes from each other in order that the assumption of a 'fundamental essence' can be maintained. There is, however, no empirical support for the possibility and existence of three distinct codes in the human brain. Accordingly, there is no empirical evidence for the assumption of a 'fundamental essence' that is ontologically distinguished from both 'mental and physical properties'.

3.3.2 'Neuroontology': The brain as an 'embedded brain'

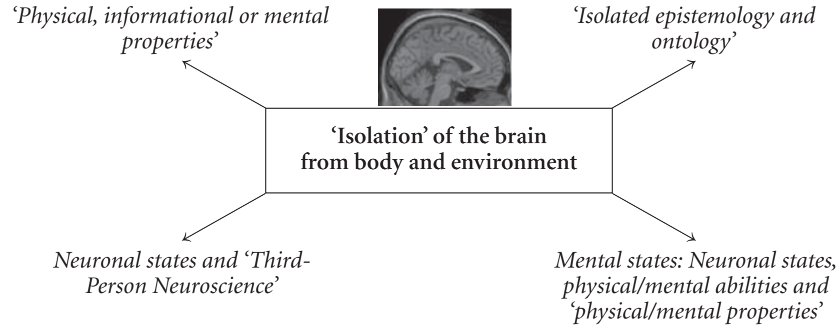
In this section, the brain shall be defined as an 'embedded brain' in ontological regard. 'Embedment' can be characterized by the 'intrinsic' integration of the brain within both the body and the environment (see 1.3). Subsequently, these two kinds of integration may be distinguished from each other ontologically. The ontological definition of the brain as an 'embedded brain' includes thus both the brain as an 'embodied brain' and the brain as an 'embedded brain'. Finally, the brain as an 'embedded brain' can account for mental states without being characterized as a 'mental brain' as well as for 'mental causation' as 'dynamic causation'.

Defining an 'embedded brain'

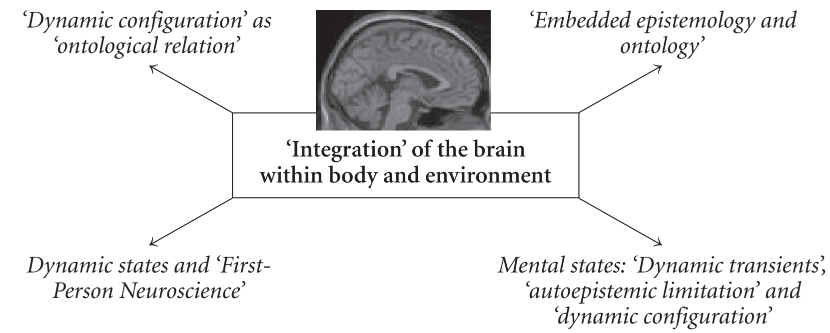
The 'embedded brain' can be defined by integration within both body and environment, resulting in the 'intrinsic' relationship between brain, body and environment (see also Figure 18). This becomes clear in the ontological, epistemic and empirical characterization of the 'embedded brain' by means of the three distinct 'relations' i.e. 'ontological relation', 'epistemic relation' and 'biological relation'.

Ontologically, the 'embedded brain' can be identified by an 'ontological relation' with body and environment. This relation accounts for 'intrinsic' integration of the brain within body and environment. As such the 'embedded brain' presupposes a 'relational ontology' as it is provided by a novel ontological framework i.e. 'embedded ontology' (see 3.3.3). The definition of the brain by means of an 'ontological relation' has to be distinguished from its definition through 'ontological properties'. This is, for example, the case in the 'isolated brain', which is characterized by 'physical and/or mental properties' (see 3.3.1). Since it is defined by 'ontological properties' rather than 'ontological relations', the 'isolated brain' presupposes the traditional ontological framework i.e. 'isolated ontology'. Similar to the brain as an 'embedded brain', body and environment may also be defined by 'ontological relations' rather than 'ontological properties'. Neither the body nor the environment can be defined by 'physical properties'. This would lead to 'isolated body' and 'isolated environment' as it has already been presupposed by Descartes, Locke, and Hume. Descartes (1641, second and sixth meditation), for example, compares the body with a 'machine' and considers it as a purely mechanical and physical device ('body of a man as being a sort of machine'). Similar to empiristic approaches (Locke, Hume), he also deems the environment as 'external', observer-independent, and as purely physical. In contrast, body and environment in the present sense can no longer be defined as 'isolated body' and 'isolated environment' but rather as 'embedded body' (see also Merleau-Ponty 1958, who speaks of a 'phenomenal body') and 'embedded environment'. The body as 'embedded body' cannot be regarded as a purely physical and mechanical machine; instead, it can be characterized as a biological (see 3.1.2) and biomechanical (see 2.1.2) organism. The environment as 'embedded environment' includes the observer itself and can therefore no longer be regarded as an (observer-independent) 'external' world and thus as an 'isolated environment' (see 3.2.1). The 'ontological relation' and the specific 'dynamic configuration' between brain, body, and environment remain subsequently constitutive for both body and environment (as well as for the brain; see above): If the body is defined as an 'embedded body', it can no longer be separated from the brain or, vice versa, the brain cannot be separated from the body. If the environment is defined as an 'embedded environment', it can neither be separated from the brain nor from the body. Conversely brain and body cannot be separated from the environment either (with the environment itself including other brains and bodies as 'embedded brains' and 'embedded bodies') (see 2.4.3 and 3.2.3).

Epistemically, the 'embedded brain' can be identified by an 'epistemic relation' between different epistemic perspectives (see 3.2.1 and 3.2.3). 'Epistemic relation' reflects 'epistemic dependence' which in turn presupposes the presence of different epistemic perspectives (see 2.4.3, 3.2.1 and 3.2.3) as it is accounted for by 'epistemic pluralism' and concurrent absence of 'epistemic hierarchy' (see 3.2.1). This



a. 'Isolated brain'



b. 'Embedded brain'

Figure 18. Characterization of different ontological definitions of the brain

makes the development of 'embedded epistemology' necessary since it can account for 'epistemic dependence', 'epistemic pluralism' and the absence of 'epistemic hierarchy' (see 3.2.1). Such an 'embedded epistemology' implies an 'intrinsic' relationship between brain, body and environment and thus the determination of the brain as an 'embedded brain'. In contrast, 'epistemic monism' and presence of 'epistemic hierarchy' would lead to the restriction and (partial) neglect of epistemic perspectives and consecutively to the impossibility of 'epistemic dependence' and 'epistemic relation'. This presupposes 'isolated epistemology' (see 3.2.1) which implies detachment i.e. isolation between brain, body, and environment and thus determination of the brain as an 'isolated brain'.

Empirically, the 'embedded brain' can be identified by a 'biological relation' with body and environment. This 'biological relation' is reflected in dynamic states (see 3.1.2) which describe how neuronal states are organized in orientation on 'observable and to-be effectuated events within the environment'. One may therefore describe the 'embedded brain' also as a 'dynamic brain' and 'biological brain' (see 3.1.2 and 3.3.3); this can subsequently be characterized by a particular organisation of its neuronal states rather than by the neuronal states i.e. physical states themselves. Descartes (1641, sixth mediation) illustrates the distinction between physical states and their organisation: It is not sufficient for a clock to be described by 'physical properties' and physical states exclusively. The physical states have to be organised in a certain way, which, according to Descartes, depends on the 'wishes of the maker' and thus the mind which has the role of the 'wishes of the maker' when it comes to the organisation of the physical states in brain and body. It is clear, that the role the mind occupies in Descartes' account is adopted by dynamic states and 'biological relation' in the case of the 'embedded brain': Dynamic states are constitutive for the organisation of the brains physical i.e. neuronal states by relating them 'intrinsically' and thus biologically to body and environment (see 3.1.2). If, in contrast, mental or physical states are regarded as constitutive for the brain, the brain could no longer 'intrinsically' and thus biologically be related to body and environment. Such a 'mental or physical brain' remains 'isolated' from body and environment and implies therefore determination of the brain as an 'isolated brain' (see 3.3.1).

The brain as an 'embodied brain'

The brain is 'intrinsically' integrated within the body, which accounts for the brain as an 'embodied brain'. This is reflected in both 'bilateral dependence' and 'mutual determination' in the ontological relationship between brain and body. If there is neither 'bilateral dependence' nor 'mutual determination' between brain and body, one may speak of a 'disembodied brain' as an 'isolated brain'. Empirically the brain cannot only be regarded as a control system for the body and thus as a 'controller for an embodied activity' (Clark 1997: XII). Physicalistic views of the body often consider the brain as the body's 'controller' and highest centre. This view can be traced back to Descartes (1641, sixth meditation; see above) and is still dominating present neuroscience and physiology. If such 'unilateral dependence' of the body on the brain could be presupposed, the 'intrinsic' integration would be replaced by an 'extrinsic' correlation (see below). However, there is 'bilateral dependence' between brain and body. The brain is also dependent on the body, which determines the spatial and temporal framework of the brain (see 2.1 and 2.2); the brain is thus shaped by the body (see 2.1 and 2.2) in the same way as the body is shaped by the brain (see 2.3 and 2.4). This 'bilateral dependence' between brain and body has already been pointed out by Schopenhauer: 'Accordingly the brain, and hence the intellect, is certainly conditioned directly by the body, as the body again is by the brain, ...' (Schopenhauer 1966, Vol. II, 259). Accordingly, the relation between brain and body can be characterized by 'bilateral dependence' and 'mutual determination' which makes the assumption of their 'intrinsic' integration necessary.

The 'bilateral dependence' and 'mutual determination' between brain and body may be reflected in the distinct ontological stages of 'embodiment'.

First, one may speak of 'physical embodiment' (this is more or less similar to what Shoemaker 1984: 117–119 calls 'biological embedment') by means of which brain and body are related to each other and this without any (either 'intrinsic' or extrinsic') linkage. This relation implies neither 'bilateral dependence' nor 'mutual determination'. Neither brain nor body are further specified with regard to a particular owner. Principal empirical and epistemic differences between a 'biologically embodied brain' and a 'biologically disembodied brain' would not exist. Since the brain is not yet related to environmental events through sensory functions (see below), both cases would therefore be characterized by 'stimulus coding' rather than 'event coding'.

Second, one may speak of 'sensory embodiment' (Shoemaker 1984: 125–126) by means of which the brain becomes adapted i.e. 'meshed' to environmental events through the sensory functions of the body. Since sensory functions account for environmental events, there is at least some ontological linkage i.e. 'extrinsic' correlation between brain, body and environment. Both brain and body, however, still remain unspecified with regard to a particular owner. Such a 'sensorily embodied brain' would differ in empirical regard from a 'biologically embodied brain'. The functional organization of the brain would be characterized by a minor form of 'event coding'. Accordingly, perception and action could be distinguished from mere sensory impressions and movements (see also 2.3.2 and 2.3.1), which provides the ground for the distinction between our own and others' actions in the next stage (see below). Stimuli could thus be distinguished from events in a 'sensorily embodied brain' while this ability would be lost in the case of a 'sensorily disembodied brain'.

Third, one may speak of 'volitional embodiment' (Shoemaker 1984: 117–119) by means of which the brain becomes 'intrinsically' integrated within a particular i.e. the own body. The own body can thus be distinguished from other bodies within the environment. Such a 'volitionally embodied brain' would be able to distinguish between stimulus and events and consecutively between own and others bodies (see 2.2.3). Moreover, it would show some intentional action i.e. intentionality (see 2.3.3). This 'volitionally embodied brain' may therefore be able to distinguish between our own i.e. intentional and others' i.e. non-intentional bodies, providing the ground for the distinction between phenomenal and physical states in the next stage (see below). Consequently, an epistemic distinction between the own and others' bodies would be possible in a 'volitionally embodied brain'. Whereas this ability would be lost in the case of a 'volitionally disembodied brain'.

Fourth, following these distinct stages as suggested by Shoemaker, one can speak of 'epistemic embodiment' by means of which the own brain is distinguished from other brains. Such an 'epistemically embodied brain' would be able to distinguish between itself and others' brain states within the environment. However, this distinction is accounted for rather indirectly through 'autoepistemic limitation' and mental states (see also 2.3.1). Moreover, it would be able to distinguish between phenomenal experience in First-Person Perspective, reflecting the own brain states, and physical observations in Third-Person Perspective, reflecting others' brain states. Accordingly, an epistemic distinction between First- and Third-Person Perspective is possible in an 'epistemically embodied brain' whereas, this ability could not be found in the case of an 'epistemically disembodied brain'.

Fifth, following these distinct ontological stages, one may speak of 'ontological embodiment' by means of which the own brain becomes 'intrinsically' integrated within itself. This 'ontologically embodied brain' would be able to directly recognize its own brain states as brain states and would at the same time be able to distinguish them from others brain states. The distinction between phenomenal and physical states would thus no longer be necessary and be replaced by the one between own and others' physical states. What is more, an epistemic distinction between First-Person Perspective and First-Brain Perspective would also no longer be necessary in such an 'ontologically embodied brain'. This epistemic distinction between First Person Perspective and 'First-Brain Perspective' would, however, not be superfluous in the case of an 'ontologically disembodied brain'. (Note that the term 'ontological' is applied in a rather strict sense in this stage, meaning that it refers only to the 'intrinsic' integration of the brain within the brain. This narrow meaning has to be distinguished from the broader sense of 'ontology' which, in addition, characterizes the 'intrinsic' integration of the brain within both body and environment)

Relying on these distinct stages of 'embodiment', the human brain may be characterized as an 'epistemically embodied brain' while being, at the same time, an 'ontologically disembodied brain'. Discussing the famous examples of a 'brain in the vat', one should characterize the type of 'disembodiment' in further detail. What philosophers often describe as a 'brain in the vat' may refer to an 'epistemically disembodied brain' where phenomenal experience of mental states in First-Person Perspective can no longer be distinguished from physical observations of non-mental states in Third-Person Perspective. However, an 'epistemically disembodied brain' must not necessarily be regarded as completely 'disembodied'. For example, even in the absence of 'epistemic embodiment' of the brain, the 'voluntarily embodied brain' and the 'sensory embodied brain' may still be preserved. Accordingly, the dissociation between the distinct ontological stages of the 'embodiment' of the brain may be possible. One may consequently imagine and conceive a variety of different logically possible cases. For example, an 'epistemically embodied brain' may at the same time be a 'sensorily disembodied brain'. Such a brain would still be able to distinguish between phenomenal experiences and physical states while the former would neither refer to events (i.e. 'contents') nor to the same environment (i.e. 'referents') as it is described in the following example: 'Applying this to the case of the brain in the vat, if there were brains in the vat, receiving their sensory inputs from computers, their words could not have the same referents (i.e. environment) as ours have and their mental states could not have the same contents (i.e. events) ours have' (Shoemaker 1996: 57). Since in our brain, the distinct stages of ontological 'embodiment' necessarily built on each other (see above), the example of co-occurrence of 'epistemic embodiment' and 'sensory disembodiment' remains naturally impossible in humans. However, natural impossibility does not necessarily exclude logical possibility (see 1.4.2). Accordingly, one may distinguish between naturally possible and logically possible cases of 'disembodied brains' i.e. 'brains in the vat'.

The brain as an 'embedded brain'

In addition to the 'intrinsic' integration within the body, the brain is also 'intrinsically' integrated within the environment. One may therefore refer to the brain as an 'embedded brain' in a strict sense (see 1.3). The 'intrinsic' character of the integration of the brain within the environment is reflected in the 'bilateral dependence' as well as the 'mutual determination' between brain and environment. If there is neither 'bilateral dependence' nor 'mutual determination', one may speak of a 'disembedded brain'.

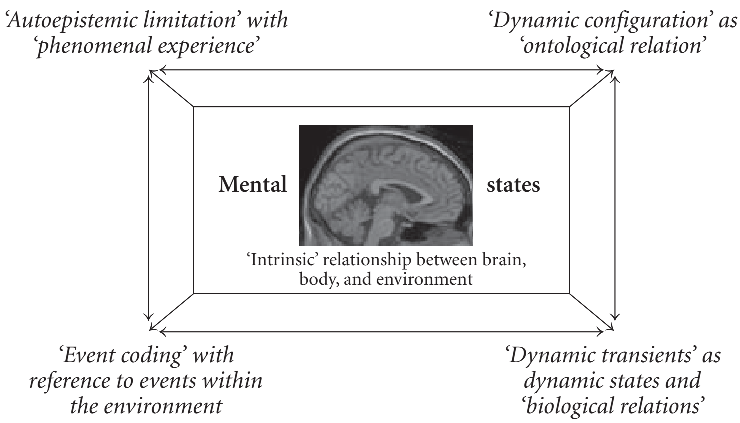
Empirically, the brain cannot be regarded as a control system for the environment. If such 'unilateral dependence' of the environment on the brain were presupposed, the 'intrinsic' integration would be replaced by an 'extrinsic' correlation (see below for further explication). Instead, the brain as the underlying vehicle is also dependent on the environment with respect to its contents since it would otherwise remain 'empty'. Accordingly, there is 'bilateral dependence' between brain and environment so that both are necessary conditions for each other. The distinction between 'intrinsic' integration and 'extrinsic' correlation is also reflected in the assumption of different types of 'embedment' as suggested by various authors: Lakoff and Johnson (1999: 36) distinguish between 'neural and phenomenal embedment'. 'Neural embedment' provides the linkage between brain and environment, which remains 'extrinsic'. 'Phenomenal embedment', in contrast, accounts for the 'intrinsic' integration of the brain within the environment. Borrett et al. (2000: 262–263) distinguish between 'analytic and phenomenological embedment'. Whereas 'analytic embedment' only describes a contingent relation between the brain and the environment 'phenomenological embedment' accounts for their necessary relation. Clark (1997, 1999) distinguishes between 'radical embedment' and 'simple embedment'. 'Radical embedment' reflects the bilateral dependence between brain and environment, which remains incompatible with the classical notion of 'mental representation' (see 3.1.4). Whereas the concept of 'representation' would have to be revised in the case of 'radical embedment' (i.e. transformed into 'embedded representation'; see 3.1.4), this is not the case in 'simple embedment' where brain and environment are not bilaterally dependent on each other.

In addition to 'bilateral dependency', the 'intrinsic' character of the integration between brain and environment can be characterized ontologically by 'mutual determination' between brain and environment. 'Mutual determination' can be accounted for by 'selective-adaptive coupling' and 'biopsychosocial historicity'. 'Selective-adaptive coupling' can be defined by a continuous 'matching process' between brain and environment, which allows for reciprocal and mutual exchange. There are 'optimal fits' (see Thelen & Smith 1994: 145) between the dynamic organization of the brain and the environmental context, which, as a result, reflect each other. One empirical characteristic of the brain as a 'dynamic brain' consisted in selection, which replaces instructional codes (see 3.1.2). The brain does not control the environment through predefined instructional codes. Rather, the brain can be characterized by a selection of certain dynamic pattern, which correspond to the respective environmental context i.e. the brain adapts to the environment. Conversely, the environmental context favours certain dynamic pattern in the dynamic organization of the brain while suppressing others (see also Edelman & Tononi 2000: 94–95, Footnote 2, 238) i.e. the environment biases the selection of the dynamic states in the brain. Subsequently, brain and environment reciprocally adapt to and mutually determine each other. If the brain did not adapt to the environment, the respective dynamic state would remain meaningless i.e. 'empty' because the brain could not refer to any 'observable and to-be effectuated events within the environment' (see also 2.3.3 and 3.1.3). Furthermore, if the environment did not adapt to the brain (i.e. bias its selection) the selection of a particular dynamic state necessary for the brain to adapt to the environment would remain arbitrary and coincidental. As such 'selective-adaptive coupling' provides an 'intrinsic' integration between brain and environment. This 'intrinsic' integration' has to be distinguished from mere 'correlations' that provide only an 'extrinsic' linkage between brain and environment. 'Correlations' cannot account for this 'matching process' because they do not allow for a mutual and reciprocal exchange between brain and environment: 'In this vision, the cognitive system is not just the encapsulated brain; rather, since the nervous system, body and environment are all constantly changing and simultaneously influencing each other, the true cognitive system is a single unified system embracing all three. The cognitive system does not interact with the body and the external world by means of the occasional static symbolic inputs and outputs; rather, interaction between the inner and the outer is best thought of as a matter of coupling, such that both sets of processes continually influencing each other's direction of change' (van Gelder 1995: 373).

In addition to 'selective-adaptive coupling', the 'intrinsic' integration between brain and environment can be characterized by 'biopsychosocial historicity' (Northoff 2001b). 'Biopsychosocial historicity' can be defined through the manifestation of the biological, psychological, and social history within the 'intrinsic' brain-environment relationship. The present 'selective-adaptive coupling' may subsequently include (and reflect) the past and future relationships between brain and environment. 'Selective-adaptive coupling' and 'biopsychosocial historicity' describe different aspects of the 'intrinsic' relationship between brain, body and environment. 'Selective-adaptive coupling' predominantly describes the spatial aspect of the ontological relationship between brain and environment while 'biopsychosocial historicity' rather focuses on its temporal dimension. Due to 'selective-adaptive coupling', the relation between brain and environment can be characterized by mutual and reciprocal exchange between different spatial positions and thus operates predominantly across space. Due to 'biopsychosocial historicity', this mutual and reciprocal exchange infers from past relations and projects towards future relations and thus across time operates predominantly.

Determination of mental states

The 'embedded brain' can be defined by 'relations' that account for the 'intrinsic' integration between brain, body and environment. Presupposing an 'embedded brain', mental states must be determined by 'relations' within the 'intrinsic' relationship between brain, body and environment' (see also Figure 18c). Mental states can no longer be detached from the environment like it is, the case in their determination by 'physical properties', presupposing the brain as a 'physical brain'. In this case, mental states must necessarily be detached from the environment since otherwise their underlying physical states can no longer be distinguished from the



c. Characterization of mental states within the framework of the 'embedded brain'

Figure 18.

ones within the environment. Mental states can also not be detached from the brain either as it is, for example, the case in their determination by 'mental properties'. In this case, mental states must necessarily be detached from the brain since otherwise they can no longer be distinguished from brain states and their respective 'physical properties'. Finally, mental states can no longer be detached from the body since the body mediates the integration of the brain within the environment. Neither the characterization of mental states by 'mental properties' nor their distinction and separation from 'physical properties' remains thus possible. Instead, mental states reflect adaptation and integration between brain and environment through the body. This is also expressed by Spinoza: 'The human body is affected in many ways by external bodies (i.e. observable events within the environment), and is to disposed as to affect external bodies (i.e. to-be effectuated events within the environment) in many ways. But the human mind (i.e. the 'embedded brain') must perceive everything which happens in the human body. The human mind is therefore adapted' (Spinoza 1985, Part II, prop. 14).

Ontologically, mental states can be determined by 'ontological relation' i.e. a particular 'dynamic configuration' within the 'intrinsic' integration between brain, body and environment. Mental states can therefore no longer be 'located' as a particular 'ontological property' within either mind or brain. Instead, mental states are an 'ontological relation'. This 'ontological relation' accounts for the 'phenomenal experience' of events which, due to their inclusion of the respective context (see 3.1.3 and 3.2.1), reflect the 'intrinsic' relationship between brain, body, and environment. Due to their definition by 'ontological relation', mental states as events require a 'relational ontology' and thus a novel ontological framework i.e. 'embedded ontology': 'Rather, one should focus on the organism-environment interactions and try to find out how higher-level processes, and ultimately experiential phenomena, fit in as a modulator of these interactions. The core issue in this approach always remains how the nervous system – in conjunction with the structure provided by a body and an environment – succeeds in solving mundane but real behavioural problems. The embedded, body-centred view of experience stands in contrast to the traditional idea of an isolated realm of inner experience. The embedded is definitely not a combination of inner experience and some bodily extras that can be subtracted at will. This latter view simply is the traditional one. The interesting and challenging problem at this point is to move beyond this traditional interpretation' (Keijzer 2001: 244–245). The shift from 'ontological properties' to 'ontological relations' requires the development of a different notion of causality in order to account for the possibility of 'mental causation'. The traditional framework presupposes 'mental causation' in the sense of 'physical causality' i.e. as 'causa efficiencs' where cause and effect can be distinguished and separated from each other (see 2.3.3). If, however, mental states are determined by 'ontological relations' rather than 'ontological properties', distinction and separation between cause and effect remain impossible. 'Mental causation' in the sense of 'causa efficiencs' remains subsequently also impossible. The need for a different conception of causality (see next section for further details) as well as the need for a different ontological framework is nicely reflected in the following quotation:

> 'The third component is an attack on the supposition that the kind of behaviour we exhibit (such that we are embedded in our world and can be said to have minds) could ever be causally explained utilizing only the generically Cartesian resources of representations, rules, procedures, algorithms, and so on. ... That is, not only is mind not to be found wholly inside the skull; cognition, the inner causal underpinning of mind, is not to be explained in terms of the basic entities of the Cartesian conception of mind'.
>
> (van Gelder 1995: 380–381)

Epistemically, mental states can be determined as both epistemic ability and epistemic inability. The epistemic ability lies in the possibility of 'phenomenal experiences' of events within the 'intrinsic' relationship between brain, body, and environment. The epistemic inability, on the other hand, consists in the impossible detection and recognition of our own brain states as brain states i.e. autoepistemic limitation' within this 'intrinsic' relationship between brain, body, and environment. Mental states therefore reflect specific events as accounted for by a particular 'epistemic relation' between brain, body, and environment. Mental states as 'events' have to be distinguished from 'facts' like 'mental or phenomenal facts', as they are, for example, defined by Nagel (1979) and Chalmers (1996) (see also 2.4.1 as well as 3.2.1 for definition of both terms). Due to 'autoepistemic limitation', we remain unable to directly account for the 'epistemic relation' between our own brain and itself as a brain (see also 3.3.4). Accordingly, McGinn (see also 2.3.1) is right when he characterizes mental states by means of an 'epistemic hiatus' rather than an 'ontological anomaly' (McGinn 1991: 31). However, he is wrong when he speaks of a 'property P' which cannot be detected and recognized by 'introspection' (McGinn 1989: 355). It is not a particular 'property P', which cannot be detected and recognized, but rather an 'epistemic relation' i.e. the one between our own brain and itself as a brain. Due to the 'intrinsic' integration of the brain within body and environment, the brain remains unable to detect and recognize itself as a brain and thus itself as part of that 'epistemic relation'. 'Autoepistemic limitation' in a broader sense reflects therefore the epistemic inability to access our own brains 'intrinsic' integration within body and environment i.e. its 'epistemic relation'. The crucial role of 'autoepistemic limitation' as an epistemic inability is also expressed by Spinoza (1985, Part II, prop. 29): 'From this it is evident that the human mind, when it perceives things in the common order of nature, has no adequate knowledge of itself nor of its own body, nor of external bodies, but only a confused and mutilated knowledge; for this mind does not know itself unless in so far as it perceives the ideas of the affections of the body. Moreover, it dos not perceive its body unless through those same ideas of the affections by means of which alone it perceives external bodies. Therefore in so far as it possesses these ideas it possesses neither an adequate knowledge of itself, nor of its body, nor of external bodies, but merely a mutilated and confused knowledge'. In the present context, the term 'mind' may be replaced by the term 'embedded brain'. Due to 'autoepistemic limitation', the 'embedded brain' has 'no adequate knowledge of itself' and its own and others' bodies, it only recognizes them in a 'confused and mutilated way' as 'isolated brain' and 'isolated body'. The 'embedded brain' knows itself only through the events within the environment i.e. the 'affections' that it experiences in mental states. The 'embedded brain' therefore does not 'possesses adequate knowledge of itself and its own and others' bodies and thus of its 'intrinsic' relationship with body and environment i.e. its 'epistemic relation' (see also 2.3.1 for discussion of Spinoza).

Due to 'autoepistemic limitation', mental states subsequently appear different from the 'outside' of the brain i.e. First-Person Perspective than from the 'inside' of the brain i.e. 'First-Brain Perspective': 'Philosophers are always discussing '(mental) states' of consciousness, alertness, and so forth. However, seen from the brain that is doing the job of creating consciousness, the (mental) state is ephermeral. When we look inside the brain we see no (mental) states, only constantly fluctuating scintillations of graded potentials and quickly flashing action potentials. We record from electrodes and see everything in flux. If there is no change, there is no function. Where do (mental) states arise in such an environment? Put simply, they do not – what seem to be (mental) states from the outside are processes on the inside' (Bridgeman 1998: 632 as well as 2.3.1, 3.1.2 and 3.2.1 here for further elaboration of the view 'from inside the brain' accounting for 'First-Brain Perspective'). The difference between mental states and brain states may thus be considered as purely epistemic in nature since it reflects the difference in the epistemic modes of the First-Person Perspective and the 'First-Brain Perspective'. What is experienced as mental states in First-Person Perspective is recognized as dynamic states in 'First-Brain Perspective'. What has been designated as different ontological substances/properties i.e. 'mind' and 'brain' (in 'isolated ontology') in First-Person Perspective is revealed as different epistemic modes in 'First-Brain Perspective'. Accordingly, the epistemic relation between mental states and brain states can be characterized by the necessity of considering both perspectives, i.e. First-Person and First-Brain Perspective. Whereas ontologically, mental states and brain states are identical within the framework of 'embedded ontology'. This is also reflected in Spinoza's account of mind and body (1985, Part III, prop. 2, school): '... that is to say, that the mind and the body are one and the same thing, conceived at one time under the attribute of thought (i.e. as mental states), and at another under that of extension (i.e. as brain states)'.

Empirically, mental states can be determined by specific 'dynamic transients' (see 3.1.3). 'Dynamic transients' reflect dynamic states which reveal the organization of neuronal states. Dynamic states refer to 'observable and to-be effectuated events within the environment' which are identical events to which mental states refer in 'phenomenal experience' (see 2.3.1 and 3.1.3). 'Dynamic transients' therefore account for events in mental states like specific 'biological relations'. Mental states are thus a 'biological phenomenon' like for example, digestion, growth, or photosynthesis (Searle 2000: 559): What digestion is for the stomach, mental states are for the brain (see also Schopenhauer 1966, Vol. II, 65). Dynamic states can be characterized by 'state parameters', 'dynamic pattern formation' and 'self-organization' which account for 'spatiotemporal integration'. Since dynamic and mental states refer to identical events, mental states can also be described by these characteristics – mental states are dynamic states: 'The brain is a self-organized, pattern-forming, dynamical system. And its coherent, but unpredictable spatiotemporal trajectories – brain behavior – is the mind' (Kelso 1995: 285). Neuronal states can no longer be considered as a sufficient condition for the possibility of mental states because neuronal states themselves must be distinguished from their organisation i.e. dynamic states. Instead, they are only necessary but not sufficient for mental states. Meanwhile, dynamic states can be considered as a sufficient condition for the possibility of mental states since both refer to the identical event within the environment.

Finally, one may raise the question why and how mental states could be defined by 'ontological properties' which is the question for the necessary conditions of such an ontological determination. How could we determine mental states through anatomo-structural, psychophysiological, computational or mental properties? Why were we misled by our epistemic apparatus when ontologically determining mental states? How is such an 'epistemic illusion' possible? The possibility of ontologically determining mental states by means of 'ontological properties' presupposes the detachment of mental states from both brain and environment. The 'epistemic illusion', as generated ultimately by 'autoepistemic limitation', may subsequently be regarded as the necessary condition for the possible detachment of mental states from brain, body, and environment respectively (see the three necessary conditions) with the consecutive assumption of an 'isolated ontology' (see 3.3.3).

First, due to 'autoepistemic limitation' (see 2.3.1), one may assume that a so-called 'vehicle-content confusion' is a necessary condition for the possible detachment of mental states from the brain. As a result, mental states could ontologically be distinguished from brain states. Due to 'autoepistemic limitation', the brain as the underlying vehicle cannot be detected and recognized as a brain. Instead of recognizing our own brain states as brain states, we rather experience certain events as the contents of mental states. If, however, the contents i.e. the events as experienced in mental states, are (falsely) regarded as the vehicle itself, one may be inclined to assume a mind as ontologically distinct from the brain. In that case, however, one confuses the contents with the vehicle so that one may speak of a 'vehicle-content confusion': 'We do not attend to the processes themselves (i.e. the vehicle) but only to the products (i.e. the content) implying an illusion (i.e. of a 'disembodied mind') that mental acts occur independent from the unnoticed (brain)/body' (Lakoff & Johnson 1999: 562; brackets inserted by me).

Second, the neglect of the 'First-Brain Perspective' may be considered as a necessary condition for the possible detachment of mental states from the body. Phenomenally, mental states can be distinguished from body states as non-mental i.e. physical states. Due to the concurrent neglect of the 'First-Brain Perspective', the idea of states that are ontologically different from body states could be developed on the basis of this phenomenal distinction. Furthermore, the neglect of the 'First-Brain Perspective' led to the exclusive consideration of brain and body in the Third-Person Perspective, resulting in their ontological characterization by physical states. Since mental states could neither be related to nor detected within body states, as observed in Third-Person Perspective, the idea of mental states, as being ontologically different from physical states and thus body states, could be developed.

Third, the neglect of 'embedded epistemology' may be regarded as a necessary condition for the possible detachment of mental states from the environment. Phenomenally, mental states as such, i.e. independent from the events as their contents, are distinguished from the environment. This distinction is extended to the ontological realm (by means of 'epistemic-ontological inferences'; see 1.4.3) in the case of neglect of 'embedded epistemology': 'Embedded epistemology' can be characterized by an 'intrinsic' integration of the First-Person Perspective within the environment (see 3.2.1). If 'embedded epistemology' is presupposed, the First-Person Perspective can account for the events within the environment, as experienced in mental states. However, if 'embedded epistemology' is neglected and replaced by 'isolated epistemology', the First-Person Perspective is no longer 'intrinsically' integrated within the environment. Due to this detachment from the events in the environment, mental states as such, as experienced in First-Person Perspective, can no longer be linked to the events and thus the environment itself. The events, as experienced in mental states, are consequently regarded as 'internal events' i.e. 'mental events' which, relying on 'epistemic-ontological inference' (see 1.4.3), are then attributed to a mind. As a result, the idea of mental states, as being ontologically different from the environment and thus the world, could be developed.

'Mental causation' and 'Dynamic causation'

'Mental causation'

The problem of 'mental causation' raises two questions. First, it brings up the question about the types of states that are causally connected to each other. The second question pertains the meaning of causality. Different states may be causally connected with each other and subsumed under the term 'mental causation'. 'Mental causation' in the traditional sense (see below) may refer to the direct causal connection between mental and physical states. It may also refer to the direct causal connection between mental and mental states or to an indirect connection between mental and mental states through physical states (though the latter may also be subsumed under 'physical causation', we nevertheless consider it as an indirect form of 'mental causation'). 'Mental causation' must therefore be distinguished from 'physical causation'. 'Physical causation' may refer to the direct causal connection between physical and mental states as well as to the direct causal connection between physical and physical states or to the indirect connection between physical and physical states through mental states (see also 2.3.3).

Considering 'mental causation', the following four problems arise (see also Eicke 2002: 19–24; Crane 1992, 1995): First, 'mental causation' remains incompatible with physicalism, as presupposed by 'physical causation'. A purely physicalistic account of mental states reduces mental states to physical states. As a result, 'mental causation' could either no longer be distinguished from 'physical causation' or mental states are not reduced to physical states. In the latter case 'mental causation' must be distinguished from 'physical causation'. However, the non-reducibility of mental states remains incompatible with physicalism. Second, physical states and 'physical causation' can be characterized by strict laws i.e. physical laws. However, in the case of mental states and 'mental causation' a characterization by strict laws remains impossible because there are no 'mental and/or psychophysical laws' (see also below). Third, the possibility of 'physical causation' excludes the possibility of mental states and thus 'mental causation' so that both forms of causation remain necessarily incompatible. If mental states are possible within the framework of 'physical causation', their possible realization through multiple i.e. different physical states cannot be excluded (we here transform the originally logical context of the argument of multiple realizability into an empirical i.e. natural context). In this case, the same mental state can be caused by different physical states. However, the assumption of different causes i.e. physical states with the same effect i.e. a particular mental state remains rather implausible and must thus be considered as 'causal overdetermination' (Kim 1993: 259) (Though the assumption of 'causal overdetermination' is meant to be in a logical sense, it should nevertheless be applicable to the natural domain as presupposed here). Accordingly, 'physical causation' must necessarily remain restricted and limited to physical states which excludes the possibility of mental states and thus 'mental causation'. Fourth, 'mental causation' requires an ontology that remains incompatible with the one presupposed by 'physical causation'. 'Physical causation' presupposes 'physical ontology' while 'mental causation' requires 'mental ontology'. Since both ontologies are not compatible with each other, except in dualism, 'mental causation' remains incompatible with 'physical causation'. However, by linking 'mental causation' to 'physical ontology', recent concepts (Kim, Davidson) undermine the distinction between 'physical and mental causation' with respect to 'physical ontology' and 'mental ontology' where the latter (i.e. 'mental ontology') is subsumed (more or less) under the former (i.e. 'physical ontology'). These concepts raise several problems especially with regard to a positive characterization of 'mental causation' (see Eicke 2002). This may be traced back to the implicit or explicit (subordination or) neglect of 'mental ontology' as distinguished from 'physical ontology'. Accordingly, either solution consideration of both 'physical and mental ontology' or neglect of 'mental ontology' remains incompatible with a positive characterization of 'mental causation' as distinguished from 'physical causation'.

All four problems necessarily presuppose some version of physicalism: Either strong physicalism, as in eliminativistic or reductionistic forms of materialism. Or weak physicalism, as in non-reductionistic forms of materialism as, for example, anomalous monism i.e. token identity (Davidson 1980). If one rejects the ontological framework of physicalism in general, the four problems may consecutively disappear independent from whether a weak or strong version of physicalism is presupposed. The four problems raised by 'mental causation' are subsequently no longer virulent within the present ontological framework of 'embedment'. First, the present framework does not presuppose any physicalism at all, neither in a strong nor in a weak version. Instead of a physicalistic version of naturalism, we rather presuppose 'dynamic naturalism' which as such remains non-reducible to any version of physicalism (see 3.3.3 for further details). The contradiction between physicalism and 'mental causation' may thus be replaced by compatibility between 'dynamic naturalism' and 'mental causation'. Second, mental states may be accounted for by 'dynamic laws', which as such have to be distinguished from (classical) 'physical laws' (see 3.3.3). Accordingly, mental states and consecutively 'mental causation' may be characterized by strict laws i.e. 'dynamic laws'. Third, the possibility of multiple formation of mental states by different physical states (i.e. the multiple realizability argument in an empirical sense; see above) cannot be considered as an instance of 'causal overdetermination' (in a natural i.e. empirical sense; see above). Physical states are a necessary but not sufficient condition for dynamic states, which, in turn, are a sufficient condition for mental states (see 3.1.2). Several i.e. multiple physical states may subsequently be necessary for the generation of one specific dynamic state, which by itself is sufficient for a particular mental state. Accordingly, the generation of mental states by multiple physical states (in an empirical sense) cannot be regarded as 'causal overdetermination' (in an empirical sense). As a result, the empirical restriction and limitation to physical states is no longer necessary since for example dynamic states may be included as well. Fourth, 'embedded ontology' provides a broad and foundational ontological framework for 'physical and mental ontology', both being forms of 'isolated ontology'. Within the framework of 'embedded ontology', 'physical and mental ontology' are no longer regarded as mutually exclusive. Instead, they are accounted for by distinct dynamic configurations within the brain, body, and environment relationship. Accordingly, 'physical and mental causation' are well compatible with each other within the framework of 'embedded ontology' so that the assumption of dualism is no longer necessary. Due to the principal rejection of dualism, any form of supervenience, either weak or strong, must be rejected. The concept of supervenience presupposes minimal physicalism and unilateral dependence of mental states on physical states (Kim 1984, 1985, 1993). Dissimilar to reductionistic accounts, it no longer necessarily presupposes the closure of 'physical causation' to physical states. This is because it claims that supervenience of mental states on physical states is possible. At the same time, it denies the possibility of 'cross-level causality' as a causality between physical and mental states (see Eicke 2002: 54) so that 'physical causation' itself remains restricted to physical states. The present account, in contrast, assumes that 'cross-level causality' between physical, dynamic and mental states is possible though in a transformed sense as 'cross-relation causality' (see below). Moreover, 'physical causation' is replaced by 'biological causality' (see below), which is no longer closed since it refers to both (classical) physical and dynamic states.

We demonstrated that 'mental causation' is not necessarily incompatible with 'physical causation' within the present framework. Moreover, we showed that physical, dynamic and mental states could be causally connected to each other. This leads us to the second main problem of 'mental causation' i.e. the meaning of causality (see above). We already described the different forms of causality in ontological respect (see above and 2.3.3). 'Final and formal causes' as forms of 'biological causality' were distinguished from 'material and efficient causes' as forms of 'physical causality'. 'Final causes' describe the goal or purpose toward which the respective state aims. 'Formal causes' refer to the form i.e. organisation which characterizes the respective state. 'Material causes' describe the stuff i.e. material, which underlies the respective state, and 'efficient causes' characterize the force that brings the respective state into being. Epistemically, these different forms of causality may be distinguished from each other in the following way. The First-Person Perspective solely accounts for 'final and formal causality' while the Third-Person Perspective is merely related to 'material and efficient causality'. In order to account for all forms of causality, one must consider all perspectives i.e. 'epistemic pluralism'. Empirically, these different forms of causality can be described by different features of the dynamic brain organization (see 2.3.3 and 3.1.2). 'Final causes' reflect 'goal-orientation', 'formal causes' can be accounted for by the particular organisation of the brain i.e. the 'brain code' which is defined by 'event coding'. 'Material causes' characterize the physical material of which the brain is made and 'efficient causes' refer to the neural mechanisms and realization of self-organisation and dynamic pattern formation (see 3.1.2). Interestingly, Schopenhauer considers 'final causes' as the 'clue to the understanding of organic nature' and its 'purpose' while 'efficient causes' can rather account for the 'inorganic nature' and its mere 'physiological functions' (see Schopenhauer 1966: 329, 332). This distinction parallels with the present one between First- and Third-Person Perspective the former reflecting a living organism and the latter rather referring to mechanisms which as such could also be present in machines (see also 3.1.4). Moreover, it parallels with our characterization of 'final causes' as 'biological causality' and 'efficient causes' as 'physical causality' (see 2.3.3, 3.1.2, and 3.3.3).

Considering their ontological, epistemic and empirical characterization, these different forms of causality do not mutually exclude each other. They are rather complementary as well as bilaterally and necessarily dependent on each other (see also Wieland 1962: 260). Both characteristics i.e. complementarity and dependence shall be subsumed under the term 'inter-dependence' (between the four causes) in the following. They complement each other: for example, they describe distinct aspects i.e. the aim, the organisation, the material and the forces. They are mutually dependent on each other: for example, the aim cannot be realized without a particular organisation, a particular material and a force. They are bilaterally dependent on each other: for instance, the aim cannot be realized without organisation while, at the same time, any organisation remains impossible without an aim. They are necessarily dependent on each other: the possibility of the one depends on the respective other(s), for example, there is no aim without organisation and there is no organisation without aim. In addition to the examples given above, this remains, of course, true for all four causes. The 'inter-dependence' between the four forms of causality is nicely illustrated by the following example of the house, which goes back to Aristotle himself (see Eicke 2002: 94; Wieland 1962: 260): There is a particular goal or concept of the way the house shall be built – this reflects 'final causality'. The goal or concept implies a certain organisation of the way, the house shall be built – this reflects 'formal causality'. This organisation may be best realized by a certain material – this reflects 'material causality'. Finally, this material may be organised by a certain force i.e. put into being by relating its different parts to each other in specific ways – this reflects 'efficient causality'. This 'inter-dependency' between the four forms of causality can also be demonstrated in the case of the brain (see also above). 'Final causes' account for the 'goal-orientation' and thus for the integration of the brain within the environment (see above and 2.3.3). 'Formal causes' describe the appropriate organisation of neuronal states by means of which 'goal-orientation' can be realized. This is reflected in 'event coding' as the corresponding 'brain code'. This organisation i.e. 'event coding' can be realized in physical material, which accounts for neuronal states and can thus be considered as the 'material cause'. Meanwhile, implementing the organisation i.e. 'event coding' requires 'efficient causality' reflecting the force of the neural mechanisms by means of which different parts of the brain are specifically related to each other with the ultimate realization of self-organisation and dynamic pattern formation (3.1.2).

'Dynamic causation'

The 'inter-dependence' between the four causes, as described above, might account for 'mental causation' in both regards i.e. ontological and empirical.

Ontologically, mental states as specific 'dynamic configurations' (see above and 3.3.3) may cause other mental states i.e. other 'dynamic configurations'. 'Mental causation' may subsequently be described as a transition from one particular 'dynamic configuration' to another. This transition between the 'dynamic configurations' involves all forms of causality. First, a particular and novel event can be considered as the aim or purpose of a transition between different 'dynamic configurations' – this reflects the change in the 'final cause'. Second, changing the 'event' makes a new organisation i.e. modification in 'selective adaptive coupling' between brain, body and environment necessary – this reflects the modification of the 'formal cause'. Third, modification in 'selective-adaptive coupling' implies modulation of the 'relation' between brain, body and environment – this reflects modulation of the 'material cause' within the framework of a 'relational ontology' where 'ontological relations' replace 'ontological properties' as the underlying material (see below). Fourth, the modified 'relation' between brain, body and environment needs to be related to previous 'relations' in a novel way. This is done through the 'efficient cause' which accounts for the realization of the switch from the previous i.e. old 'dynamic configuration' to a new one. It should be noted that the four forms of causality no longer refer to relations between 'ontological properties' i.e. 'physical and mental properties' but to relations between relations i.e. 'dynamic configurations' reflecting an 'ontological relation' (see 3.3.3) – relations between properties are thus replaced by relations between relations. Unlike in the case of 'ontological properties', these 'dynamic configurations' as an 'ontological relation' can no longer be characterized as either 'mental' or 'physical' by themselves. This is so because they provide the broader and foundational framework i.e. the necessary condition for the possibility of the assumption of 'ontological properties' in general (see 3.3.3).

'Mental causation' in this sense can no longer be regarded as 'cross-level causality' since this would presuppose relation between different 'ontological properties'. Instead, 'mental causation' in the present sense can rather be described as 'cross-relation causality' since it presupposes relations between relations. The different notions of 'mental causation', as described above, may therefore be redefined within this novel context. Direct 'mental causation' between mental states and mental states (see above) is possible but it should rather be regarded as direct 'dynamic causation' between 'dynamic configuration' and dynamic configuration'. Direct 'mental causation' between mental states and physical states (see above) is also possible. Ontologically, this is reflected in the modulation of the previous 'dynamic configuration' and its linkage/integration with the novel 'dynamic configuration' ('material and efficient cause') in orientation on the novel event within the environment ('final and formal cause'). Finally, indirect 'mental causation' from one mental state to another one through a physical state (see above) is possible as well. It is accounted for by the transition from one 'dynamic configuration' to another one through modulation of and relation between previous 'dynamic configurations' ('material and efficient cause'). It should be noted that 'mental and physical causation' can no longer be distinguished from each other in ontological regards within the present framework. Accordingly, the terms 'downward causation' and 'upward causation' which are often used to characterize 'mental and physical causation' with regard to brain and mind (see Thompson & Varela 2001) remain superfluous. There is neither 'downward causation' nor 'upward causation' within the 'intrinsic' relationship between brain, body, and environment. Instead, 'down- and upward causation' as forms of 'vertical causality' are replaced by 'horizontal causality' (Northoff 2003b) which reflects the integration and 'interdependence between the four forms of causality.

Due to its ontological characterization by relations between 'dynamic configurations' 'mental causation' may be regarded as 'dynamic causation' in ontological regard. 'Dynamic causation', since it relates changes to changes, focuses on changes rather than stationary moments. Moreover, 'dynamic causation' focuses on 'events' rather than 'states', this because 'events' reflect the relation between change and context (see 3.2.1). 'States' can neither account for change nor the context since they reflect 'properties' rather than 'relations' (see also Beckermann 1999). Finally, 'dynamic causation', since it links and relates 'events' to each other through their underlying 'dynamic configuration', refers to 'relations' rather than 'properties': 'Mental events are effective, maybe, but not by way of their mental properties; any causal role that the latter might have hoped to play is occupied already by their physical rivals' (Yablo 1992: 249; note a different definition of events in this quote). 'Events', in turn, reflect epistemic 'changes' in relation to a particular 'context', which ontologically can only be accounted for by 'relations' but not 'properties' – explanation of 'events' by 'properties' must thus be considered as a confusion between different ontological categories (see also Beckermann 1999). Subsequently, 'dynamic causation' in ontological regard may be characterized by (i) the inclusion and 'inter-dependence' between all four forms of causality; (ii) a relation between 'relations' instead of a relation between 'properties'; (iii) a relation between 'events' instead of a relation between 'states'; (iv) a predominant focus on changes rather than stationary moments; and (v) inclusion of the 'context' in the relation instead of neglecting it.

Ontologically, 'dynamic causation' provides a 'broader and foundational framework' (see 3.3.3 for definition) than either 'mental causation' or 'physical causation' in the traditional sense. In the same way 'ontological relations' provide the necessary condition for the possibility of 'mental and physical properties' as 'ontological properties' 'dynamic causation' as 'biological causation' (see 3.3.3) provides the necessary condition for the possibility of both 'physical and mental causation'. Accordingly, 'dynamic causation' can be considered as 'foundational' for both kinds of causations. Moreover, 'dynamic causality' includes all four forms of causality while 'physical and mental causation' in the traditional sense only refer to 'efficient causality' (see 2.3.3). Accordingly, 'dynamic causation' provides a 'broader' framework than 'physical and mental causation'.

Empirically, mental states as specific dynamic states i.e. 'dynamic transients' may cause other mental states i.e. other 'dynamic transients'. 'Mental causation' may subsequently be described and re-defined as a transition from one particular 'dynamic transient' to another. This transition between the 'dynamic transients' involves all forms of causality. First, the particular 'goal-orientation' and thus the 'final cause' change. Second, a change in 'goal-orientation' makes the modification in the organisation of neuronal states, i.e. the particular event on which the organisation is oriented, necessary – the 'formal cause' is modified. Third, changes in the organisation imply the modulation of neuronal states so that the 'material cause' is modulated. Fourth, the modulated neuronal states have to be related to each other in a novel way in order to modulate the specific realization of both self-organisation and dynamic pattern formation – the 'efficient cause' is involved in the alteration of the dynamic state i.e. the respective 'dynamic transient'. Direct 'mental causation' between mental and mental states (see above) is possible. This, however, should be regarded as direct 'dynamic causation' with transition between two different 'dynamic transients'. Direct 'mental causation' between mental and physical states (see above) is also possible. It is reflected empirically in the linkage between dynamic and neuronal states the latter being modulated by and related ('material and efficient cause') to the former in orientation on the respective 'goal-orientation' and event ('final and formal cause'). Indirect 'mental causation' from one mental state to another one through a physical state (see above) is also possible and accounted for by the transition from one 'dynamic transient' to another through modulation of and relation between neuronal states ('material and efficient cause'). Due to its characterization by relations between 'dynamic transients', 'mental causation' in empirical regard may be conseived as 'dynamic causation'. There is a circular character in 'dynamic causation': 'Final and formal causes' serve as a guide for 'material and efficient causes' which, in turn, provide realization and implementation of the former. ‘Material and efficient causes’ may therefore be regarded as intermediate causes since they depart from and return to ‘final and formal causes’. In summary, ‘dynamic causation’ in empirical regard may be characterized by (i) the inclusion of all four forms of causality; (ii) the ‘inter-dependency’ between all four forms of causality (see above) and (iii) the circular character i.e. circularity between the four forms of causality (see above).

Finally, one may reveal the necessary conditions for the possibility of the problem of ‘mental causation’ as ontologically distinguished and separate from ‘physical causation’. First, the exclusive consideration of ‘efficient (and material) causality’ implies the neglect of ‘inter-dependency’ and ‘circularity’ between the different forms of causality. Due to this neglect of ‘inter-dependency’ and ‘circularity’, the ontological focus was restricted to physical states and consecutively to ‘material and efficient causes’. ‘Final and formal causes’ were meanwhile neglected. Due to the neglect of the latter, causation was restricted to ‘physical causation’ while ‘mental causation’ was excluded. This restriction of causation to ‘physical causation’ provided the ground for the possibility of ‘mental causation’ as a problem being ontologically distinguished from ‘physical causation’. Accordingly, the neglect of ‘inter-dependency’ and ‘circularity’ can be considered as a necessary ontological condition for the possibility of ‘mental causation’ as a separate ontological problem.

Second, the main epistemic condition for the possibility of ‘mental causation’ as an ontologically separate problem consists in ‘autoepistemic limitation’ (see 2.3.1). Due to ‘autoepistemic limitation’ we remain unable to ‘locate’ the origin of mental states in our own brain. This epistemic inability to trace back the origin of our own mental states implies the problem of ‘mental causation’ since otherwise, in the case of absence of ‘autoepistemic limitation’, ‘mental causation’ could not have been raised as a problem at all. As already pointed out by Hume, mental states and their effects i.e. ‘mental causation’ (which Hume described as the ‘secret union of soul and body’) appear therefore (i.e. due to ‘autoepistemic limitation’) as a ‘production of something out of nothing’: ‘This is a real creation; a production of something out of nothing: which implies a power so great, that it may seem, at first sight, beyond the reach of any being, less than infinite.’ (Hume 1748, 68). ‘Physical causation’, in contrast, can be described as a ‘production of something’ i.e. the ‘effect’ which can be traced back to a cause i.e. the ‘physical cause’. Due to our epistemic inability to recognize our own brain as a brain, the ‘effect’ cannot be traced back to a ‘cause’ in the case of ‘mental causation’. The difference between ‘physical and mental causation’ with respect to the ‘cause’ provided the ground for the possibility of their empirical and ontological distinction and consecutively for ‘mental causation’ as an ontologically separate problem.

Third, the main empirical condition for the possibility of ‘mental causation’ as an ontologically separate problem consists in restriction of neuroscience to the

Third-Person Perspective as 'Third-Person Neuroscience'. As such neuroscience has necessarily been limited to 'material and efficient causes' which can be accounted for in Third-Person Perspective (see above). This remains impossible in the case of 'final and formal causes' which can be accounted for in First-Person Perspective (see above) and subsequently in 'First-Person Neuroscience' (see 3.2.1). Accordingly, the restriction of neuroscience to 'Third-Person Neuroscience' and the concurrent neglect of 'First-Person Neuroscience' must be considered as necessary conditions for equating causality with 'efficient (and material) causality'. Since 'efficient causality', as related to the Third-Person Perspective, characterizes 'physical causation' in a paradigmatic way, the equation of causality with 'efficient causality' provided the ground for the empirical and ontological distinction between 'physical and mental causation' and consecutively for 'mental causation' as an ontologically separate problem.

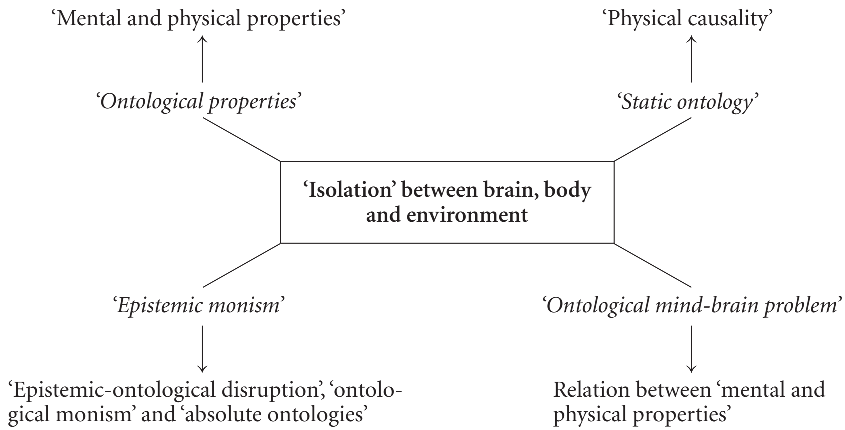
3.3.3 'Ontology of the brain': 'Embedded ontology'

Determining the brain as an 'embedded brain' and defining mental states by means of a specific 'dynamic configuration' within the 'intrinsic' relationship between brain, body and environment requires a novel ontology. This novel ontology can no longer be oriented on the Cartesian conception of mind and brain which, in turn, presupposes 'mental and physical ontology' as forms of an 'isolated ontology'. These traditional forms of ontology, i.e. 'physical ontology' and 'mental ontology' are subsequently rejected and an alternative ontological framework, i.e. 'embedded ontology' is developed.

'Isolated ontology': 'Physical and mental ontology'

The 'isolated brain' is characterized by either 'physical properties' or 'mental properties' (see 3.3.1). The 'structural brain' and the 'functional brain' can be characterized by 'physical properties'. The 'mental brain', on the other hand, rather refers to 'mental properties'. These different 'ontological properties' presuppose distinct ontologies i.e. 'physical ontology' and 'mental ontology'. 'Physical ontology' accounts for 'physical properties' while 'mental ontology' is rather characterized by 'mental properties'. In the following, both ontologies shall be considered in further detail (see also Figure 19).

First, both 'physical and mental ontology' can be characterized as forms of an 'isolated ontology', presupposing the detachment i.e. 'isolation' between brain, body, and environment. 'Physical ontology' detaches the brain/body from the environment, leading to 'isolation' of the brain and thus an 'isolated brain'. It must detach the brain/body from the environment because the 'physical properties' of the former can otherwise not be distinguished from the ones of the latter. 'Mental



a. Characterization of 'Isolated ontology'

Figure 19.

ontology' detaches the environment from brain/body by presupposing a mind as an 'isolated mind'. It must detach the environment from brain/body since 'mental properties' can otherwise not be distinguished from 'physical properties'. Brain, body and environment remain therefore separated i.e. 'isolated' from each other in both ontologies. Accordingly, one may characterize 'physical ontology' and 'mental ontology' as forms of an 'isolated ontology'.

Second, both 'physical and mental ontology' can be considered as forms of 'static ontology'. 'Physical and mental ontology' presuppose 'ontological properties' (or substances) as either mental or physical. 'Physical ontology' presupposes 'physical properties' which are defined by their static, fixed and predefined character. If they are not static, fixed and predefined in ontological regard, they cannot be defined as 'ontological properties'. 'Mental properties', too, must be defined as static, fixed and predefined since they could otherwise not be defined as 'ontological properties'. Since 'ontological properties' (or substances) are static, fixed and predefined, one may characterize 'physical ontology' and 'mental ontology' as forms of 'static ontology'.

Third, both 'physical and mental ontology' can be characterized by 'epistemic monism' and 'epistemic hierarchy'. 'Physical and mental ontology', are related to different epistemic perspectives respectively. Whereas 'mental ontology' is (supposed to be; see below) related to the First-Person Perspective as distinguished and separated from the Third-Person Perspective 'physical ontology', in contrast, either eliminates or subordinates the First-Person Perspective in favour of the Third-Person Perspective. Since 'physical and mental properties' are related to one particular perspective exclusively, one may characterize 'physical ontology' and 'mental ontology' by 'epistemic monism' and 'epistemic hierarchy'. Accordingly, both ontologies are not compatible with 'embedded epistemology' (see 3.2.1). 'Embedded epistemology' can be characterized by 'epistemic pluralism', 'epistemic dependency', and absence of 'epistemic hierarchy'. Neither separation nor subordination between First- and Third-Person Perspective remains compatible with these characteristics. Separation between both perspectives, as in 'mental ontology', remains incompatible with 'epistemic dependency' while elimination/subordination, as in 'physical ontology' is not compatible with 'epistemic pluralism' and absence of 'epistemic hierarchy' (see 3.2.1 for further details). However, though 'mental ontology' is supposed to be related to the First-Person Perspective, it nevertheless describes the mind in terms of the Third-Person Perspective. The mind as the underlying ontological correlate of the First-Person Perspective is characterized in the same way as objects i.e. by ('mental properties' as) 'ontological properties' that can be accessed in Third-Person Perspective. As a result, the mind is detached from the subject itself and thus from First-Person Perspective which, originally, it was intended to account for in ontological regard. This detachment of the mind from the subject itself and its consecutive degeneration into an 'object' has been described nicely by Hume: 'Now as every perception is distinguishable from another, and may be considered as separately existent; it evidently follows, that there is no absurdity in separating any particular perception from the mind; that is breaking off all its relations, with that connected mass of perceptions, which constitute a thinking being.' (Hume 1978: 207). However, since the mind itself cannot be detected and recognized in 'external objects' with 'physical properties', one describes (or 'posits' or 'feigns') it as an 'internal object' with 'mental properties'. This strategy has been pointed out already by Hume: 'Our last resource is to yield to it, and boldly assert that these different related objects are in effect the same, however interrupted and variable. In order to justify to ourselves this absurdity, we often feign some new and unintelligible principle, that connects the objects together, and prevents their interruption or variation. Thus we feign the continu'd existence of the perceptions of our senses, to remove the interruption; and run into the notion of a soul, and self, and substance, to disguise the variation.' (Hume 1978: 254). The characterization of the mind as an 'internal object' with 'mental properties', however, remains inappropriate since the mind itself can principally not be characterized by 'ontological properties' in the Third-Person Perspective. Instead, the mind requires a genuine First-Person Perspective characterization, which can no longer be accounted for by 'ontological properties' but rather by 'ontological relations'. A description of the mind by means of 'ontological relations' may therefore be regarded as an inclusion of the First-Person Perspective itself within ontology. The necessity to include the First-Person Perspective in the ontological description of mental states is also reflected in Searle's emphasis of the need of a 'First-Person Ontology': ' ... much of the bankruptcy of most work in the philosophy of mind ... over the past fifty years . . . has come from a persistent failure to recognize and come to terms with the fact that the ontology of the mental is an irreducibly first-person ontology'. (Searle 1992: 95).

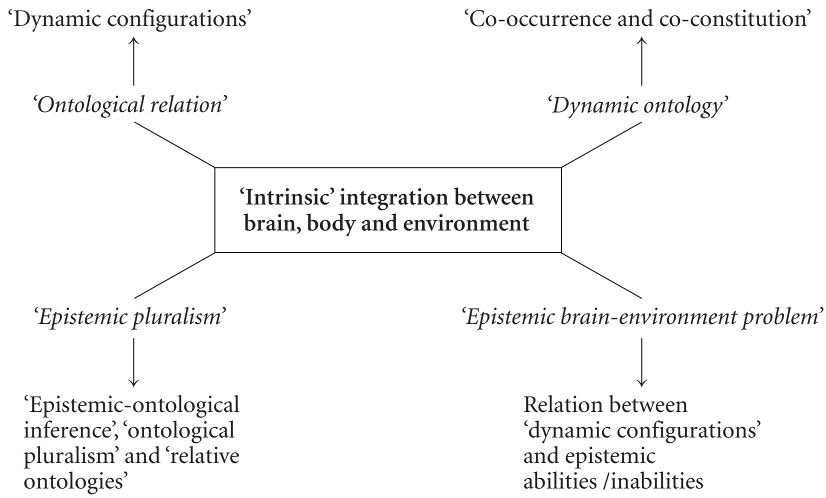
Fourth, the relationship between 'physical ontology' and 'mental ontology' is reflected in the 'ontological mind-brain relationship problem' (see also 1.1.1). Either both ontologies are regarded as identical, resulting in 'ontological monism' between brain and mind. Or both ontologies are regarded as different, resulting in 'ontological dualism' between brain and mind (see also 3.3.4 for the discussion of the epistemic mechanisms underlying the generation of different mind-brain theories). 'Ontological monism' may appear in a 'physicalistic version' in the gestalt of materialism. The mind is equated with the brain implying either identification or elimination of 'mental ontology' in favour of 'physical ontology'. 'Ontological monism' may also appear in a 'mentalistic version' in the gestalt of panpsychism. 'Physical properties' i.e. the brain are directly linked to 'mental properties' i.e. the mind the latter also being present within the former. 'Physical ontology' becomes thus merged with 'mental ontology'.

'Ontological dualism' may appear in a 'substance version' in the gestalt of substance dualism. Brain and mind are regarded as different substances; this presupposes a principal difference between 'physical ontology' and 'mental ontology'. Dualism may also appear in a 'property version' in the gestalt of property dualism as a dual-aspect theory. Brain and mind may then be regarded as the different 'ontological properties' of one common underlying ontological foundation. This common underlying ontological foundation may be defined by a 'fundamental essence' (see Nagel in 3.3.1) or by 'structural isomorphism' between phenomenal and physical properties in the notion of 'information' (see the discussion of Chalmers' in 3.3.1 and 3.3.3).

'Embedded ontology': The 'ontological mind-brain relationship problem'

The 'embedded brain' is defined by 'ontological relation' rather than 'ontological properties' (see 3.3.2). It therefore remains incompatible with 'physical and mental ontology' because both can be characterized by 'physical and mental properties'. The appropriate ontological framework, which is characterized by 'ontological relation' rather than 'ontological properties', may be called 'embedded ontology' (see also Figure 19b).

First, 'embedded ontology' can be characterized as a 'relational ontology' which accounts for 'intrinsic' integration between brain, body, and environment. The distinction between 'physical and mental properties' is resolved within the 'intrinsic' relationship between brain, body and environment. Brain/body can no longer be detached from the environment which makes 'physical properties' and 'physical ontology' impossible. The environment can neither be detached from brain/body which makes 'mental properties' and 'mental ontology' impossible.



b. Characterization of 'Embedded ontology'

Figure 19.

'Physical and mental properties' are subsequently replaced by 'dynamic configurations' (see below for further explication) within the 'intrinsic' relationship between brain, body, and environment. The ontological focus therefore shifts from 'ontological properties' (or substances) to 'ontological relations'. This is, for example, reflected in the 'mutual determination' between brain, body, and environment which can be accounted for by 'selective-adaptive coupling' and 'biopsychosocial historicity' (see 3.3.2). The 'property (or substance) ontology', characterizing 'isolated ontology', is subsequently replaced by a 'relational ontology' in 'embedded ontology'.

Second, 'embedded ontology' can be characterized as a 'dynamic ontology' which accounts for 'dynamic configurations'. 'Isolated ontology', as a 'static ontology' (see above), disrupts the relationship between brain, body and environment and extracts 'ontological properties' (or substances) which, by definition, are predefined, static and fixed. 'Embedded ontology', in contrast, rather focuses on 'ontological relations' that can be described by 'dynamic configurations'. 'Dynamic configurations' can be defined as self-organized, dynamic and flexible forms of 'selective-adaptive coupling' between brain, body and environment. As such they should be distinguished from 'properties' so that one should not speak of 'dynamic properties'. This is also reflected in Schopenhauer's (1966) account of the 'will': The 'will' reflects not the 'will' in the psychological sense but rather in the sense of a 'dynamic power/force', which can neither be accounted for by 'mental properties' nor by 'physical properties'. Schopenhauer thus rejects 'ontological properties' (or substances) as being too static, fixed and predefined and replaces them by the 'will' that is rather 'dynamic', self-organising and flexible. What Schopenhauer calls 'will' may therefore be accounted for by 'dynamic configurations' as 'ontological relation' in the present context. The 'ontological relation' with its different 'dynamic configurations' provides the 'dynamic power/force' which as such cannot be 'located' in either brain or body (Schopenhauer 1966: 246, 271). Instead, it must be 'located' within the 'intrinsic' relationship between brain, body, and environment itself. Since 'embedded ontology' provides the ontological framework for the 'dynamic configurations' within the 'intrinsic' relationship between brain, body and environment, it can be characterized as a 'dynamic ontology'.

Third, 'co-constitution and co-occurrence' can qualify as a 'dynamic relation' within the framework of an 'embedded ontology'. 'Co-constitution and co-occurrence' can be distinguished by 'mutual determination' and 'reciprocal dependency'. 'Mutual determination' accounts for 'co-constitution' while 'reciprocal dependency' accounts for 'co-occurrence': 'Mutual determination' is provided by 'selective-adaptive coupling' and 'biopsychosocial historicity' (see 3.3.2 for further details). Whereas 'reciprocal dependence' is reflected in the 'bilateral dependency' between brain, body and environment, which are all necessary conditions for each other. 'Co-constitution and co-occurrence' therefore remain incompatible with 'physical causality' as 'causa efficiencs' (see also 3.3.2). Due to the separation between cause and effect, 'mutual determination' and 'reciprocal dependence' remain impossible in 'causa efficiencs'. Accordingly, 'physical causality' i.e. 'causa efficiencs' may be characterized as a 'static relation' that is only compatible with 'isolated ontology'. Meanwhile, due to the inseparability between cause and effect, 'mutual determination' and 'reciprocal dependence' are well compatible with both 'causa formalis and finalis' (see 3.3.2). Accordingly, 'causa formalis and finalis' as forms of 'dynamic causation' (see 3.3.2) can be characterized as 'dynamic relations'. They are, as such, well compatible with 'co-constitution and co-occurrence' within the framework of 'embedded ontology'.

The ontological notion of 'co-constitution and co-occurrence' is closely related to the epistemic definition of 'events'. 'Events' cannot be reduced to mere 'stimuli' that are independent and 'isolated' from other stimuli. Instead, 'events', both empirically and epistemically defined by the inclusion of 'change' and 'context' (see 3.1.3 and 3.2.1), ontologically presuppose a 'dynamic relation' as the 'intrinsic ' relationship between brain, body and environment. 'Co-constitution and co-occurrence' between brain, body and environment is thus a necessary ontological condition for the epistemic possibility of 'events' i.e. without 'co-constitution and co-occurrence' 'events' would remain impossible. Since 'co-constitution and co-occurrence' provide the necessary ontological condition for the possibility of 'events', 'events' cannot be regarded as an ontological feature by themselves. Instead, 'events' have to be defined in epistemic terms rather than in ontological regard which distinguishes their present definition from other philosophical i.e. more ontologically oriented definitions (see 3.2.1 for discussion).

Fourth, 'embedded ontology' can be characterized by 'epistemic pluralism' and the absence of an 'epistemic hierarchy'. The different perspectives i.e. First-, Second- and Third-Person Perspective can ontologically be accounted for by distinct 'dynamic configurations' within the 'intrinsic' relationship between brain, body, and environment. If preference is given to either perspective, as it is the case in 'isolated ontology', the variety of 'dynamic configurations' would be neglected. This, in turn, leads to an incomplete account of the 'intrinsic' relationship between brain, body, and environment. The 'intrinsic' relationship between brain, body, and environment can subsequently only be accounted for when considering all epistemic perspectives which results in a so-called 'mixed perspective account' (Velmans 2000: 248). Accordingly, the 'epistemic monism', as it is presupposed in 'isolated ontology', is in 'embedded ontology' replaced by 'epistemic pluralism'. Another strategy is the following: In order to avoid 'epistemic pluralism', one might postulate a 'neutral vantage point' (Hornsby 1997: 79) from which ontological questions could be raised (see also 3.2.1 and 3.3.1). This 'neutral vantage point' would make the consideration of the different epistemic perspectives and thus 'epistemic pluralism' superfluous. However, there is no support for the epistemic possibility of such a 'neutral vantage point' in humans. All three perspectives show epistemic abilities as well as inabilities (see 2.4.2 and 3.2.2), which are complementary and mutually exclusive. Accordingly, none of the three epistemic perspectives could account for a 'neutral vantage point' from which all epistemic abilities and inabilities could be recognized. Neither perspective can therefore be regarded as a 'neutral vantage point' from which ontological questions like the mind-brain relationship problem can be raised. Such a 'neutral vantage point' may for example be provided by a 'First-Brain Perspective' to which, however, we have no direct epistemic access (see 3.2.1). In the case of direct epistemic access to the 'First-Brain Perspective', a mind-brain theory as it is described in the following quote by T. Nagel could be developed (T. Nagel 1998: 351; see also 3.2.1 for reference to a more or less similar quote by Nagel in relation to the 'First-Brain Perspective'): 'What will be the point of view, so to speak, of such a theory? If we could arrive at it, it would render transparent the relation between mental and physical, not directly, but through the transparency of their common relation to something that is not merely either of them. Neither the mental nor the physical point of view will do for this purpose. . . . The right point of view would be one which, contrary to present conceptual possibilities, included both subjectivity and spatiotemporal structure from the outset, all its descriptions implying both things at once, so that it would describe inner states and their functional relation to behavior and to one another from the phenomenological inside and the physiological outside simultaneously – not in parallel. The mental and physiological concepts and their reference to this same inner phenomenon would then be seen as secondary and each partial in its grasp of the phenomenon: Each would be seen as referring to something that extends beyond its grounds of application'.

Fifth, 'embedded ontology' can be characterized by 'epistemic-ontological relativity', 'ontological pluralism', and 'relative ontologies'. Ontological assumptions are no longer detached from the respective epistemic perspective from which they are made. Unlike in 'isolated ontology', in 'embedded ontology' one considers the relationship between a particular ontological assumption and a specific epistemic perspective (with its respective epistemic abilities/inabilities). Therefore, the different ontologies can no longer be regarded as 'absolute' and independent from the respective epistemic perspective in which they are made and inferred. They are rather 'relative' to and dependent on a particular epistemic perspective. One may therefore speak of 'epistemic-ontological relativity'. Since there are different perspectives, different ontologies can be developed (see 3.3.4 for the exact mechanisms) which implies 'ontological pluralism'. 'Ontological pluralism' can be defined by a co-existence of different ontologies that, due to their dependence on different perspectives, do not exclude each other (see also 1.4.3 for consideration of 'ontological pluralism' as a methodological strategy). This is, for instance, the case in the co-existence between 'mental and physical ontology' which (claim to; see above) presuppose different perspectives i.e. First- and Third-Person Perspective (see above). Since they do not exclude each other, neither of the two i.e. 'mental and physical ontology' can be regarded as the 'pre-eminent and all-inclusive one' i.e. as an 'absolute ontology' (see also 1.4.3) within the framework of 'embedded ontology'. Instead, one may characterize these different ontologies as 'relative ontologies' (see also 3.3.4). Accordingly, 'embedded ontology' is necessarily accompanied by 'epistemic-ontological relativity' and 'ontological pluralism' with 'relative ontologies'. Although the assumptions of 'physical ontology' and 'mental ontology' are (claimed to be; see above) made from different epistemic perspectives i.e. Third- and First-Person Perspective respectively, this epistemic-ontological relationship is neglected in 'isolated ontology'. Instead, 'physical and mental ontology' are detached from their respective epistemic perspective so that the former are regarded as 'absolute ontologies' and independent from the latter; this may be called 'epistemic-ontological disruption'. Moreover, due to 'epistemic monism' and 'epistemic hierarchy' (see above), co-existence between potentially different 'absolute ontologies' remains impossible and 'ontological pluralism' is thus replaced by 'ontological monism'. The conjunction of 'epistemic-ontological disruption' and 'ontological monism' implies 'isolated ontology' with the detachment i.e. 'isolation' between brain, body and environment. 'Epistemic-ontological disruption' and 'ontological monism' are avoided in 'embedded ontology' by 'epistemic-ontological relativity' and 'ontological pluralism' (see above).

Accordingly, 'epistemic-ontological relativity' and 'ontological pluralism' can be regarded as necessary conditions for the possibility of ontology as 'embedded ontology'.

Sixth, 'embedded ontology' can be characterized by the solution and transformation of the 'ontological mind-brain relationship problem' (see 1.1.1). 'Ontological properties' i.e. 'physical and mental properties', that characterize the brain and the mind in 'isolated ontology', are replaced by an 'ontological relation' (see above) i.e. the 'intrinsic' relationship between brain, body and environment within the framework of 'embedded ontology'. 'Ontological relation' is reflected in different 'dynamic configurations' which ontologically account for mental states as brain states (see above and 3.3.2). Since mental states and brain states can ontologically be accounted for by 'ontological relation', assumption of 'ontological properties' like 'physical and mental properties' and thus of brain and mind as 'isolated brain' and 'isolated mind' remains no longer necessary. There is only an 'embedded brain' (see 3.3.2); this accounts for mental states (as brain states) reflecting a specific 'dynamic configuration' within the 'intrinsic' relationship between brain, body and environment. The assumption of an ontologically separate mind, to which mental states can be attributed to in ontological respect, remains thus an 'epistemic illusion' (see below for further details) within 'embedded ontology'. The question for the ontological determination of the mind, as the first part of the 'ontological mind-brain relationship problem', can subsequently be considered as solved (see 1.1.1). Whereas its second part, the question for the ontological relationship between brain and mind is transformed into a 'brain-environment problem': If mental states (as brain states) reflect 'dynamic configurations' i.e. 'ontological relation' within the 'intrinsic' relationship between brain, body and environment, the question for the ontological relationship between brain and mind is transformed into the question for the relationship between brain and environment (through the body) i.e. a 'brain-environment problem'. The definition of the brain as an 'isolated brain', as ontologically defined by 'physical properties', and the assumption of a possible mind as an 'isolated mind', as ontologically defined by 'mental properties', must be considered as necessary conditions for the possibility of the 'ontological mind-brain relationship problem' in the traditional sense. If these necessary conditions can no longer be presupposed, the 'ontological mind-brain relationship problem' remains impossible as such. This is the case in 'embedded ontology' where the notions of 'isolated brain' and 'isolated mind', reflecting different 'ontological properties' i.e. 'physical and mental properties', are replaced by the ones of 'embedded brain' and 'dynamic configuration'. Re-definition of the brain as an 'embedded brain' and association of mental states with 'dynamic configuration' rather than a mind must subsequently be regarded as necessary conditions for the possibility of the transformation of the 'ontological mind-brain relationship problem' into a 'brain-environment problem'.

Seventh, 'embedded ontology' implies re-characterization of the 'ontological mind-brain relationship problem' as an epistemic problem. The necessary ontological conditions i.e. 'physical and mental properties' for the possibility of the 'ontological mind-brain relationship problem' can no longer be presupposed in 'embedded ontology': 'Physical and mental properties' are replaced by 'dynamic configurations' within an 'ontological relation' i.e. the 'intrinsic' relationship between brain, body and environment (see above). Instead of reflecting different types of 'ontological properties' i.e. 'physical and mental properties', the different 'dynamic configurations' rather account for different epistemic perspectives and their respective epistemic abilities and inabilities (see above and 3.2.1) that are possible within an 'ontological relation' i.e. the 'intrinsic' relationship between brain, body and environment. Accordingly, 'embedded ontology' not only requires transformation of the 'ontological mind-brain relationship problem' into a 'brain-environment problem' but in addition re-characterization of it as an epistemic problem. One may therefore speak of an 'epistemic brain-environment problem' which concerns the epistemic relationship between 'dynamic configurations' and epistemic abilities/inabilities within the framework of an 'embedded ontology' (see Chapter 2 as well as 3.2.1). In contrast, the 'dynamic configurations' are not defined by 'ontological relation' but replaced by 'ontological properties' i.e. 'physical and mental properties' (which presuppose 'physical and mental ontology') within the framework of 'isolated ontology' (see above). The 'epistemic brain-environment problem' must then be regarded as an ontological problem concerning the question for the ontological relationship between 'isolated brain' i.e. 'physical ontology' and 'isolated mind' i.e. 'mental ontology'. The presupposition of 'physical and mental ontology' and thus 'isolated ontology' must subsequently be considered as a necessary condition for the possibility of the 'ontological mind-brain relationship problem'. If this necessary condition is no longer presupposed, the 'ontological mind-brain relationship problem' remains impossible; this is the case in 'embedded ontology'. Accordingly, replacement of 'isolated ontology' by 'embedded ontology' and the subsequent epistemic characterization of the 'dynamic configurations' can be regarded as necessary conditions for the possibility of re-characterization of the 'ontological mind-brain relationship problem' as an 'epistemic brain-environment problem'.

Eighth, the possibility of the 'ontological mind-brain relationship problem' may be traced back to an 'epistemic illusion', which is caused by the neglect of 'autoepistemic limitation'. Due to 'autoepistemic limitation', it is possible to distinguish mental states from brain states i.e. neuronal states in epistemic regard (see 2.3.1). If 'autoepistemic limitation' is neglected, mental states can ontologically be separated and detached i.e. 'isolated' from the brain as well as from their 'intrinsic' relationship to body and environment. Mental states are consecutively attributed and related to a mind, as distinguished from brain/body in ontological regard. This, however, must be regarded as an 'epistemic illusion'. The distinction between neuronal and mental states, which is originally purely epistemic in nature, is falsely interpreted as an ontological difference between brain and mind. Brain and mind are consecutively defined independently from the environment as ‘isolated brain’ and ‘isolated mind’. Moreover, ‘isolated ontology’ with ‘physical and mental ontology’ is inevitably developed as the appropriate ontological framework for both ‘isolated brain’ and ‘isolated mind’. Both necessary ontological conditions for the possibility of the ‘ontological mind-brain relationship problem’ i.e. ‘isolated brain’/’isolated mind’ and ‘physical and mental ontology’ (see above) can thus be traced back to ‘autoepistemic limitation’. Accordingly, ‘autoepistemic limitation’ can be regarded as a necessary epistemic condition for the possibility of the ‘ontological mind-brain relationship problem’. Our (i.e., the human) epistemic design is characterized by ‘autoepistemic limitation’, which allows for the epistemic distinction between neuronal and mental states. The epistemic distinction between neuronal and mental states is a necessary condition for the possibility of ontological inferences from epistemic differences i.e. ‘false ontologisation’ (see also 2.4.1). The neglect of the epistemic origin of ontological assumptions (i.e. ‘epistemic-ontological disruption’ (see above)) may provide the ground for the characterization of ‘physical and mental ontology’ as ‘absolute ontologies’ (see above). ‘Isolated ontology’ therefore looses and neglects the necessary condition for its own possibility (see below for further illustration). This neglect of the own epistemic origin may have contributed to the apparent principal insolvability of the ‘ontological mind-brain relationship problem’ within the framework of ‘isolated ontology’. In contrast, due to the consideration of ‘epistemic-ontological relativity’ (see above), the detachment from the own necessary epistemic conditions is avoided in ‘embedded ontology’: Since the own epistemic origin is preserved, the ‘ontological mind-brain relationship problem’ may no longer appear as principally insolvable. Meanwhile, even here we cannot get rid of the ‘ontological mind-brain relationship problem’ altogether because we remain unable to avoid its transformation into and re-characterization as an ‘epistemic brain-environment problem’. This is due to our epistemic design with ‘autoepistemic limitation’. The ‘epistemic brain-environment problem’ can only be avoided if ‘autoepistemic limitation’ remains absent. Since in this case there is no ‘intrinsic’ relationship between brain and environment (see 2.3.1 and 3.3.2), the idea of a possible ‘epistemic brain-environment problem’ could not even be raised anymore.

Ninth, ‘embedded ontology’ presupposes a broader ontological framework than ‘isolated ontology’. One may speak of a broader ontological framework, if a particular ontology can reveal the necessary epistemic and ontological conditions for the possibility of another ontology. ‘Embedded ontology’ can reveal the necessary epistemic and ontological conditions for the possibility of ‘isolated ontology’: Epistemic condition consists in ‘autoepistemic limitation’ while ‘epistemic-ontological disruption’ can be considered as the necessary ontological condition for the possibility of 'isolated ontology' (see above). In addition, since the other ontology becomes, at least partially, invalid within the broader ontological framework, 'isolated ontology' becomes (partially) invalid within the framework of 'embedded ontology' (see above): Within the ontological framework of 'isolation' between brain, body, and environment i.e. 'isolated ontology', the assumption of 'ontological properties' must be considered as valid. In contrast, the same assumption becomes invalid within the ontological framework of the 'intrinsic' integration between brain, body and environment i.e. 'embedded ontology' (see above). Accordingly, 'embedded ontology' provides the broader ontological framework for 'isolated ontology'.

Tenth, the relationship between 'embedded ontology' and 'isolated ontology' can be characterized as a foundational relationship. One could speak of a foundational relationship if the necessary conditions for the possibility of 'isolated ontology' presuppose 'embedded ontology'. 'Autoepistemic limitation' and 'epistemic-ontological disruption' are necessary conditions for the possibility of 'isolated ontology'. If there is a foundational relationship between 'embedded ontology' and 'isolated ontology', both conditions by themselves should presuppose 'embedded ontology'. The possibility of 'autoepistemic limitation' necessarily presupposes 'embedded ontology' since it would otherwise, i.e. within the framework of an 'isolated ontology' as foundation, remain impossible. 'Epistemic-ontological disruption' presupposes a linkage between the epistemic perspectives and the ontological assumptions since a disruption, as such, would otherwise no longer be necessary and possible. This linkage, in turn, is reflected in 'epistemic-ontological relativity' as a characteristic hallmark of 'embedded ontology' (see above). The possibility of 'epistemic-ontological disruption' thus presupposes 'embedded ontology'. Accordingly, since both 'autoepistemic limitation' and 'epistemic-ontological disruption' are necessary conditions for 'isolated ontology' and, at the same time, presuppose 'embedded ontology', the latter type of ontology must be considered as foundational for the former. The relationship between 'embedded ontology' and 'isolated ontology' may be regarded as analogous to the one between Einstein's theory of relativity and Newton's mechanics. Einstein relativized and demonstrated the validity of Newton's mechanics only within a certain framework; this means that outside this framework his theory remains invalid. By defining the appropriate framework for the validity of Newton's mechanics, he revealed the necessary conditions for its possibility. Einstein's relativity theory thus provides the broader framework for Newton's mechanics. Moreover, he demonstrated that the necessary conditions for the possibility of Newton's mechanics presuppose his own theory of relativity. Accordingly, the relation between Einstein's theory of relativity and Newton's mechanics can be characterized as a foundational relationship.

Rejection of 'physical ontology': 'Dynamic naturalism'
We demonstrated that the relationship between brain, body, and environment can be accounted for by 'embedded ontology', which presupposes a naturalistic framework. A naturalistic framework i.e. naturalism is often associated with 'physical ontology' and 'physical truism' (see Seager 1999: 249–250). This implies also psychological and neural forms of naturalism which share the same underlying ontological presuppositions (i.e. 'isolated ontology') and thus do not differ principally from physicalistic forms of naturalism. These, however, remain incompatible with 'embedded ontology'. Subsequently, characterizing 'embedded ontology' by naturalism in a physicalistic sense is impossible. One may distinguish between physicalistic and non-physicalistic versions of naturalism. Physicalistic versions can be defined by the possible reduction of all properties and relations to physical properties. This, however, remains impossible in the non-physicalistic versions (see Koppelberg 2000). Since dynamic states cannot be accounted for by (classical) 'physical properties', they remain non-reducible to 'physical properties' (see 3.3.2). One could therefore characterize 'embedded ontology' by a distinct i.e. non-physicalistic form of naturalism, which in orientation on 'embedded ontology' as 'dynamic ontology' (see above) could be called 'dynamic naturalism' (see below for further explanation).

Hornsby (1997: 2, 7–8, 169–180) speaks of 'naive naturalism' and distinguishes it from 'scientific naturalism' as a physicalistic version of naturalism (see Akins 2001 who also speaks of the 'naivity of naturalism'). According to Hornsby, 'naive naturalism' can be characterized by the following features: (i) Not everything is visible from the perspective adopted by the 'naturalizer'; (ii) Conception of 'nature' to which humanity is not inimical; (iii) Opposition to both reductive and non-reductive materialism; (iv) Against 'objective materialistic third-person standpoint'; (v) Inclusion of first-person knowledge within the framework of a 'new mental ontology' rejecting the Cartesian sense; (vi) Rejection of simplistic notion of causality. In the following, these features shall be investigated with respect to the present concept of 'embedment' as reflected in 'embedded epistemology' and 'embedded ontology'. If these features are in accordance with 'embedded ontology', it may be compatible with 'naïve naturalism' as a non-physicalistic version of naturalism.

i. Due to 'autoepistemic limitation', the states of the own brain cannot be recognized as such. The naturalizer itself subsequently lacks direct epistemic and empirical access to his own brain so that 'not everything is visible' from his perspective.
ii. 'Embedded ontology' focuses on the relationship between brain, body and environment. This does not just include humans but, in addition, other species as well. Humans can be considered as the environment for other species and

vice versa. Accordingly, humans are integrated within the relationship between brain, body, and environment and can therefore not be considered as inimical to 'nature'.

iii. Any form of materialism either reductive or non-reductive presupposes a 'physical ontology', which, however, is rejected in 'embedded ontology'. Accordingly, 'embedded ontology' opposes both reductive and non-reductive materialism.

iv. 'Embedded ontology' can be characterized by 'epistemic pluralism'; as a result, there is no restriction to an 'objective third-person standpoint'. Instead, the 'objective third-person standpoint' is directly linked to a 'subjective first-person standpoint' as it is reflected in 'First-Person Neuroscience'.

v. First-Person knowledge is accounted for by 'First-Person Epistemology'. 'First-Person Epistemology' is an integral part of 'embedded epistemology', which can be characterized by 'epistemic pluralism'. 'Epistemic pluralism', in turn, is crucial in the characterization of 'embedded ontology'. 'Embedded ontology' rejects the traditional i.e. Cartesian ontology by developing a novel ontological framework i.e. 'new (mental) ontology'. In 'embedded ontology' 'ontological relation' and 'dynamic configurations' replace for 'mental properties', which characterize '(old)mental ontology'.

vi. The simplistic notion of 'causa efficiencs' as 'physical causality' is complemented by the more sophisticated notions of 'causa finalis' and 'causa formalis'. These forms of 'biological causality' account for the 'embedded brain', mental causation as 'dynamic causation' (see 3.3.2), and 'co-constitution and co-occurrence' in 'embedded ontology' (see above). Causality is therefore no longer restricted to purely physical forms of causality. Instead, it may also include biological forms of causality that are non-reducible to physical forms of causality.

It is apparent that 'embedded ontology' is in full accordance with these features that characterize 'naive naturalism'. Accordingly, both 'embedded ontology' and 'naïve naturalism' are compatible with each other. How can we define the terms 'naïve' and 'naturalism' within the framework of 'embedded ontology'? Within the framework of 'embedded ontology', the meaning of 'naturalism' refers to 'biological relations' between brain, body and environment which as such are non-reducible to 'physical properties'. The meaning of the term 'naïve' remains unclear in the present context – it should describe the 'biological relations' in further detail. McDowell (1996: 96–97, 181–182) suggests a conception of 'premodern naturalism' which comes close to what Hornsby calls 'naïve naturalism' (see Hornsby 1997, Footnote 7, 224 for further comparison). He characterizes this 'premodern naturalism' by using meaning and spontaneity as crucial criteria which, according to him, remain incompatible with the realm of laws. Both meaning and spontaneity can be well accounted for by 'embedded ontology' as dynamic ontology' (see above). If meaning and spontaneity can be accounted for by 'embedded ontology', they can be regarded as compatible with 'dynamic laws' which characterize 'embedded ontology' as 'dynamic ontology'. These 'dynamic laws' must be distinguished from (classical) 'physical laws'. McDowell's conception of 'premodern naturalism' must subsequently be further specified in relation to the type of law: His assumption of the incompatibility between meaning/spontaneity and laws may be true with regard to (classical) 'physical laws'. However, it can no longer be considered as true with regard to 'dynamic laws' which will be demonstrated in the following. Ontologically, meaning is reflected in the 'intrinsic' character of the relationship between brain, body and environment (see also 2.3.3 and 3.1.4). Whereas empirically, meaning is accounted for by the 'principle of meaningful organisation' epistemically, meaning is reflected in the consideration of 'phenomenal experience' and First-Person Perspective. Ontologically, spontaneity is accounted for by 'co-constitution and co-occurrence' as a 'dynamic relation' between brain, body, and environment. Empirically, spontaneity is accounted for by self-organisation as well as the replacement of instructional codes by selection (see 3.1.2). Epistemically, spontaneity is reflected in the possible switch between the different epistemic perspectives. Due to their complementary epistemic abilities and inabilities, the different perspectives can be freely and spontaneously combined to each other according to the respective needs. Following the characterization of meaning and spontaneity by 'dynamic laws', we want to characterize (and modify) McDowell's non-physicalistic version of naturalism as 'dynamic naturalism'.

'Naturalism' refers to the relationship between brain, body, and environment. As a 'biological relation' it remains non-reducible to 'physical properties' (see Edelman & Tononi 2000: 209–211 for the non-reduction of biology to physics). 'Co-constitution and co-occurrence' characterize the 'biological relation' as a 'dynamic relation' (see above) which can be accounted for by 'dynamic laws'. 'Dynamic naturalism' in this sense is well compatible with 'embedded ontology' and its rejection of both 'physical ontology' and physicalistic versions of naturalism (see above). 'Dynamic naturalism' may therefore be regarded as a form of 'biological naturalism', which is non-reducible to physicalistic versions of naturalism. As such 'dynamic naturalism' has to be distinguished from the concept of 'biological naturalism' as suggested by Searle (1997, 2000). Similar to 'dynamic naturalism', he includes the First-Person Perspective as distinguished from the Third-Person Perspective. Moreover, he directly relates the First-Person Perspective to the brain so that both are compatible with each other. He meanwhile characterizes the brain as a 'machine' by describing it as a 'biological machine just as much as heart and liver' (Searle 1997: 202). However, machines can only be characterized in physicalistic terms which remains incompatible with the brain as a 'dynamic brain' and 'embedded brain'. Accordingly, Searle's 'biological naturalism' may still be regarded as a physicalistic version of naturalism where biological properties are still reducible to 'physical properties'; his 'biological naturalism' remains therefore incompatible with 'dynamic naturalism'. Due to the 'isolation' of the brain from body and environment, Searle must necessarily presuppose 'biological properties' that are reducible to 'physical properties'. This is no longer necessary in the case of an 'intrinsic' integration between brain, body and environment. Here, 'biological properties' are replaced by 'biological relations' which by definition remain non-reducible to 'ontological properties' in general and thus to 'physical properties' in particular.

Finally, the concept of 'nature' presupposed in 'dynamic naturalism' can neither be accounted for by 'physical properties' nor by 'mental properties'. Instead, 'nature' can be accounted for by relations as 'biological relations' i.e. 'ontological relations' as opposed to 'ontological properties'. Since these 'biological relations' are necessary for the possibility of the assumption of 'mental and physical properties', 'dynamic naturalism' presupposes a concept of 'nature' which provides a 'broader and more foundational' (see 3.3.3.2 for further definition of 'broader' and 'foundational') framework than both physicalistic and mentalistic conceptions of 'nature'. This conception of 'nature' is thus richer than purely physicalistic or mentalistic versions which is reflected in the following quote by T. Nagel (2000: 470): 'The aim is rather to integrate them all the way to the bottom of our world view, in such a way that neither is subordinate to other. This means that what Bernhard Williams calls the 'absolute' conception of reality will not be a physical conception, but something richer that entails both the physical and mental.'

Rejection of 'mental ontology': 'Embedded information'

'Embedded ontology' remains incompatible with 'mental ontology'. Both 'mental substances' and 'mental properties' were consequently rejected, which is for example, reflected in the discussion about the brain as a 'mental brain' (see 3.3.1). Whereas 'mental ontology' itself may be rejected, one may nevertheless maintain the assumption of a second form of ontology, one that complements 'physical ontology'. This second form of ontology replaces the assumption of 'mental substances/properties' with, for example, the notion of 'information'. The resulting 'informational ontology' may then be regarded as an ontological analogon of 'mental ontology' within the framework of an 'isolated ontology'. However, even these analogous forms of 'mental ontology' like for example 'informational ontology' have to be rejected within the framework of 'embedded ontology'. First, they do not replace but rather complement 'physical ontology'. Second, they necessarily presuppose 'isolation' between brain, body, and information and thus an 'isolated ontology'. Third, they cannot escape the mental-physical dichotomy since they may be characterized by either 'physical ontology' or 'mental ontology'. Accordingly, 'informational ontology', as an ontological analogon of 'mental ontology', remains necessarily incompatible with 'embedded ontology'.

Chalmer's (1996) concept can be considered as an example for the introduction of an 'informational ontology' as an analogon to and replacement of 'mental ontology' (see also 3.3.1 for a different interpretation with another role of 'informational ontology' in Chalmers concept). He considers consciousness as essential and fundamental, which per se cannot be accounted for by 'physical ontology'. In order to justify consciousness, he complements 'physical ontology' with 'informational ontology'. 'Informational ontology' presupposes that information can be realized in both ways i.e. physically and phenomenally (see Chalmers 1996: 284–307). On the basis of this 'double realization' of information he assumes ontological 'duality at a deep level' reflecting physical and phenomenal properties. The relationship between phenomenal and physical properties, on the other hand, can be described by 'structural isomorphism' (i.e. 'similar structures'), 'lawful connections' (i.e. 'psychophysical laws'), 'correlated properties', a 'nice fit' between 'cognitive role of information states and epistemology of experience', and two distinct points of view (i.e. from the 'inside' and from the 'outside') (see Chalmers 1996: 284–302). If, in contrast, 'informational ontology' is considered by itself, that is to say independent from its role as an ontological analogon of 'mental ontology', the question for the compatibility between 'informational ontology' and 'embedded ontology' depends on the definition of 'information'. If 'information' presupposes 'isolation' between brain, body, and environment i.e. 'isolated information' (see 3.1.4), 'informational ontology' has to be rejected. However, if information is defined by 'embedded information', 'informational ontology' is compatible with 'embedded ontology'. The notion of information is often characterized as discrete, symbolic, and syntactic which requires representation in the classical sense (see 3.1.4). 'Information' in this sense is encapsulated, predefined and therefore context-independent and 'isolated' from the respective context i.e. the environment. Accordingly, this concept of 'information' shall be characterized as 'isolated information'. Unfortunately, Chalmers (1996) does not really specify his notion of 'information'. It seems that he considers 'information' in a rather 'isolated' sense (see above): he strongly relies on the comparison with classical physics and computers. The distinction between his notion of 'information', which closely resembles the notion of 'isolated information', and the notion of 'physical information', remains therefore rather difficult (see also 3.3.1). However, if the difference between his notion of 'information' i.e. in the sense of 'isolated information' and the concept of 'physical information' is blurred, his distinction between 'informational ontology' and 'physical ontology' becomes questionable and superfluous as well (see also Searle 1997: 176, 205, 211). 'Informational ontology' and 'physical ontology' are subsequently indistinguishable from each other which makes their distinction superfluous. If Chalmers, in contrast, defines 'information' as 'embedded information' (see below), the distinction between 'informational ontology' and 'physical ontology' is contradictory with respect to the presupposed ontological framework. 'Embedded information' presupposes ‘embedded ontology’ which is not compatible with the assumption of ‘physical ontology’ as a form of an ‘isolated ontology’. Accordingly, the presupposition of ‘information’ in the sense of ‘embedded information’ necessarily excludes the possible distinction between ‘informational ontology’ and ‘physical ontology’ within a common ontological framework. Chalmers’ distinction between ‘informational ontology’ and ‘physical ontology’ can thus no longer be maintained since it is either superfluous (in the case of information as ‘isolated information’) or contradictory (in the case of information as ‘embedded information’).

Unlike ‘isolated information’, which is characterized as discrete, symbolic and syntactic, ‘information’ may also be described as continuous, rate-dependent and semantic (see Kelso 1995: 144–145). Instead of reflecting predefined and context-independent instructional codes, ‘information’ in this sense is rather defined by context-dependent regularities (see Varela 1990: 121). The instructional predefined codes are replaced by self-organisation and flexible adaptation to the context i.e. the environment. ‘Information’ in this sense is thus necessarily related to the respective environmental context so that one can speak of ‘embedded information’, which is well compatible with ‘embedded ontology’. Accordingly, Chalmers’ implicit distinction between ‘informational and physical ontology’ must be replaced by a single ontological framework i.e. ‘informational ontology’ as ‘embedded ontology’ in which ‘information’ is defined in the sense of ‘embedded information’. The relationship between phenomenal and physical properties with ‘structural isomorphism’ (i.e. ‘similar structures‘), ‘lawful connections’ (i.e. ‘psychophysical laws‘), ‘correlated properties’, ‘nice fit’ between ‘cognitive role of information states and epistemology of experience’, and two distinct points of view (i.e. from the ‘inside’ and from the ‘outside‘) (see Chalmers 1996: 284–302) no longer have to be accounted for by ontological ‘duality at a very deep level’ (see above). Instead, these characteristics may rather reflect ‘dynamic configurations’ within the ‘intrinsic’ relationship between brain, body, and environment and thus ‘information’ in the sense of ‘embedded information’. The ontological ‘duality at a very deep level’ is replaced by the ‘dynamic’ and ‘relational’ character of ‘embedded information’. This ‘informational ontology’ with information as ‘embedded information’ no longer requires the assumption of both ‘physical ontology’ and ‘informational ontology’ (with information in the sense of ‘isolated information’).

Whereas ‘isolated information’ can be accounted for by ‘physical laws’ (i.e. the laws from ‘classical physics’), ‘embedded information’ rather requires ‘dynamic laws’: ‘Notice, coordination dynamics is not trapped (like ordinary physics) by its (purely formal) syntax. Order parameters are semantic, relational quantities that are intrinsically meaningful to a system functioning. What could be more meaningful to an organism than information that specifies the coordinative relations among its parts or between itself and the environment? This view turns the mind-matter, information-dynamics interaction on the head. Instead of treating dynamics as ordinary physics and information as a symbolic code acting that a program relates to a computer, dynamics is cast in terms that are semantically meaningful. The upshot of this step, which, I stress is empirically motivated, is that intentions do not lie outside self-organized coordination dynamics.' (Kelso 1995: 145). As opposed to 'dynamic laws', Chalmers' speaks of 'psychophysical laws' as distinguished from 'physical laws'. He consequently emphasizes 'naturalistic dualism with psychophysical laws' (Chalmers 1996: 299–302, 128–129). Moreover, similar to Searle, Chalmers includes the First-Person Perspective (as, for example, reflected in his emphasis on consciousness) but, unlike Searle, he does not relate it to 'physical laws' but 'psychophysical laws'. His naturalism can therefore neither be characterized as a physicalistic version like it is the case in Searle's concept of 'biological naturalism' (see above) nor can it be equated with 'dynamic naturalism'. 'Dynamic naturalism' presupposes 'embedment' between brain, body, and environment and thus 'information' in the sense of 'embedded information'. Chalmers rather presupposes 'isolation' between brain, body and environment and therefore assumes 'information' in the sense of 'isolated information' (see above). Accordingly, Chalmers' version of naturalism seems to straddle on a rather ill-defined middle ground between 'physicalistic and dynamic naturalism'. Finally, similar to 'mental ontology', the introduction of 'informational ontology', which is employed to complement 'physical ontology', leads to 'emergentism' which results in some kind of ontological dualism. For example, Chalmers vouches for a 'dual aspect theory' with a 'natural supervenience of experience on the physical' (Chalmers 1996: 128–129, 299–302). Since within the framework of 'embedded ontology', any ontological analogon to 'mental ontology' remains contradictory (see above), the various forms of 'emergentism' (supervenience, epiphenomenalism, etc.; see Seager 1999: 277) have to be rejected.

Another strategy to solve the problem of the relationship between 'physical and mental ontology' consists in the complete replacement of 'physical ontology' by 'mental ontology' with the consecutive development of panpsychistic theories (see 3.3.1). These however, remain incompatible with 'embedded ontology' as well. Even though panpsychistic theories may link (or replace) 'physical and mental properties' (see, for example, T. Nagel in 3.3.1), they also 'isolate' these 'ontological properties' from their respective environmental context. Accordingly, panpsychistic theories must be regarded as forms of an 'isolated ontology'. Due to 'isolation' between brain, body, and environment, panpsychistic theories raise various problems (Seager 1999: 242–247), which no longer appear in 'embedded ontology'.

First, the 'combination problem', which consists in the convergence of atomic 'mental particles' into the 'phenomenal experience' of consciousness, is no longer possible in 'embedded ontology'. Unlike panpsychistic theories, 'embedded ontology' does neither presuppose some 'mental ontology' nor an ontological analogon like 'informational ontology'. Accordingly, the question whether the step from 'mental (or informational) particles' to 'phenomenal experience' is possible cannot be raised in 'embedded ontology'.

Second, the 'unconscious mentality problem', which consists in the possibility of unconsciousness as ontologically different from consciousness, does no longer appear in 'embedded ontology'. Unlike to the panpsychistic theories, the difference between consciousness and unconsciousness bears no ontological implications (see 3.2.2). Instead, both reflect distinct 'dynamic configurations' within the relationship between brain, body, and environment.

Third, the 'completeness problem', which lies in the completeness of the causal world of physics, becomes 'relativized' in 'embedded ontology'. Within the realm of physics, the causal world remains closed and can be accounted for by 'physical cousality' as 'causa efficiences'. However the physical world with 'physical causality' as causa efficiencs (see 2.3.3) cannot account for the relationship between brain, body, and environment. There, causa finalis and causa formalis as forms of 'biological causality' seem to be more appropriate (see 3.3.2). Accordingly, both 'physical causality' and the closeness of the physical world are 'relativized' by showing the limits of their validity in the case of the relationship between brain, body and environment.

Fourth, the 'no-sign problem', consisting in the absence of direct evidence for 'mental reality', is no longer possible in 'embedded ontology'. Due to the rejection of 'mental ontology', the assumption of 'mental reality' is replaced by the consideration of the relationship i.e. 'intrinsic' integration between brain, body and environment. The 'intrinsic' relationship between brain, body, and environment provides ontological, epistemic, and empirical signs of mental states. Ontological 'signs' are reflected in the 'dynamic' and 'relational' character of this relationship and thus in 'dynamic configurations' (see above). The First-Person Perspective provides epistemic 'signs' while dynamic states, as indirectly accessible through 'First-Brain Perspective' and 'First-Person Neuroscience' (see 3.2.1), provide empirical 'signs' of mental states. Accordingly, there are 'signs' of mental states through the 'intrinsic' the relationship between brain, body, and environment within the framework of 'embedded ontology'.

Fifth, the 'not-mental problem', consisting in the difficulty to distinguish between 'mental and physical properties', is no longer possible in 'embedded ontology'. Since both 'physical and mental ontology' are rejected the question whether a distinction between 'mental and physical properties' is possible can no longer be raised in 'embedded ontology'.

Finally, similar to panpsychistic theories (see Seager 1999: 247), one may accuse 'embedded ontology' of 'mysterianism'. Due to the apparent impossibility of solving the 'ontological mind-brain relationship problem' within the current naturalistic i.e. physicalistic framework, panpsychistic theories introduce and postulate some kind of non-naturalistic realms. These non-natural realms concern particular non-physical properties e.g. 'protomental properties' (see 3.3.1 and Nagel 1986); their positive definition remains however elusive. One may therefore speak of a so-called 'ontological mysterianism'. In the case of panpsychistic theories, these non-naturalistic realms imply the assumption of 'mental ontology' or an ontological analogon (see above). They are often only negatively defined i.e. as 'non-natural' which distinguishes them from 'physical ontology'. However, a 'non-natural' definition does not characterize these realms by themselves which makes them necessarily 'mysterious'. Analogously, a positive definition of the 'brain, body and environment relationship' must necessarily fail within the framework of an 'isolated ontology'. 'Isolated ontology' presupposes 'ontological properties' (or substances), which, by definition, are not compatible with 'ontological relations' i.e. the 'intrinsic' relationship between brain, body and environment. However, since 'ontological properties' (or substances) remain incompatible with the 'intrinsic' relationship between brain, body and environment, a positive definition of the latter must necessarily remain 'mysterious' within the framework of 'isolated ontology'. In the case of 'embedded ontology', the 'intrinsic' relationship between brain, body, and environment may potentially be considered as 'mysterious'. Since this relationship can neither be defined in terms of (classical) 'physical properties' nor 'mental properties', a positive definition seems to remain elusive, which may make it rather 'mysterious'. A positive definition of this relationship is however possible considering the peculiar characteristics of 'embedded ontology' (see above). The possibility of a positive definition of the relationship between brain, body and environment within the framework of an 'embedded ontology' is reflected in ontological, epistemic and empirical characterizations. Ontologically, a positive definition is reflected when the 'brain, body and environment relationship' is characterized by a 'dynamic configuration'. Epistemically, a positive definition is reflected in the characterization of the various epistemic abilities and inabilities. Those epistemic abilities and inabilities are accounted for by distinct 'dynamic configurations' within the relationship between brain, body, and environment. Empirically, a positive definition is reflected in the characterization of the brain by dynamic states, which account for the possibility of an 'intrinsic' integration between brain, body and environment. Accordingly, unlike panpsychistic theories, which presuppose 'isolated ontology', 'embedded ontology' cannot be characterized by 'ontological mysterianism'.

Finally, however, one may even concede some kind of 'mysterianism' within the framework of 'embedded ontology'. 'Autoepistemic limitation' is a characteristic epistemic hallmark of 'embedded ontology'. By reflecting the inability to recognize the own brain states as brain states, 'autoepistemic limitation' accounts for the possibility of an epistemic distinction between mental states and brain states as neuronal states (see 2.3.1 and 3.1.3). Due to the fact that 'autoepistemic limitation' is primarily defined as an epistemic inability and thus in negative terms, a positive epistemic definition of it remains necssarily elusive. One may therefore characterize 'embedded ontology' (and 'embedded epistemology') by 'epistemic mysterianism'. However, this 'epistemic mysterianism' in 'embedded ontology' has to be distinguished from the 'ontological mysterianism' in panpsychistic theories in the following points. First, the 'ontological mysterianism' concerns the ontological realm while the 'epistemic mysterianism' concerns the epistemic realm. Second, unlike 'ontological mysterianism', the 'epistemic mysterianism' i.e. 'autoepistemic limitation' can be accounted for by empirical mechanisms i.e. 'event coding' (see 3.1.3) and remains thus compatible with a naturalistic framework. Third, unlike 'ontological mysterianism', 'epistemic mysterianism' can be clearly specified and defined i.e. in epistemic terms. This is reflected in the determination of 'autoepistemic limitation' through the absence of particular epistemic abilities. Fourth, unlike 'ontological mysterianism', 'epistemic mysterianism' can be defined in positive ontological terms as it is reflected in the characterization of 'autoepistemic limitation' and mental states by a specific 'dynamic configuration' within the relationship between brain, body and environment. Fifth, unlike 'ontological mysterianism', the negative description of 'autoepistemic limitation' as an epistemic inability is necessarily coupled with a positive description i.e. the epistemic ability to experience mental states. Accordingly, the 'epistemic mysterianism' in 'embedded ontology' can not be compared with the 'ontological mysterianism' in panpsychistic theories.

3.3.4 'Ontology of the brain': 'Self-reference' of the brain

The necessary conditions for the principal possibility of the hypothesis of 'embedment' as such have not been revealed yet. How is it possible for the author, Georg Northoff, to develop this hypothesis? The possibility of development of this hypothesis presupposes two different necessary conditions. First, the existence of a brain is presupposed i.e. a particular brain as the one from the author Georg Northoff. Second, the brain of the author must be able to refer to itself which may be called 'self-reference' of his own brain.

First, if the author of the present book, Georg Northoff, had no brain, he could not have developed his hypothesis of 'embedment'. In this case, the author would have lacked the cognitive capacities like, for example, thoughts, which are necessary for philosophizing (see also 3.2.3). More generally, the existence of a brain must be considered as a necessary condition for the principal possibility of generating and developing philosophy as such. The necessity of the existence of the brain as a necessary condition for its own generation and development has been avoided in philosophy by making the implicit presupposition of a mind as both vehicle and content: The vehicle of philosophy i.e. the brain was neglected while the contents of philosophy i.e. investigation of mental states in epistemology and ontology were attributed to the cognitive capacities of a mind. Due to this neglect of the brain, the vehicle of philosophy as the necessary condition for the possibility of generating and developing epistemological and ontological concepts was related to the mind. This can be regarded as a confusion between content i.e. mind and vehicle i.e. brain where the latter is falsely equated i.e. confused with the former. The neglect of the brain as the necessary condition for the possibility of generating and developing philosophy has already been pointed out by Schopenhauer:

> For only after men had tried their hand for thousands of years at merely objective philosophizing did they discover that, among the many things that make the world so puzzling and precarious, the first and foremost thing is that, however immeasurable and massive it may be, its existence hangs nevertheless on a single thread; and this thread is the actual consciousness in which it exists. This condition, with which the existence of the world is irrevocably encumbered, marks it with the stamp of ideality, in spite of all empirical reality, and consequently with the stamp of the mere phenomenon. Thus the world must be recognized, from one aspect at least, as akin to a dream, indeed as capable of being put in the same class with a dream. For the same brain-function that conjures up during sleep a perfectly objective, perceptible, and indirect palpable world must have just as large a share in the presentation of the objective world of wakefulness. Though different as regards as their matter, the two worlds are nevertheless obviously moulded from one form. This form is the intellect, the brain-function. (Schopenhauer 1966, Vol. II, 3–4)

Second, the hypothesis of 'embedment' is a hypothesis about the brain and one can therefore characterize it as a 'hypothesis about the brain from a brain'. In this sense, the brain of the author Georg Northoff refers to itself by developing the hypothesis of 'embedment' (otherwise he would have to exclude his own brain from his own hypothesis) which therefore presupposes 'self-reference' of the (i.e. his own) brain. A principal impossibility of 'self-reference' of the brain subsequently implies the principal impossibility of the hypothesis of 'embedment'. Accordingly, the principal possibility of 'self-reference' of the brain is a necessary condition for the principal possibility of the hypothesis of 'embedment'. Due to the confusion between content and vehicle i.e. between mind and brain (see above), the problem of the 'self-reference' of the brain could not even be raised in philosophy and was consecutively neglected. As a result, the own brain was neglected entirely in philosophical discussion about 'self-reference'. Epistemological and ontological concepts were supposed to reflect the mind at the same time as they were regarded as independent from the own brain and thus the brain in general. The problem of 'self-reference' of the (i.e. our own) brain was thus transformed into a problem of 'self-reference' of the mind (see below). However, we demonstrated that epistemological and ontological concepts necessarily (i) reflect and (ii) depend on the definition and determination of the brain (see thought experiments in Chapter 2 as well as 3.2.1 and

3.3.1): (i) Different definitions of the brain as either 'isolated brain' or 'embedded brain' imply different epistemological and ontological concepts (see 3.2.1 and 3.3.3) – the content of philosophy mirrors or reflects the definition of its underlying vehicle i.e. the brain. (ii) The development and generation of philosophical theories remain impossible without the existence of a (our own) brain (see above) – the vehicle of philosophy depends on the existence of a (i.e. our own) brain. Taken together, reflection and dependence account for content and vehicle of philosophy and do therefore presuppose the possibility of 'self-reference' of the (i.e. our own) brain.

Third, the philosophical assumption of 'self-reference' of the mind must be considered as a confusion between the illusion of direct 'self-reference' of the mind and the impossibility of direct 'self-reference' of the (i.e. our own) brain. The philosopher is right by characterizing the content of philosophy by mental states (see above). This implies that direct 'self-reference' of the (i.e. our own) brain remains impossible since the contents of philosophy should otherwise consist in (our own) brain states as brain states rather than in (brain states as) mental states. However, he is wrong by assuming that the impossibility of direct 'self-reference' of the (i.e. our own) brain implies the principal impossibility of 'self-reference' of the (i.e. our own) brain altogether from which he infers the illusory assumption of the possibility of direct 'self-reference' of the mind. As will be demonstrated, indirect 'self-reference' of the (i.e. our own) brain is possible (see below) which makes the assumption of 'self-reference' of the mind not only superfluous but also illusory: The (i.e. our own) brain as the vehicle of philosophy refers indirectly to itself through mental states as the contents of philosophy. This (indirect) 'self-reference' of the (i.e. our own) brain must subsequently be considered as a necessary condition for the possibility of generating and developing neurophilosophy and philosophy as such. In order to show the principal possibility of our hypothesis of 'embedment' as a 'hypothesis about the brain from a brain', we must therefore demonstrate the possibility of indirect 'self-reference' of the (i.e. our own) brain (otherwise this neurophilosophical hypothesis remains impossible or the own brain, i.e., the one from the author Georg Northoff must be excluded from it).

The definition of 'self-reference'

The hypothesis of 'embedment' covers three domains: empirical, epistemic and ontological. Empirically, it characterizes the brain as a 'dynamic brain' (see 3.1.2) that can be investigated in the 'First-Brain Perspective'. Epistemically, it characterizes the brain by 'autoepistemic limitation', reflecting the epistemic inability of the brain to recognize its own brain states as brain states (see 2.3.1). Instead, brain states are recognized as mental states which makes the development of 'First-Person Neuroscience' and 'embedded epistemology' necessary (see 3.2.1). Ontologically, it characterizes the brain as an 'embedded brain' (see 3.3.2) and makes the development of 'embedded ontology', as distinguished from 'isolated ontology', necessary.

Due to the fact that the hypothesis of 'embedment' covers empirical, epistemic and ontological domains, the problem of 'self-reference' of the brain as a necessary condition for the possibility of this hypothesis should be raised in all three domains i.e. empirical, epistemic and ontological.

'Empirical self-reference' raises the question for the principal possibility of the empirical investigation of the brain with a brain i.e. our own brain which cannot be included in an empirical investigation by itself. How can we investigate the brain with a brain i.e. the one of the investigator that by itself remains inaccessible to an empirical investigation? How can the author of the hypothesis, Georg Northoff, make the empirical claim that the brain as a 'dynamic brain' is only accessible in 'First-Brain Perspective'? If he himself has no empirical access to his own brain and its 'First-Brain Perspective', he shouldn't be able to characterize the brain as a 'dynamic brain'. If 'empirical self-reference' is not possible, the claim for the brain as a 'dynamic brain', being only accessible in 'First-Brain Perspective', remains principally impossible.

'Epistemic self-reference' raises the question for the principal possibility of recognizing the epistemic abilities/inabilities of the brain with a brain i.e. our own brain which by itself underlies the same epistemic limitation. How can we recognize the (epistemic inabilities of the) brain with a brain that cannot recognize itself as such? How is it possible for the author of the hypothesis, Georg Northoff, to make the epistemic claim that 'autoepistemic limitation' is the reason for the epistemic inability to recognize brain states as brain states? If he himself suffers from 'autoepistemic limitation', he shouldn't be able to reveal the epistemic inabilities of the brain i.e. 'autoepistemic limitation'. If 'epistemic self-reference' is not possible, the claim for epistemic characterization of the brain by 'autoepistemic limitation' remains principally impossible.

'Ontological self-reference' raises the question for the principal possibility of the development of logical possibilities in relation to the brain with a brain i.e. our own brain, which by itself underlies natural possibilities, as distinguished from logical possibilities. How can we develop logical possibilities regarding the brain with a brain which by itself is tied to natural possibilities? How is it possible for the author of the hypothesis, Georg Northoff, to claim that an ontological distinction between 'embedded ontology' and 'isolated ontology' is possible? If he himself is 'embedded', presupposing an 'embedded ontology', he should remain unable to develop the idea of an 'isolated ontology', as distinguished from 'embedded ontology'. If 'ontological self-reference' is not possible, the claim that an ontological distinction between 'embedded ontology' and 'isolated ontology' exists remains principally impossible.

We hypothesize, that 'self-reference' of the brain is not impossible in the three domains empirical, epistemic and ontological. However, a distinction between 'direct' and 'indirect' 'self-reference' needs to be made. 'Direct self-reference' of the brain shall be defined by reference of the brain to the brain without any intermediation. 'Indirect self-reference' of the brain shall be defined by reference of the brain to the brain with some intermediation. Whereas 'direct self-reference' of the brain remains impossible, 'indirect self-reference' is believed to be possible. In the following, we will demonstrate the possibility of 'indirect self-reference' of the brain in all three domains e.g. empirical, epistemic and ontological. If 'self-reference' of the brain is possible, even if only indirectly, one necessary condition for the principal possibility of the hypothesis of 'embedment' (and philosophy as such) is realized (see above).

'Empirical self-reference'

'Direct empirical self-reference' is possible, if we (i.e. our own brain) can find our (its) mental states within our (its) own neuronal states without any intermediate states. 'Indirect empirical self-reference' is possible, if we (i.e. our own brain) cannot find our (its) mental states within our (its) own neuronal states. Meanwhile, indirect inference from mental states to neuronal states through some intermediate states as, for example, dynamic states remains possible. Complete absence of 'empirical self-reference' is possible, if neither the detection of our mental states within our own neuronal states nor the inference from our mental states to our own neuronal states through some intermediate states is possible. Whereas experience and recognition/detection of (the own) mental states are necessarily linked to the First and Second-Person Perspective, recognition/detection of others' neuronal states is tied to the Third-Person Perspective (others' mental states, in contrast, remain inaccessible). The brains of others i.e. their respective brain states can thus be observed as neuronal states in Third-Person Perspective. The own brain states, in contrast, can be experienced and recognized/detected as mental states in First/Second-Person Perspective (see 2.3.1). The question for 'empirical self-reference' of the brain subsequently concerns thus the empirical relation between mental states and neuronal states.

How can I relate my mental states to my own neuronal states? In the case of the human brain, we claim that 'indirect empirical self-reference' is possible. We cannot detect and recognize our mental states within the neuronal states of our brain which makes 'direct empirical self-reference' impossible (see also below). Mental states refer to events while neuronal states refer to stimuli (see 3.1.3). Due to these different referents i.e. events and stimuli, a direct empirical linkage between mental and neuronal states remains principally impossible. 'Direct empirical self-reference' of the brain is therefore impossible. We can, however, infer (indirectly) from our mental states to our own neuronal states through the consid-

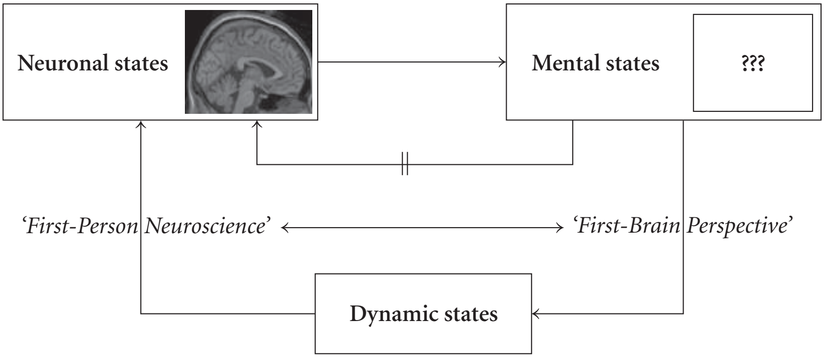


Figure 20. 'Direct and indirect empirical self-reference' of the brain

eration of dynamic states. Dynamic states can subsequently be regarded as intermediate states in empirical regard which allow for indirect empirical linkage between mental and neuronal states. Accordingly, 'indirect empirical self-reference' remains possible while complete absence of 'empirical self-reference' has to be denied (see also Figure 20).

Empirically, the intermediate position of dynamic states is reflected in their linkage to both mental and neuronal states. Dynamic states can be defined by the particular organization of neuronal states in orientation on 'observable and to-be effectuated events within the environment' (see 3.1.3). On one hand they are linked to mental states since both refer to the same event within the environment. Whereas, on the other hand they are linked to neuronal states since they provide their particular organization. This is also reflected in the relation between the three different types of states: Neuronal states are a necessary (though not sufficient) condition for dynamic states which by themselves are a sufficient condition for mental states (see 3.1.2). How can we link mental states to neuronal states in an empirical investigation? 'Indirect empirical self-reference' is provided by the conjunction of 'First-Person Neuroscience' and 'First-Brain Perspective'. Due to the development of specific methodological tools, 'First-Person Neuroscience' links mental states and neuronal states from which dynamic states can be inferred (see 3.2.1). By providing a connection between 'phenomenal experience' of mental states and 'physical judgment' of neuronal states, it allows for indirect access to the 'First-Brain Perspective' as a view 'from within' the brain itself. Accordingly, we are able to link mental and neuronal states though indirectly through dynamic states in 'First-Brain Perspective'. This provides 'indirect empirical self-reference' of the brain.

'Epistemic self-reference'
'Direct epistemic self-reference' is possible, if the brain (i.e. we) can detect and recognize its own brain states as brain states. 'Indirect epistemic self-reference' is possible, if the brain (i.e. we) cannot detect and recognize its own brain states as brain states. At the same time, indirect inference from its own brain states to states of the own brain through some intermediate states as, for example, mental states remains possible. Complete absence of 'epistemic self-reference' is possible, if neither detection/recognition of its own brain states as brain states nor indirect inference from its own brain states to states of the own brain is possible.

In the case of the human brain, we claim for 'indirect epistemic self-reference'. Our brain remains unable to detect and recognize its own brain states as brain states. This is reflected in 'autoepistemic limitation', which makes 'direct epistemic self-reference' impossible. Nevertheless, we remain able to infer from our own brain states to states of the own brain through mental states. Mental states can subsequently be regarded as intermediate states in epistemic regard since they allow for indirect detection and recognition of our own brain states as brain states. Accordingly, 'indirect epistemic self-reference' remains possible while complete absence of 'epistemic self-reference' has to be denied (see also Figure 21).

Epistemically, the intermediate role of mental states is reflected in 'autoepistemic limitation' (see 2.3.1) and the dependence of mental states on the existence of brain states. Due to 'autoepistemic limitation', the brain remains unable to detect and recognize its own brain states as brain states in 'First-Brain Perspective'. Instead, we (the brain) experience(s) ('phenomenal experience') and judge(s) ('phenomenal judgment') our own brain states as mental states in First-Person Perspective. If mental states could not be characterized as intermediate states in epistemic respect, we would have been unable to characterize the brain by 'autoepistemic limitation'. In this case, 'autoepistemic limitation' could not have been linked to mental

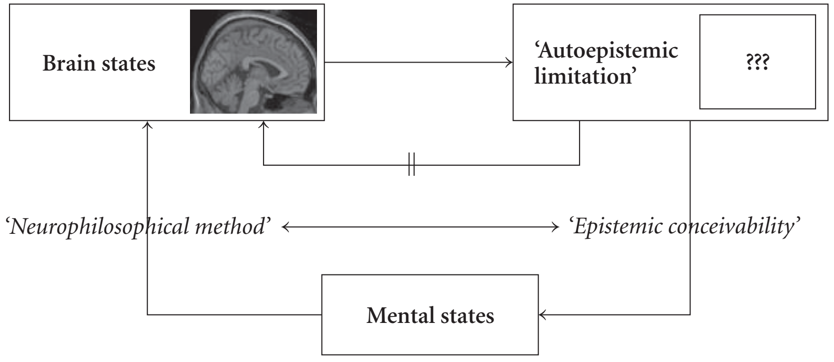


Figure 21. 'Direct and indirect epistemic self-reference' of the brain

states which would have made the assumption of 'autoepistemic limitation' as such impossible. Moreover, we would have been unable to link the absence of mental states to the absence of the brain. If we remain unable to link mental states to the (own) brain in either case i.e. its presence or absence, it would also be impossible for us to observe the dependence of mental states on (our own) brain states.

How can we link mental states and brain states in epistemic regards? How can we know about 'autoepistemic limitation'? How can we know about the epistemic dependence of (our) mental states on (our own) brain states? We hypothesize that the epistemic linkage between brain states and mental states is provided by the conjunction of 'epistemic conceivability' and the neurophilosophical method. Due to 'autoepistemic limitation', we experience our own brain states as mental states in First-Person Perspective and can accordingly distinguish them from brain states which are accessible in Third-Person Perspective. Once we distinguish mental states from brain states, several possibilities concerning their epistemic relationship can be developed conceived. For example, both states e.g. brain states and mental states may epistemically be regarded as either different or complementary. A variety of other epistemic relationships between brain states and mental states can be imagined as well which all reflect different epistemic designs respectively. The ability to develop different epistemic designs may be called 'epistemic conceivability' (see below for further details). In addition, we are able to select and identify one of these logically possible epistemic designs and link it as the most appropriate one to our own brain i.e. as a natural possibility. The selection and consecutive characterization of a particular epistemic design as a natural possibility is provided by the neurophilosophical method (see below for further details).

'Epistemic conceivability'

As already pointed out, a variety of different epistemic designs can be conceived. 'Epistemic conceivability' may provide us with different logically possible epistemic designs that can then be processed further in modal and ontological regards. If we want to understand our epistemic ability to develop different logically possible epistemic designs, we have to investigate the natural conditions for 'epistemic conceivability'. The term 'epistemic conceivability' is closely related to the claims of both modal and ontological possibilities (see Chalmers 2000; Nagel 1998). Chalmers (2000:1) characterizes the development of logical possibilities by three steps (he includes both primary and secondary intensions; such a broad meaning makes any a priori deduction impossible. see Chalmers 1996:35–36, 66–68): (a) epistemic claim of conceivability; (b) modal claim of possibility; (c) ontological claim of difference. These three steps can be applied on the example of mental and neural states within the present context. The difference between neuronal and mental states is epistemically conceivable (a) since they show distinct functional, phenomenal and epistemic characteristics (see 2.3.1). From the 'epistemic conceivability' of an epistemic difference, the modal possibility of a difference between neuronal and mental states can be inferred (b). Finally, one may go one step further by claiming that there is an ontological difference between neuronal and mental states (c).

Functionally, the simulation of 'act-orientation' with splicing, re-combination and novel integration (see 2.4.1 and 2.4.3) may account for 'epistemic conceivability'. We pointed out that the simulation of original 'act-orientation' might be the explanation for the contents of thoughts (see 2.4.1 for simulation and 3.2.3 for thoughts). Exact simulation of the original 'act-orientation', reflecting the actual world, may be an explanation for those contents of thoughts, which reflect natural possibilities. This is not true in the case when the thought content reflects logical possibilities. Thought contents that concern logical possibilities cannot be regarded as exact simulations of the original 'act-orientations' since they no longer reflect the actual i.e. natural world. This may either be due to inexact simulation with splicing or re-combination between different original 'act-orientations' (see also Hill 1995: 68–69, 70–72). On there may be a novel or inexact integration of the simulated 'act-orientation' within the actual 'act-orientation'. It is important to note that the resulting simulated 'act-orientations' are not mere copies of the original 'act-orientation'. If this were the case, the 'ideas' could not go beyond perception and action as it is, for example, presupposed by both Locke and Hume. This makes the development of 'act-orientations' that are contradictory to the original ones impossible (Hume 1748, Section II, 13 and 14). Instead of asking, 'from what impression (i.e. original 'act-orientation') is that supposed idea (i.e. simulated 'act-orientation') derived' (Hume 1748, Section II, 17), we better focus on the mechanisms of novel integration and recombination between simulated and actual 'act-orientation'. Both mechanisms may lead to the simulation of a novel 'act-orientation' which might neither be identical nor comparable to the original 'act-orientation'. Accordingly, the thoughts may concern contents that never existed as such in the actual world. Instead, they reflect a virtual world. The contents of these thoughts are thus epistemically conceivable though they no longer can be considered as the starting point for the development of natural possibilities but rather logical possibilities. The simulation of 'act-orientation' with splicing, recombination and novel integration can therefore be considered as a necessary natural condition for 'epistemic conceivability' and thus for the future development of logical possibilities from a functional point of view. What are the criteria for the consecutive possibility of distinguishing between natural and logical possibilities? Hill (1995: 77) gives two exact criteria for the simulation of 'act-orientation' with splicing, re-combination and novel integration. There should neither be analytic i.e. a priori ties between the two simulated 'act-orientations' that are spliced and re-combined nor should there be any a posteriori reasons for the assumption of a potential co-extensiveness between the two simulated 'act-orientations'. Thought contents, that account for logical possibilities, can only be distinguished from those that reflect natural possibilities if both criteria are met.

Phenomenally, 'epistemic conceivability' may be accounted for by novel linkage, novel integration and re-combination of the contents between different 'phenomenal experiences', different 'phenomenal judgments', and different 'physical judgments'. The contents from different experiences/judgments can be confused and mixed which results in their linkage, novel integration and re-combination in our imagination. The novel contents may then no longer be identical or comparable with the original contents i.e. they may even be contradictory. For example, we can imagine and think that embodiment and disembodiment is possible (see Nagel 1974, Footnote 11). Whereas embodiment is in full accordance with our actual situation, disembodiment is not. The former describes a natural possibility and the latter a logical possibility (see 1.4.1 for distinction between natural and logical possibilities/conditions). Although we are not disembodied by ourselves, we are nevertheless able to imagine and think that the possibility of disembodiment exists i.e. it is epistemically conceivable. Spinoza already points out that epistemic conceivability of disembodiment is possible which, in turn, necessarily presupposes 'embedment' (see 3.3.2); he mentions the dependence of imagination (i.e. the mind) on the body: 'Finally, we have shown that the power of the mind by which it imagines and remembers things also depends on this – that it involves the actual existence of the body. From these things it follows, that the present existence of the mind and its power of imagination are negated as soon as the mind ceases to affirm the present existence of the body'. (Spinoza 1985, Part III, prop. 11, school; see also below). These novel contents are related to a different i.e. virtual world because they no longer match the original contents that are associated with the actual world. The distinction between the virtual and the actual world is reflected in the difference between logical and natural possibilities. Linkage and exchange between the different contents of experience/ judgments can thus be considered as a necessary natural condition for the possibility of 'epistemic conceivability' from a phenomenal point of view. Accordingly, it is possible to conceive contents that are contradictory to our own contents. Unlike in idealistic approaches, 'epistemic conceivability' of contradictory contents (as logical possibilities) cannot be related and attributed to a mind (or a subject) that is separate and distinguished from the own contents (as natural possibilities) themselves (see for example Berkeley 1710); instead, the brain itself creates these contradictory contents. Unlike in empiristic approaches (see, for example, Locke (1690, Book II, Chapter I, 22) and Hume (1748, Section V, Part II, 39)), 'epistemic conceivability' of contradictory contents is possible and can, at the same time, be traced back to the empirical functions and epistemic abilities of the brain itself.

Epistemically, it might be the connection and exchange between the contents from different perspectives that account for 'epistemic conceivability'. The First-

Person Perspective may be linked to the Third-Person Perspective which makes the exchange between their contents possible. Analogous connections and exchanges may be possible between all three perspectives. For example, contents that are experienced in First-Person Perspective may be judged in Second-Person Perspective and may afterwards be transferred to Third-Person Perspective for 'physical judgment'. This is also reflected in the discussion about the mind in philosophy. Mental states as experienced in First-Person Perspectives are considered and discussed in terms of the Third-Person Perspective (see 3.3.3). This may lead to the illusion that the mind ontologically exists with 'mental properties' that are similar and analogous to the 'physical properties' of the brain.

Since all three perspectives, First-, Second- and Third-Person Perspective can be characterized by distinct and complementary epistemic abilities/inabilities, their contents differ from each other. If their contents differ from each other, linkage and exchange may lead to the creation of novel contents that are no longer identical or comparable to the original contents. The contents between the different perspectives are mixed and confused with each other which may result in novel linkage, novel integration and re-combination of contents. Logical possibilities, as distinguished from natural possibilities, may be created by these exchanges within our epistemic apparatus. The consideration of all epistemic perspectives i.e. 'epistemic pluralism' with consecutive linkage and exchange of contents may thus be regarded as a necessary and natural condition for the possibility of developing 'epistemic conceivability' from an epistemic point of view. Moreover, during linkage and reintegration, the differences and/or similarities between different 'phenomenal experiences' may be confused or conflated which may result in the development of 'universal' or 'transcendental' categories like 'being', 'thing', etc. This has been nicely expressed by Spinoza (1985, Part II, prop. 40):

> ... I will briefly give the causes from which terms called *Transcendental*, such as *Being, Thing, Something*', have taken their origin. These terms have arisen because the human body, inasmuch as it is limited, can form distinctly in itself a certain number only of images at once. If this number be exceeded, the images will become confused; and if the number of images which the body is able to form distinctly be greatly exceeded, they will all run into another. Since this is so, it is clear that in proportion to the number of images which can be formed at the same time in the body will be the number of bodies which the human mind can imagine at the same time. If the images in the body, therefore, are all confused, the mind will confusedly imagine all the bodies without distinguishing the one from the other, and will include them all, as it were, under one attribute, that of being or thing. The same confusion may also be caused by lack of uniform causes, ... For it all comes to this, that these terms signify ideas in the highest degree confused. It is in this way that those notions have arisen which are called *Universal*, such as, *Man, Horse, Dog,* & ...

Neurophilosophical method

We demonstrated the necessary and natural conditions that make 'epistemic conceivability' possible. Our brain can develop different epistemic designs that are all epistemically conceivable. Accordingly, an epistemic design that is characterized by 'autoepistemic limitation' may be developed as one epistemic possibility among others. How can we i.e. our brain, however, select and identify 'autoepistemic limitation' as the epistemic design that is the most appropriate and naturally plausible one for the brain itself? This may be due to our ability to distinguish between natural and logical possibilities, a capability that is provided by the neurophilosophical method (see also 1.4.1).

Instead of starting from the different epistemic designs themselves, empirical investigation that reveals natural conditions may serve as the starting point (see 1.4.1). Natural conditions can afterwards be compared with the various epistemic designs as elucidated by 'epistemic conceivability'. Those logical possibilities that are identical to natural possibilities, can be distinguished from those that are not identical to natural possibilities (see 1.4.2 for a more extensive account). The particular epistemic design of 'autoepistemic limitation' is empirically plausible in functional, phenomenal and epistemic regards (see below). It must therefore be regarded as the most empirically plausible epistemic design with respect to our own brain. As such it must be distinguished from other possible epistemic designs that remain empirically implausible with respect to our own brain. The epistemic design of 'autoepistemic limitation' must subsequently be regarded as a natural epistemic possibility while other possible epistemic designs may rather be considered as purely logical possibilities. The empirical plausibility of the epistemic design of 'autoepistemic limitation' is reflected in functional, phenomenal and epistemic regard. Functionally, it is a specific feature of the dynamic organization of the brain i.e. 'event coding' that accounts for the possibility of 'autoepistemic limitation'. The functional organization of the brain is thus well compatible with the epistemic design of 'autoepistemic limitation'. Phenomenally, we experience mental states that as such cannot be related to the brain. Yet, at the same time, we can recognize that mental states depend on the brain (see above). 'Phenomenal experience' of mental states is thus in full accordance with the epistemic implications of 'autoepistemic limitation'. Epistemically, we presuppose First-Person Perspective while the 'First-Brain Perspective' has been neglected entirely. Whereas the First-Person Perspective refers to mental states, the 'First-Brain Perspective' refers to brain states. Neglecting the 'First-Brain Perspective' is thus well compatible with the impossibility of direct epistemic accessibility of our own brain as claimed for by 'autoepistemic limitation'.

'Ontological self-reference'

'Direct ontological self-reference' is possible, if the different types of ontology, that the brain is able to develop, necessarily remain within the ontological framework, as presupposed by the brain itself. 'Indirect ontological self-reference' is possible, if the different types of ontology that the brain can develop, do not remain within the ontological framework, as it is presupposed by the brain. Moreover, these different types of ontology can be compared with and distinguished from the own ontological framework. One may subsequently characterize these different types of ontology as intermediate ontologies which are necessary for the detection and distinction of the own ontological framework. Complete absence of 'ontological self-reference' is possible, if neither of the different types of ontology that the brain can develop, remain within the ontological framework, as it is presupposed by the brain. The distinction between the own ontological framework and the different types of ontology is not possible in this case.

The problem of 'ontological self-reference' of the brain touches the principal problem of the possibility of transcendence. Are we able to go beyond i.e. transcend our own ontological framework? In the case of either 'indirect ontological self-reference' or complete absence of 'ontological self-reference', transcendence remains possible. This implies the potential development of virtual environments and logical conditions. In the case of 'direct ontological self-reference' transcendence is replaced by immanence implying restriction to the actual environment and natural conditions. In the case of the human brain, we maintain that 'indirect ontological self-reference' is possible. Our brain can develop different types of ontology, which no longer remain within the ontological framework, as it is presupposed by the brain. For example, our brain can develop 'isolated ontology' that contrasts with the ontological framework, as it is presupposed by the brain itself i.e. 'embedded ontology'. 'Direct ontological self-reference' subsequently remains impossible. Moreover, we can distinguish between the different types of ontology with regard to our own brain. For example, we are able to select and identify 'embedded ontology' as the most appropriate ontology for our own brain and distinguish it from 'isolated ontology'. 'Isolated ontology' may thus be regarded as an intermediate ontology for our own brain by means of which it i.e. the brain is able to detect and distinguish its own ontological framework i.e. 'embedded ontology'. Accordingly, 'indirect ontological self-reference' seems to subsist at the same time as complete absence of 'ontological self-reference' has to be denied (see also Figure 22).

Due to the possible development and distinction between the different types of ontology, it is impossible to consider one ontology as the sole and only ontology whose validity remains independent from the respective context and presuppositions. Such an ontology could be called 'absolute ontology'. Since such an 'absolute ontology' remains however impossible, it must be replaced by 'relative

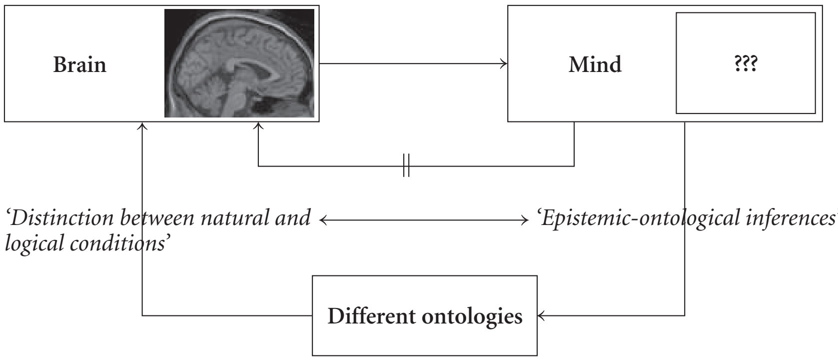


Figure 22. 'Direct and indirect ontological self-reference' of the brain

ontologies'. 'Relative ontologies' reflect multiple and many ontologies (which presupposes 'ontological pluralism'; see 1.4.3) whose validity is dependent on the respective environmental context (see 3.3.3. for further explication). Different types of ontology therefore 'relativize' each other with respect to the environmental context. This may be called 'ontological relativization' which accounts for the context-dependence of the validity of different types of ontology. The possibility of development of different types of ontology and 'indirect ontological self-reference' of the brain are therefore necessarily accompanied by 'ontological relativization' as reflected in 'ontological pluralism' and context dependence.

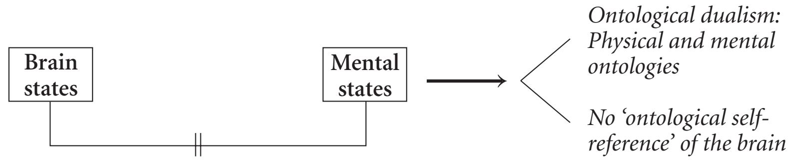
How can our brain possibly develop certain types of ontology that differ from the ontological framework that is presupposed by the brain itself? The ability to make ontological assumptions may be based upon epistemic perspectives. Since the different epistemic perspectives differ from each other in their epistemic abilities and inabilities (see 2.4 and 3.2), the respective ontological assumptions could differ as well (see 3.3.3 for the closely related 'epistemic-ontological relativity'). Different types of ontology may subsequently be developed by means of so-called 'epistemic-ontological inferences' (see below for further details). One of these different and logically possible ontologies has to be selected and identified as the most appropriate one with respect to our own brain. The linkage between one particular ontology and the own brain leads to the exclusion of the other types of ontology which, in turn, implies the distinction between natural and logical conditions (see below for further details).

Epistemic-ontological inferences

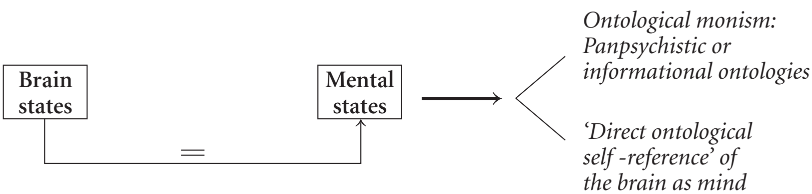
Due to the lack of 'direct epistemic self-reference' and 'autoepistemic limitation', we remain unable to recognize our own brain states as brain states. Instead, we experience our own brain states as mental states. However, due to the possibility of 'indirect epistemic self-reference', we are nevertheless able to link our brain states, even though indirectly through mental states, to our own brain. One may therefore distinguish two epistemic steps, one from brain states to mental states and another one from mental states back to brain states. On the basis of this epistemic design, various modal possibilities and ontological differences (see Chalmers 2000; Nagel 1998) can be inferred which can be called 'epistemic-ontological inferences' (see below and Figure 23).

One may emphasize one particular epistemic step while neglecting the respective other. In this case, brain states and mental states can either be distinguished from or reduced to each other in ontological regards. This results in the assumption of 'ontological properties' i.e. 'mental and/or physical properties' which, in turn, presuppose an 'isolated ontology' (see Figure 23a–c). If one focuses predominantly on the first step (from brain states to mental states) while neglecting the second step, the modal possibility of brain and mind can be inferred (see Figure 23a). This may ultimately result in bilateral dissociation between brain states and mental states with the consecutive assumption that there is an ontological difference between brain and mind. In this case, two different ontologies i.e. 'physical ontology' and 'mental ontology' are developed. The brain, presupposing 'physical ontology', is then detached and excluded completely from 'mental ontology'. This ontological dissociation of the brain from the mind makes the selection and distinction between different types of ontology (including 'mental ontology') by the brain with respect to the brain itself impossible because it (i.e. the brain) remains principally unable to decide whether they (i.e. the different types of ontology) are presupposed by the brain or the mind. The resulting 'ontological dualism' can subsequently be characterized by complete absence of 'ontological self-reference' of the brain.

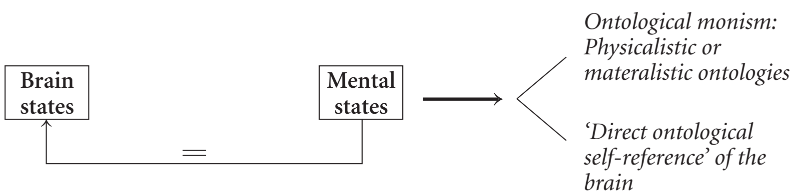
One could, in contrast, focus unilaterally on the second step (from mental states to brain states) while neglecting the first step (see Figure 23b). In this case, the modal possibility of a mind within the brain and thus a 'mental brain' can be inferred. This may ultimately result in unilateral resolution of brain states into mental states and consecutively in 'ontological monism' like, for example, panpsychism (see, for example, T. Nagel 1986) or dual-aspect theory (see, for example, D. Chalmers 1996). Both 'physical and mental ontology' are linked to each other resulting in either 'panpsychistic ontology' (Nagel) or 'informational ontology' (Chalmers) (with the consecutive determination of the brain as a 'mental brain' and thus as the mind). Due to the complete identification of all possibly developed ontologies with the ontological determination of the brain (as the mind) the brain as the mind remains unable to develop other types of ontology that are different from its own presupposed ontology. This 'mental ontological monism' can subsequently be characterized by 'direct ontological self-reference' of the brain as the mind.



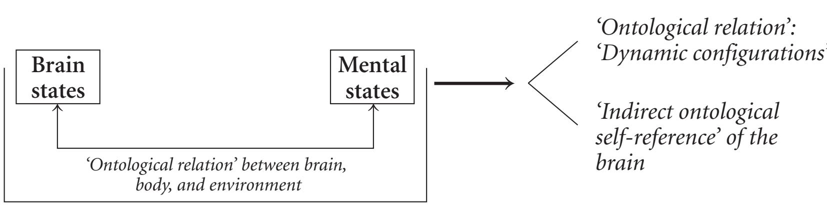
a. Bilateral dissociation between brain states and mental states



b. Unilateral resolution of brain states into mental states



c. Unilateral resolution of mental states into brain states



d. Bilateral integration of brain states and mental states within the ‘ontological’ relation between brain, body, and environment

Figure 23. ‘Epistemic-ontological inference’ in ‘isolated ontology’ (a–c) and ‘embedded ontology’ (d)

Alternatively, one may also focus unilaterally on the circular character of the two steps in our epistemic design (see Figure 23c). Both depart from and arrive at brain states. The intermediate epistemic position of mental states is meanwhile rather neglected. In this case, the modal possibility of the inseparability between brain and mind with the consecutive reduction of the latter to the former as a 'physical brain' may be inferred. This may ultimately result in unilateral resolution of mental states into brain states and consecutively to physicalistic or, at least, materialistic ontological theories like the identity theory, reductionism and eliminativism. Due to the complete identification of all possibly developed ontologies with the ontological determination of the brain as a 'physical brain', the brain remains unable to develop other types of ontology that are different from its own presupposed ontology. This 'physical ontological monism' can subsequently be characterized by 'direct ontological self-reference' of the brain.

Finally, it is also possible to focus bilaterally on both epistemic steps. As such, equal importance is attributed to epistemic arrival from/departure to the brain and the intermediate epistemic position of mental states (see Figure 23d). In this case, the distinction between brain states and mental states is considered as purely phenomenal and epistemic in nature which does not allow for any ontological inferences. Accordingly, brain states and mental states can not be distinguished from each other in ontological regard; unlike in the first case no different 'ontological properties' i.e. 'physical and mental properties' can be inferred from them. Moreover, unlike in the second and third case, any ontological reduction of mental states to brain states (or vice versa) with the consecutive predominance of either 'mental or physical ontological properties' remains impossible either. Instead, brain states and mental states are bilaterally integrated within a common ontological framework. Since any assumption of 'ontological properties' either mental or physical must be rejected, this common ontological framework is defined by 'ontological relation'. 'Ontological relation', in turn, can be defined by the 'intrinsic' relationship between brain, body and environment (and thus the brain as a 'dynamic brain') within which mental states are brain states as specific 'dynamic configurations' (see 3.3.2 and 3.3.3). The main distinction concerns then no longer brain states and mental states and is not ontological anymore. Instead, the focus shifts from the ontological difference between brain states and mental states to the epistemic distinction between distinct 'dynamic configurations' within the 'ontological relation' between brain/body and environment. 'Isolated ontology', as presupposed for the possibility of inference of any 'ontological properties', must then be replaced by 'embedded ontology' which accounts for 'ontological relation' and 'dynamic configurations'. Due to epistemically distinct and ontologically relational 'dynamic configurations', the brain is able to develop other types of ontology than the one presupposed by itself. This, in contrast, remains impossible in both cases of 'ontological monism' as described above. Moreover, unlike in the case of 'ontological dualism', the brain remains able to select and distinguish the different types of ontology with regard to itself. The assumption of 'ontological relation' can subsequently be characterized by 'indirect self-reference' of the brain.

Distinction between logical and natural possibilities

Having developed these different types of ontology, the (i.e. our own) brain (i.e. we) must select and identify one of these as the most appropriate for itself (i.e., ourselves). This particular ontology can then be applied to the brain itself and distinguished as a natural possibility from the other ontologies as purely logical possibilities. As already demonstrated, the First-Person Perspective can neither provide direct empirical nor epistemic access to the brain and its respective ontological framework. Within the First-Person Perspective alone, we therefore remain unable to select and identify the type of ontology that is the most appropriate for the brain and thus ultimately to distinguish between natural and logical possibilities. It may therefore be assumed that the same problem i.e. the distinction between natural and logical possibilities appears in different gestalts in both First-Person Perspective and 'First-Brain Perspective'. The First-Person Perspective is confronted with the problem of linking a particular ontology to the own brain. This presupposes the distinction between natural and logical possibilities. However, the First-Person Perspective itself remains unable to solve this problem because, due to 'autoepistemic limitation', it has no direct access to the own brain and its natural conditions by itself. The 'First-Brain Perspective', on the other hand, is confronted with the problem of distinguishing between different (i.e. the own and others') environments which reflect different types of ontology (see below as well as 3.2.1). This also presupposes the distinction between natural and logical possibilities. However, the 'First-Brain Perspective' itself remains unable to solve this problem because, due to 'autoepistemic limitation', it has no direct access to the own environment by itself (see below). Taken together, the following configuration arises: The First-Person Perspective lacks direct access to the own brain by itself. This access, however, is provided by dynamic states in 'First-Brain Perspective'. The 'First-Brain Perspective' meanwhile lacks direct access to the own environment by itself; the access in this case is provided by experience of mental states (and their 'observable and to-be-effectuated events within the environment') in the First-Person Perspective. Accordingly, First-Person Perspective and 'First-Brain Perspective' show complementary epistemic abilities with respect to direct access to the own brain and the own environment respectively. Subsequently, the conjunction of both First-Person Perspective and 'First-Brain Perspective' may account for the resolution of their respective problems and the consecutive distinction between natural and logical possibilities.

Due to the complementary epistemic abilities and inabilities in both perspectives, both natural and logical possibilities may appear in different gestalts in First-

Person Perspective and 'First-Brain Perspective' respectively. Natural possibilities that reflect the actual world may be considered as useful for the 'intrinsic' integration of the own brain (i.e. the own person) within the environment in the 'First-Brain Perspective' – they may be regarded as 'tools of the brain'. Functionally, natural possibilities may reflect simulated and original 'goal-orientation' without any 'splicing and re-combination' (see above). These simulated 'goal-orientations' are well compatible with and can be integrated in the actual 'goal-orientation' i.e. they serve for better adaptation of the own brain to the respective environmental context. Taking a 'First-Brain Perspective', they may thus be considered as 'tools' i.e. the 'tools of the brain' which are useful for the integration of the own brain in the respective actual environmental context. What in 'First-Brain Perspective' appears as 'tools of the brain' may subsequently be considered as naturally possible i.e. as a natural possibility in First-Person Perspective. Since the First-Person Perspective has no direct access to the own brain but to the own environment, it cannot consider these simulated and original 'goal-orientations' without any 'splicing and recombination' as 'tools of the brain'. Instead, it (i.e. the First-Person Perspective) can reveal that they (i.e. the simulated and original 'goal-orientations') 'match' the own environment and regards them consecutively as natural possibilities.

In contrast, logical possibilities that reflect a virtual world may not be considered as useful for the 'intrinsic' integration of the own brain (i.e. the own person) within the environment in the 'First-Brain Perspective' – they may be regarded as 'trash of the brain'. Functionally, logical possibilities must be regarded as simulated 'goal-orientation' with splicing, re-combination and novel integration (see above). These simulated 'goal-orientations' remain incompatible with and cannot be integrated in the actual 'goal-orientation' i.e. they cannot serve for better adaptation of the own brain to the respective actual environmental context. Taking a 'First-Brain Perspective', they may thus be considered as 'trash' i.e. the 'trash of the brain' that could be useful only in case of potential changes in the respective environmental context i.e. in a different or virtual environment. This implies that these simulated 'goal-orientations' may be useful in the future i.e. in case of changes in the respective environmental context. The transition from a virtual environment to an actual environment is then accompanied by transformation of the 'trash of the brain' into 'tools of the brain'. What in the 'First-Brain Perspective' appears as 'trash of the brain' may be considered as a logical possibility in First-Person Perspective. Since the First-Person Perspective has no direct access to the own brain but to the own environment, it cannot consider these simulated 'goal-orientations' with 'splicing and recombination' as 'trash of the brain'. Instead, it (i.e. the First-Person Perspective) can reveal that they (i.e. the simulated 'goal-orientations') do not 'match' the own actual environment and regards them consecutively as logical possibilities reflecting a different or virtual environment.

First-Person Perspective and 'First-Brain Perspective' can be characterized by different epistemic referents (see above): Whereas the former refers to the (events in the) environment (in mental states; see 3.2.1), the latter refers to the brain (in dynamic states; see 3.2.1). Consideration of both (as a conjunction between) First-Person Perspective and 'First-Brain Perspective' may therefore transform the problem of the distinction between natural and logical possibilities into the question for the relation between brain and environment. How do the type(s) of ontology, as presupposed and developed by the brain itself, 'match' with the respective (actual or virtual) environmental context? In the case of compatibility (or 'match') between a particular ontology and the actual environmental context, the respective ontology can be considered as a natural possibility. If, however, a particular ontology and the actual environmental context remain incompatible, the respective ontology must be considered as a logical possibility. 'Embedded ontology' (see 3.3.3) is the type of ontology that is most appropriate (and plausible) for the (human) brain itself (see 3.3.2) which, in addition, 'matches' and is well (and most) compatible with the actual environmental context. 'Isolated ontology', in contrast, is neither appropriate (and plausible) for the (human) brain itself nor does it 'match' and is well compatible with the actual environmental context, i.e. it rather refers to a virtual environment. Subsequently, one may characterize 'embedded ontology' as a natural possibility in First-Person Perspective and as a 'tool of the brain' in 'First-Brain Perspective'. 'Isolated ontology', in contrast, must rather be considered as a logical possibility in First-Person Perspective and as 'trash of the brain' in 'First-Brain Perspective'. Though it is designated as 'trash of the brain', 'isolated ontology' may nevertheless be regarded as useful in two ways. First, in the case of potential environmental changes, the former virtual environment may become the actual environmental which is accompanied by transformation of the 'trash of the brain' into 'tools of the brain' (see above). In this case, 'isolated ontology' may be regarded as a 'tool of the brain' and subsequently as a natural possibility. The 'trash of the brain' may thus allow for better adaptation of the brain to the environment in the case of potential (i.e. virtual) changes in the latter – the 'trash of the brain' may also be regarded as a 'potential (i.e. virtual) tool of the brain'. Second, 'isolated ontology' may be regarded as an intermediate ontology (see above) by means of which the brain can detect and distinguish its own presupposed ontological framework. Without the negative distinction from 'isolated ontology', 'embedded ontology' could have not been as clearly defined (see 3.3.3). 'Isolated ontology' serves thus an important epistemic purpose – the 'trash of the brain' may also be regarded as an 'epistemic tool of the brain'. Accordingly, 'isolated ontology' as an intermediate ontology and thus as a 'epistemic tool of the brain' reflects the possibility of 'indirect ontological self-reference of the brain' (see above).

CHAPTER 4

The 'Embedded brain'

'Mind problems', hypothesis of 'Embedment', and 'Paradigm shifts'

The Brain – is wider than the sky –
For – put them side by side –
The one the other will contain
With ease – and You – beside –

The Brain is deeper than the sea –
For – hold them – Blue to Blue –
The one the other will absorb –
As Sponges – Buckets – do –

The Brain is just the weight of God –
For Heft them – Pound for Pound –
And they will differ – if they do –
As Syllable from Sound –

Emily Dickinson (ca. 1862)

The hypothesis of 'embedment' (see 1.3) leads to the novel empirical (see 3.1), epistemic (see 3.2) and ontological (see 3.3) determination of the brain as an 'embedded brain'. This novel determination of the brain can be summarized by answering the questions (see 4.1) from the first chapter (see 1.2.1). Due to the necessary linkage between the 'brain problem' and the 'dilemma of the brain' (see 1.1.2), the novel determination of the brain as an 'embedded brain' leads to the resolution of the dilemma (see 4.2) that was raised in the first chapter (see 1.2.2). Moreover, the resolution of the 'brain problem' with the definition of the brain as an 'embedded brain' is accompanied by the solution and transformation of the 'mind problems' (see 4.3). Finally, the development of novel concepts, as implied by the definition of the brain as an 'embedded brain', leads to 'paradigm shifts' in neuroscience, epistemology, ontology and philosophy (see 4.4).

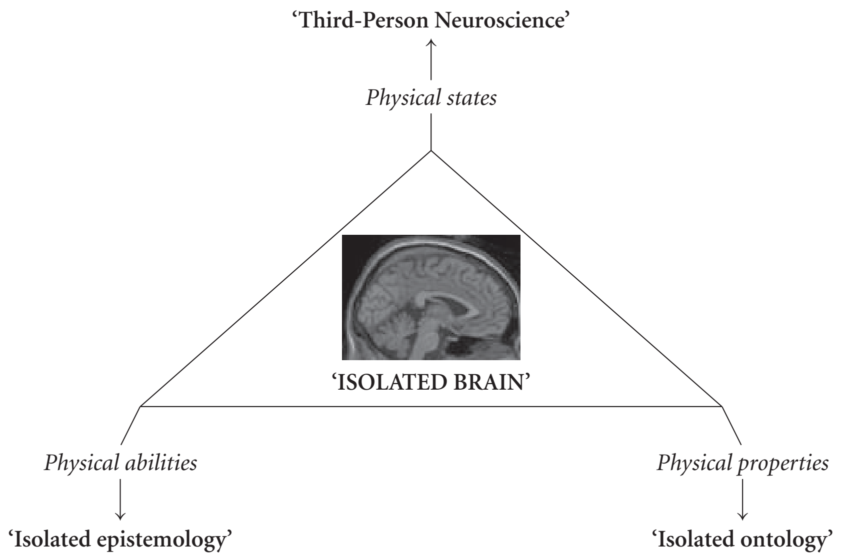
4.1 The determination of the brain

This section returns to the questions from the first chapter (see 1.2.1) and answers them by replacing the traditional definition of the brain as an 'isolated brain' by the novel definition of the brain as an 'embedded brain' (see also Figure 24 for a general overview).

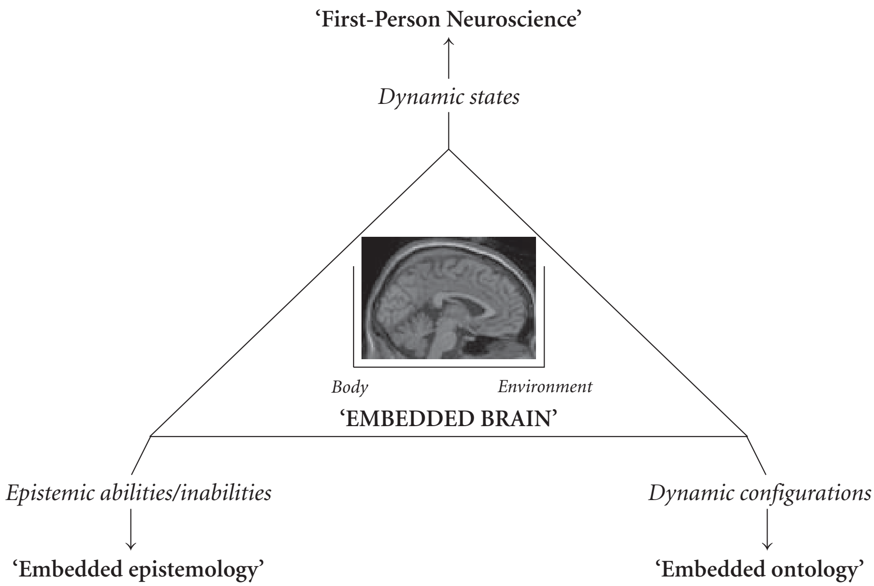
4.1.1 What is the brain?

Empirically, the brain cannot be regarded as a purely physical device like, for example, a traditional computer. The 'physical brain' has to be replaced by a 'dynamic brain', which can be characterized by dynamic states. Unlike neuronal states, dynamic states cannot be accounted for by the laws of (classical) physics but rather by 'dynamic laws'. Since dynamic states refer to identical events within the environment as mental states, brain states can no longer be separated i.e. dissociated from mental states. The empirical dissociation between neuronal and mental states is thus undermined by the revelation of dynamic states. Subsequently, the empirical characterization of the brain as a 'dynamic brain' makes the detachment of mental states from the brain impossible, which in turn results in the solution of the 'empirical mind problem'. This is also reflected in the distinction between the biological and (classical) physical definition of the brain: The definition of the brain by dynamic states may be regarded as a biological definition. Unlike in other biological definitions (see Searle 1997), 'biological' in the present sense cannot be reduced to the laws of (classical) physics but rather to dynamic laws as 'biological laws' (see 3.3.3).

Epistemically, the brain is not only accessible in the Third-Person Perspective but, in addition, in 'First-Brain Perspective' (see 3.2.1). The 'First-Brain Perspective' accounts for dynamic states which refer to identical events within the environment as mental states. The 'First-Brain Perspective' can be accessed only indirectly, which means, through linkage between First- and Third-Person Perspective. This epistemic linkage is, methodologically, provided by 'First-Person Neuroscience'. The epistemic dissociation between First- and Third-Person Perspective is thus undermined by the revelation of the 'First-Brain Perspective'. Subsequently, the epistemic characterization of the brain by the 'First-Brain Perspective' makes the detachment of the First-Person Perspective from the brain impossible, which results in the solution of the 'epistemic mind problem'. This is also reflected in the linkage between 'subject and object of recognition' within the brain itself. The brain itself can account for the First-Person Perspective and thus for the 'subject of recognition'. Being accessible in Third-Person Perspective, it can, at the same time, also be an 'object of recognition' (see also 4.2.5 for more extensive discus-



a. Traditional determination and concepts in the case of the brain as an 'isolated brain'



b. Novel determination and concepts in the case of the brain as an 'embedded brain'

Figure 24. Determination of the brain and corresponding concepts

sion). Accordingly, the brain as a 'subject of recognition' can, even if rather indirectly through itself as an 'object of recognition', refer to itself, which implies that 'indirect epistemic self-reference' of the brain is possible.

Ontologically, the brain can no longer be defined by 'physical properties' and 'physical ontology' but rather by 'dynamic configurations' and 'embedded ontology'. The ontological definition of the brain as an 'isolated brain', as defined by 'physical or mental properties', is therefore replaced by the brain as an 'embedded brain', as defined by 'dynamic configuration'. 'Embedded ontology', by providing a broader and more foundational ontological framework, reveals the necessary conditions for the possibility of 'physical and mental ontology' as forms of an 'isolated ontology'. The ontological dissociation between 'physical and mental ontology' is thus undermined by the development of 'embedded ontology'. Subsequently, characterizing the brain by 'dynamic configurations' and 'embedded ontology' makes the ontological detachment of the mind from the brain impossible, which results in the solution of the 'ontological mind-brain relationship problem'. This is also reflected in the contradiction between dependence and independence of the mind from the brain. On one hand the mind (i.e. mental states which are attributed to it) is dependent on the existence of a brain, yet on the other hand the mind cannot be detected within the brain and therefore seems to be independent. The mind is indeed dependent on the brain, but not on the brain as an 'isolated brain' but rather on the brain as an 'embedded brain'. The mind can without a doubt not be detected within the 'physical properties' of the brain as an 'isolated brain'. It, i.e. the mental states which are attributed to it, can, however, be detected within the 'dynamic configurations' of the brain as an 'embedded brain'.

4.1.2 How can we characterize the brain?

Empirically, the brain can be characterized by dynamic states. Whereas neuronal states as physical states are a necessary but not sufficient condition for dynamic states, dynamic states can be considered as a necessary and sufficient condition for mental states. Consequently, neuronal states and mental states reflect false empirical categories of states for the empirical characterization of brain states. One may therefore speak of an 'empirical categorical fallacy' when considering either neuronal or mental states as constitutive for the brain. The alternative between 'empirical under- and overdetermination' of the brain is thus undermined by the revelation of dynamic states which provide the empirical linkage between neuronal and mental states.

Epistemically, the brain can be characterized by the 'First-Brain Perspective'. The Third-Person Perspective is a necessary yet not sufficient condition for the possibility of epistemic access to the 'First-Brain Perspective'. Only the linkage between First- and Third-Person Perspective can be regarded as a sufficient condition for an epistemic account of the ‘First-Brain Perspective’. ‘Embedded epistemology’, which accounts for the inclusion of ‘First- and Third-Person Perspective’, should thus be complemented by ‘First-Person Neuroscience’, which links both perspectives with regard to the brain and thus to the ‘First-Brain Perspective’. The linkage of the ‘First-Brain Perspective’ with both First-Person Perspective and the brain can therefore be revealed in ‘First-Person Neuroscience’. Consequently, First- and Third-Person Perspective reflect false epistemic categories for the epistemic characterization of the brain itself. One may therefore speak of an ‘epistemic categorical fallacy’ when one considers either First- or Third-Person Perspective as constitutive for the brain. The alternative between ‘epistemic under- and overdetermination’ of the brain is thus undermined by revelation of the ‘First-Brain Perspective’ which provides the epistemic linkage between the First-Person Perspective and the brain.

Ontologically, the brain can be characterized by ‘dynamic configurations’ as an ‘ontological relation’ which accounts for the ‘intrinsic’ relationship between brain, body, and environment i.e. ‘embedment’. Mental states as states of the brain as an ‘embedded brain’ can be described as a specific ‘dynamic configuration’ and thus as an ‘ontological relation’; as such they can no longer be characterized by ‘ontological properties’ like ‘mental of physical properties’. The ontological assumption of a mind to which mental states and thus the presupposed ‘mental properties’ can be attributed to remains no longer necessary because it can be replaced by the brain as an ‘embedded brain’ as characterized by ‘ontological relation’. Consequently, both ‘physical and mental properties’ reflect false ontological categories for the ontological characterization of the brain itself. One may therefore speak of an ‘ontological categorical fallacy’ when one considers either ‘physical or mental properties’ as constitutive for the brain. The alternative between ‘ontological under- and overdetermination’ of the brain is thus undermined by the revelation of ‘ontological relation’ which provides the ontological linkage between mental states and brain states within the brain as an ‘embedded brain’.

4.1.3 When can we speak of a brain?

Empirically, the brain can be characterized by ‘event coding’. ‘Event coding’ reflects the ‘neural code’ of the brain and is defined by processing and organization of neuronal states in orientation on ‘observable and to-be effectuated events within the environment’. ‘Event coding’ must therefore be distinguished from ‘stimulus coding’ which is defined by the orientation of processing and organization on stimuli. Other bodily organs like the heart, kidney, muscles, etc. (see 3.1.3) as well as artificial devices as, for example, computers can be characterized by ‘stimulus coding’. In contrast, ‘event coding’ can be regarded as the constitutive empirical feature of the brain that defines the brain as a brain in empirical regard. 'Event coding' presupposes an 'intrinsic' integration of the brain within body and environment i.e. 'embedment'. The organization of neuronal states in orientation on events within the environment remains otherwise impossible (see 2.3.1). 'Embedment' may subsequently be regarded as the 'unifying theoretical principle' (see 1.2.1) of the brain.

Epistemically, the brain can be characterized by 'autoepistemic limitation'. 'Autoepistemic limitation' describes the epistemic inability of the brain to detect and recognize its own brain states as brain states. This distinguishes the brain from other organs and artificial devices that are able to detect and recognize their own physical/computational states as physical/computational states (see 3.1.4). 'Autoepistemic limitation' can thus be regarded as the constitutive epistemic feature of the brain that defines the brain as a brain in epistemic regard. 'Autoepistemic limitation' is closely related to 'event coding' i.e. the latter is a necessary empirical condition for the possibility of the former. If 'event coding' is replaced by 'stimulus coding', 'autoepistemic limitation' remains absent. This is, for example, the case in artificial devices like machines and computers which process their information in orientation on stimuli rather than events (see 3.1.4). Subsequently, one may suppose they do not show 'autoepistemic limitation', i.e. they are able to detect and recognize their own physical/computational states as physical/computational states.

Ontologically, the brain can be characterized by 'ontological relation' as 'dynamic configurations' which account for the 'intrinsic' integration of the brain within body and environment (see 3.3.2). 'Ontological relation' as 'dynamic configurations' replaces the ontological characterization of the brain by 'ontological properties' as, for example 'physical properties', 'informational properties', or 'mental properties' (see 1.2.1, 3.3.1 and 3.3.3). This distinguishes the brain from both other organs and artificial devices which can be characterized by 'ontological properties' rather than 'ontological relation'. 'Ontological relation' as 'dynamic configuration' can thus be regarded as the constitutive ontological feature of the brain that define the brain as a brain in ontological regard. It should be noted that we do not deny that the brain may have 'physical properties' (and/or 'informational properties'). We do however deny that these 'ontological properties' define the brain as a brain, are constitutive for it, and distinguish it from other devices in ontological regard.

4.1.4 Where can we investigate the brain?

Empirically, the brain can no longer be characterized by neuronal states as physical states exclusively. Instead, the brain can be characterized by dynamic states as being non-reducible to (classical) physical states. Dynamic states cannot be accounted for in Third-Person Perspective but rather in 'First-Brain Perspective'. The 'First-Brain Perspective' is only indirectly accessible through linkage between First- and Third-Person Perspective as provided by 'First-Person Neuroscience' (see 3.2.1). 'First-Person Neuroscience' relates neuronal and mental states by means of which dynamic states (i.e. reflecting the organization of neuronal states) can be revealed. Accordingly, the restriction of 'Third-Person Neuroscience' to neuronal states is undermined and complemented by the revelation of dynamic states in 'First-Person Neuroscience'. Since dynamic states are mental states, 'First-Person Neuroscience' as 'neuroscience of mind' allows for indirect empirical investigation of mental states through dynamic states.

Epistemically, the brain can no longer be characterized by physical abilities and inabilities exclusively but, in addition, by epistemic abilities and inabilities. These epistemic abilities and inabilities cannot be accounted for by brain states as (classical) physical states but rather by brain states as dynamic states. Instead of attributing them to a mind, mental states reflect a particular epistemic inability of the brain i.e. 'autoepistemic limitation' which can be accounted for by specific dynamic states. Furthermore, other epistemic abilities and inabilities do not require the assumption of a mind either since they also can be accounted for by the brain and its different dynamic states (see Chapter 2). The various epistemic abilities and inabilities can subsequently be accounted for by an 'epistemology of the brain' (see 3.2.1.1). Accordingly, the restriction of epistemology to the mind as an 'epistemology of the mind' is undermined and complemented by the revelation of the epistemic abilities and inabilities of the brain with an 'epistemology of the brain' which allows for epistemic investigation of the brain itself.

Ontologically, the brain can no longer be characterized by 'physical properties' exclusively. Instead, the brain can be characterized by 'ontological relation' as 'dynamic configurations' by means of which it is 'intrinsically' integrated within body and environment. Due to the presupposition of 'ontological relation', the ontological assumption of a mind with 'mental properties' as 'ontological properties', to which mental states can be attributed, remains no longer necessary. Whereas mental states only reflect one particular 'dynamic configuration' of the 'intrinsic' relationship of the brain within the body and the environment, other non-mental states may reflect other 'dynamic configurations'. Both mental and non-mental states as different 'dynamic configurations' may subsequently be accounted for by an 'ontology of the brain' (see 3.3.1 and 3.3.2). Accordingly, the restriction of ontology to 'ontological properties' and 'ontology of the mind' is undermined and complemented by the revelation of 'ontological relation' with 'dynamic configurations' and the subsequent 'ontology of the brain' which both allow for ontological investigation of the brain itself.

4.1.5 Why do we have a brain?

Empirically, the brain can be characterized by 'event coding' as its constitutive empirical feature (see also 4.1.3). 'Event coding' is defined by the organization of neuronal states in orientation on 'observable and to-be effectuated events within the environment' (see 3.1.3). Due to this orientation on 'events within the environment', 'event coding' allows for 'selective-adaptive coupling' between organism and environment by means of which brain, body, and environment can be 'matched' with each other, resulting in 'optimal fits' (see 3.3.2): The better the 'selective-adaptive coupling', the better the 'matching' between brain, body, and environment. The better the 'matching' between brain, body, and environment, the better the adaptation of the organism to its respective environment. Accordingly, 'event coding' as the constitutive empirical feature of the brain may provide the function of 'selective-adaptive coupling' by means of which the brain is able to contribute to better adaptation of the organism to the environment. The price for the possibility of environmental adaptation consists in the empirical distinction between mental and neuronal states which makes 'direct empirical self-reference' of the brain impossible (see 3.3.4). 'Event coding' is necessarily accompanied by mental states which dissociate from neuronal states in phenomenal and epistemic respect (see 2.3.1). Since mental states dissociate from neuronal states (in phenomenal and epistemic respect), they cannot be detected empirically within the neuronal states of the brain itself. Due to its generation of mental states by means of 'event coding', the brain remains unable to directly refer to itself through its own neuronal states. However, if 'event coding' is replaced by 'stimulus coding', both the generation of mental states and the orientation on 'events within the environment' would be impossible as such: Due to the impossibility of mental states, the brain would be able to directly refer to itself through its own neuronal states – 'direct empirical self-reference' of the brain would be possible. Due to the lack of orientation on ('observable- and to-be effectuated') 'events within the environment', 'selective-adaptive coupling' between brain, body, and environment would, however, remain impossible. The brain could thus no longer contribute to better adaptation to the environment.

Epistemically, the brain can be characterized by 'autoepistemic limitation' as its constitutive epistemic feature (see also 4.1.3). 'Autoepistemic limitation' is defined by the epistemic inability of the brain to directly detect and recognize its own brain states as brain states which, instead, are experienced as mental states in First-Person Perspective. Others' brain states, on the other hand, are observed as non-mental states i.e. physical (or neuronal) states in the Third-Person Perspective. First- and Third-Person Perspective can therefore be distinguished from each other in epistemic respect. First- and Third-Person Perspective not only differ from each other with respect to the states i.e. mental and physical but, in addition, they concern different organisms i.e. the own and others (see also 2.3.1). The own organism is characterized by the experience of mental states while other organisms are observed in terms of physical states. This distinction between the own and other organisms in terms of states may serve for better orientation of the own organism within the environment: The better our own and other organisms can be distinguished from each other, the better the orientation of the own organism within the respective environment. Accordingly, 'autoepistemic limitation' as the constitutive epistemic feature of the brain may provide the function of epistemic distinction between First- and Third-Person Perspective by means of which the brain is able to contribute to better orientation of the organism in the environment. The price for the possibility to distinguish between different persons i.e. the own and others consists in the epistemic dissociation between First-Person Perspective and the brain which makes 'direct epistemic self-reference' of the brain impossible (see 3.3.4). Only the Third-Person Perspective can be directly related to the brain (though not the own brain as the own brain with its respective dynamic states as mental states) because it refers to physical i.e. neuronal states. Due to 'autoepistemic limitation', this remains, however, impossible in the case of the First-Person Perspective because it refers to mental states as distinguished from physical i.e. neuronal states. The brain therefore remains unable to directly relate to itself through its First-Person Perspective which makes the distinction between First-Person Perspective and 'First-Brain Perspective' (see 3.2.1) necessary. This implies the dissociation between the First-Person Perspective and the brain which, in turn, leads to the distinction between First- and Third-Person Perspective with respect to states (i.e. mental and neuronal states). However, if there is no 'autoepistemic limitation', both experience of mental states and First-Person Perspective would be impossible as such (see also 2.3.1). The brain would consequently be able to directly relate to itself through its own neuronal states and thus its 'First-Brain Perspective'; this implies that 'direct epistemic self-reference' of the brain would be possible. Moreover, the distinction between 'First-Brain Perspective' and First-Person Perspective would no longer be necessary because both would refer to neuronal states of the own brain. If, however, the First-Person Perspective refers to neuronal states it can no longer be distinguished from the Third-Person Perspective since the latter also refers to neuronal states. The distinction between own and others organisms in terms of states would thus be rather difficult, if not impossible, and, as a result, the brain could no longer contribute to better orientation of the organism within the environment.

Ontologically, the brain can be characterized by 'ontological relation' as its constitutive ontological feature (see 4.1.3). 'Ontological relation' reflect the 'intrinsic' relationship between brain, body, and environment in the case of the human brain which therefore presupposes 'embedded ontology' (see 3.3.3). Due to its characterization by 'ontological relation', 'embedded ontology' can account for different types of relationship between brain, body, and environment with the consecutive development of different and virtual types of ontology. The development of different and virtual types of ontology may, in turn, serve for the distinction between different types of environments and the prediction of potential changes in the latter (see also 3.3.4): The more diverse types of ontology can be developed, the better i.e. fine-grained is the distinction between the different types of environments. The more virtual types of ontology can be developed, the more accurate the prediction of potential (i.e. virtual) changes in the actual environment. Accordingly, 'ontological relation' and 'embedded ontology' as the constitutive ontological features of the brain may provide the function of the development of different and virtual types of ontology. This function enables the brain to contribute to better distinction between different environments and more accurate prediction of potential (i.e. virtual) changes in the latter. The price for the possibility to distinguish between different environments and predict their potential (i.e. virtual) changes consists in our inability to remain within our own ontological framework which makes 'direct ontological self-reference' of the brain impossible (see 3.3.4). Within the framework of an 'embedded ontology', we are well able to develop different and virtual types of ontology. These different and virtual types of ontology do not necessarily correspond to the ontological framework within which they are developed, i.e. the one which is presupposed by the brain itself. The brain therefore remains unable to directly refer to itself through the different and virtual types of ontology it is able to develop. This is, for example, the case in the assumption of 'physical and mental ontology' as forms of 'isolated ontology' which, as purely logical possibilities, do not reflect the type of ontology which is presupposed by the brain itself i.e. 'embedded ontology' (see 3.3.4). If, in contrast, the ontological characterization of the brain by 'ontological relation' and 'embedded ontology' is replaced by 'ontological properties' and 'isolated ontology', the development of different types of ontology (like for example 'embedded ontology') remains impossible. Due to the neglect of 'ontological relation', the brain could develop only the type of ontology it is presupposes by itself i.e. 'isolated ontology'. The brain could thus refer directly to itself through the type of ontology it is able to develop; this implies that 'direct ontological self-reference' of the brain is possible (see 3.3.4). If, however, the brain could only develop the type of ontology it presupposes by itself, it remains unable to develop other i.e. different and virtual types of ontology which may reflect different and virtual environments. As a result, the brain could no longer contribute to the fine-grained distinction between different environments and the accurate prediction of potential (i.e. virtual) changes in the latter.

4.2 The 'Dilemma of the brain'

The dilemma, as discussed in the first chapter, can be traced back to a particular definition of the brain i.e. 'isolated brain'. The dilemma can be resolved by the presupposition of a novel and different definition of the brain as an 'embedded brain'. Due to the necessary relationship between the 'brain problem' and the 'dilemma of the brain' (1.1.2 and 1.2.2), the resolution of the 'brain problem' is accompanied by the resolution of the dilemma. In turn, the possibility to resolve the dilemma lends further support to the validity of the definition of the brain as an 'embedded brain'.

4.2.1 'Empirical dilemma'

The 'empirical dilemma' (see 1.2.2) is resolved through the empirical characterization of brain states as dynamic states, as distinguished from neuronal states. Unlike neuronal states, dynamic states do not refer to stimuli but rather events. Both dynamic states and mental states refer to the same 'observable and to-be effectuated event within the environment'. Mental states are therefore necessary and sufficiently dependent on dynamic states. Accordingly, mental states can be linked to brain states as dynamic states through the respective event within the environment. Characterizing brain states as dynamic states thus undermines the alternative between the impossibility and possibility of empirical linkage of mental states to brain states.

A1: No (necessary) impossibility of linkage between mental states and brain states

- P1: Mental states cannot be detected within neuronal states.
- P2: Brain states can be characterized as dynamic states.
- C1: Linkage between mental states and brain states is not (necessarily) impossible.

A2: (Necessary) Possibility of linkage between mental states and brain states

- P1: The possibility of mental states depends necessarily and sufficiently on the existence of dynamic states.
- P2: Brain states can be characterized as dynamic states.
- C2: Linkage between mental states and brain states is (necessarily) possible.

There are two main sources for the possibility of the 'empirical dilemma'. The first one is the neglect to distinguish between events and stimuli. Mental states account for events while neuronal states reflect stimuli. Any linkage between neuronal and mental states must necessarily fail because both types of states imply different referents i.e. events and stimuli (see 2.3.1 and 3.1.2). The second source consists in identifying brain states and neuronal states. If brain states are defined by neuronal states exclusively, the possibility of characterizing brain states as dynamic states is necessarily excluded.

4.2.2 'Epistemic dilemma'

The 'epistemic dilemma' is resolved through the epistemic characterization of brain states by 'autoepistemic limitation'. Due to 'autoepistemic limitation', the brain remains unable to detect and recognize its own brain states as brain states. Instead, the own brain states are experienced as mental states in First-Person Perspective. Since brain states as dynamic states and mental states refer to identical 'observable and to-be effectuated event within the environment', mental states can be related to brain states (as dynamic states). A linkage between First-Person Perspective and brain states (as dynamic states) does therefore not remain impossible. However, this linkage is not only not impossible but also possible which can be demonstrated separately. 'Autoepistemic limitation' accounts for mental states and their experience in First-Person Perspective while it is generated by 'event coding' (see 2.3.1) which presupposes brain states as dynamic states (see 3.1.3). Therefore, dynamic states are a necessary and sufficient condition for mental states – dynamic states are mental states (see 3.1.3). In contrast, neuronal states are only a necessary though not sufficient condition for mental states. Subsequently, the First-Person Perspective is only necessarily dependent on neuronal states; in contrast it is necessarily as well as sufficiently dependent on dynamic states which makes its epistemic linkage to (the own) brain states (as dynamic states) possible. The characterization of (the own) brain states by 'autoepistemic limitation' (and dynamic states) thus undermines the alternative between impossibility and possibility of the epistemic linkage of the First-Person Perspective to brain states.

A1: No (necessary) impossibility of linkage between First-Person Perspective and brain states

- P1: The First-Person Perspective can be characterized by mental states.
- P2: Mental states refer to identical events within the environment as brain states as dynamic states.
- C1: Linkage between First-Person Perspective and brain states is not (necessarily) impossible.

A2: (Necessary) possibility of linkage between First-Person Perspective and brain states

- P1: The First-Person Perspective can be characterized by mental states.
- P2: Mental states are necessarily and sufficiently altered by changes in (the own) brain states as dynamic states.

C2: Linkage between First-Person Perspective and (the own) brain states (as dynamic states) is (necessarily) possible.

There are two main sources for the possibility of the 'epistemic dilemma'. The first one consists in the neglect of 'autoepistemic limitation' as a crucial epistemic inability of the brain itself. At the same time, however, 'autoepistemic limitation' also accounts for an epistemic ability i.e. the possibility to experience mental states in First-Person Perspective. Due to the neglect of 'autoepistemic limitation' as an epistemic inability of the brain, the concurrent epistemic ability i.e. mental states cannot be related to the brain and its brain states as dynamic states (see below). The second source for the possibility of the 'epistemic dilemma' is the neglect of the difference between neuronal states and their organization i.e. dynamic states: The same neuronal states may be organized in different ways and the same organization may be subserved by different neuronal states (see 3.1.3). 'Autoepistemic limitation' cannot be accounted for by neuronal states themselves but rather by a particular organization of them (i.e. 'event coding'; see 3.1.3) which reflects a specific dynamic state. Due to the neglect of the difference between neuronal states themselves and their organization i.e. dynamic states, the relation between 'autoepistemic limitation' and brain states as dynamic states cannot be accounted for.

4.2.3 'Ontological dilemma'

The 'ontological dilemma' is resolved through the ontological characterization of the mind (i.e. mental states which have been assumed to be related to a mind) by means of 'dynamic configurations' as defined by the 'intrinsic' relationship between brain, body, and environment (see 3.3.2). The assumption of a mind as ontologically distinguished from the brain is then no longer necessary. This implies that the linkage between brain (as an 'embedded or dynamic brain' with 'dynamic states as brain states) and mind (i.e. mental states) no longer remains impossible. However, this linkage is not only not impossible but also possible which can be demonstrated separately. The brain, as 'intrinsically' integrated within body and environment, can no longer be defined by 'ontological properties' like, for example, 'physical properties', which characterize the brain as an 'isolated brain' (see 3.3.1). Instead, the brain can be defined by 'ontological relation' e.g. 'dynamic configurations', which characterize the brain as an 'embedded brain' or 'dynamic brain' (see 3.3.2). The brain (i.e. the one of the respective philosopher itself) as an 'embedded brain' can necessarily and sufficiently account for the possible development of different types of ontology as, for instance, 'embedded ontology' (see 3.3.3 and 3.3.4). What has been attributed to a mind (as the one of the respective philosopher itself) i.e. mental states and the ability to develop different types of ontology can thus be accounted for by the brain as an 'embedded brain' – ontological linkage between mind (i.e. mental states) and brain (i.e. brain states) is possible. Characterizing the mind (i.e. mental states) through 'dynamic configurations' thus undermines the alternative between the impossibility and the possibility of an ontological linkage between the mind and the brain.

A1: No (necessary) impossibility of linkage between mind and brain

- P1: The mind can be characterized by 'dynamic configurations'.
- P2: 'Dynamic configurations' are defined by 'intrinsic' integration of the brain within body and environment (i.e. 'embedded brain' as 'dynamic brain').
- C1: Linkage between mind and (embedded/dynamic) brain is not (necessarily) impossible.

A2: (Necessary) possibility of linkage between mind and brain

- P1: The mind presupposes 'embedded ontology'.
- P2: The possibility of development of 'embedded ontology' depends necessarily and sufficiently on the existence of the brain (as an 'embedded/dynamic brain') i.e. the one of the respective philosopher itself.
- C2: Linkage between mind and (embedded/dynamic) brain i.e. the own brain is (necessarily) possible.

There are two main sources for the possibility of the 'ontological dilemma'. The first one is the neglect of the difference between 'ontological relation' and 'ontological properties' (see 3.3.3). Due to the neglect of 'ontological relation', brain states and mental states must be characterized by different 'ontological properties' i.e. 'physical and mental properties'. Whereas 'physical properties are related to the brain, 'mental properties' are attributed to a mind. The attribution of 'mental properties' to a mind provided the ground for the ontological distinction between mind and brain. In contrast, this ontological distinction between mind and brain remains no longer necessary in the case of 'ontological relation': Mental states are accounted for by a specific 'dynamic configuration' within the 'intrinsic' relationship between brain, body, and environment and thus the brain as an 'embedded/dynamic brain' (see 3.3.2). Attribution of mental states to an ontologically distinct underlying mind remains then no longer necessary. The second source for the possibility of the 'ontological dilemma' consists in the characterization of the brain by 'physical properties', which presupposes the brain as an 'isolated brain' (see 3.3.1). Due to the characterization of the brain by 'physical properties', the brain is isolated ('isolated brain') from the environment and consequently from mental states; this makes the assumption of a mind, as ontologically distinguished from the brain, necessary. Moreover, the characterization of the brain by 'physical properties' prevents the assumption of the brain as an 'embedded brain' which makes the linkage between brain states (i.e. brain) and mental states (i.e. mind) impossible.

4.2.4 'Disciplinary dilemma'

The 'disciplinary dilemma' (see 1.2.2) is resolved through the development of neurophilosophy as a transdisciplinary method for the linkage between logical and natural conditions (see 1.4.1). Two subtypes of logical conditions can be distinguished: Logical conditions, as accounted for in philosophy, can either be identical or non-identical with natural conditions, as investigated in neuroscience (see 1.4.2 for details). Due to this overlap between logical and natural conditions, the linkage between philosophy and neuroscience no longer remains impossible. However, this linkage is not only not impossible but also possible which can be demonstrated separately. The possibility to develop logical conditions, as presupposed in the epistemological and ontological concepts of philosophy, is necessarily and sufficiently dependent on the existence of the brain, i.e. the one of the philosopher itself. As a result, the brain i.e. the one of the philosopher itself provides the transition from natural conditions, which it presupposes by itself, to logical conditions, which it is able to develop (see 3.3.4). This transition from natural to logical conditions (i.e. their linkage) as the step from empirical mechanisms of the brain to epistemological and ontological concepts is focused on in neurophilosophy. As such neurophilosophy provides the transdisciplinary linkage between neuroscience, as being preoccupied with the empirical mechanisms and thus natural conditions exclusively, and philosophy, focusing on epistemological and ontological concepts and thus logical conditions exclusively. The characterization of neurophilosophy by the linkage between natural and logical conditions thus undermines the alternative between the possibility and the impossibility of a transdisciplinary linkage between philosophy and neuroscience.

A1: No (necessary) impossibility of linkage between philosophy and neuroscience

- P1: Philosophy presupposes logical conditions including those being identical and those being non-identical with natural conditions.
- P2: Neuroscience presupposes natural conditions that are identical with a subtype of logical conditions.
- C1: Linkage between philosophy and neuroscience is not (necessarily) impossible.

A2: (Necessary) possibility of linkage between philosophy and neuroscience

- P1: Philosophy presupposes logical conditions.
- P2: The possibility of development of logical conditions depends necessarily and sufficiently on the existence of the brain (i.e. the one of the respective philosopher itself) which, underlying natural conditions by itself as investigated in neuroscience, provides the linkage (i.e. transition) between natural and logical conditions.

C2: Linkage between philosophy and neuroscience is (necessarily) possible.

There are two main sources for the possibility of the 'disciplinary dilemma'. The first one consists in the neglect of the distinction between two distinct subtypes of logical conditions in philosophy i.e. those being identical and those being non-identical with natural conditions. Due to the neglect of the former subtype, logical conditions can be detached from natural conditions, which results in the impossibility of a linkage between philosophy and neuroscience. The second source for the possibility of the 'disciplinary dilemma' consists in the neglect of the ability of our own brain to develop logical conditions. The brain, underlying natural conditions by itself, is able to develop logical conditions that are no longer in accordance with those conditions i.e. natural conditions that characterize the brain itself (see 3.3.4). Due to the fact that the brain itself provides the transition from natural to logical conditions, the transdisciplinary linkage between neuroscience, as focusing on natural conditions, and philosophy, as investigating logical conditions, is possible. The method and discipline for this transdisciplinary linkage between natural and logical conditions is provided by neurophilosophy (see 1.4).

4.2.5 'Logical dilemma'

The 'logical dilemma' (see 1.2.2) is resolved through the distinction between the 'embedded brain' and the 'isolated brain' (see 3.3.1 and 3.3.2). The 'embedded brain' includes characterization of the own and others' brains as they (i.e. as 'subjects of recognition') observe themselves and others' as 'isolated brains' (i.e. as 'objects of recognition'). In contrast the 'isolated brain' reflects both brains (i.e. the own and others') as they are observed (i.e. as 'objects of recognition') by the 'embedded brain' (i.e. as 'subject of recognition'). As such the distinction between 'embedded and isolated brain' can no longer be considered as analogous to the one between 'subject and object of recognition' with respect to the own and others persons/brains: Due to the fact that the brain as an 'embedded brain' includes both own and others' brains, as they observe, it can no longer be equated with the 'subject of recognition' (in the traditional sense) which explicitly refers to the own subject while excluding the others' (as subjects). The same remains true for the 'isolated brain' (though in a reverse way) which includes both own and others' brains, as they are observed, whereas the 'object of recognition' refers only to the others' (as objects) while excluding the own (subject as an object). Both our own and the others' brains are subsequently 'subjects of recognition' as 'embedded brains' and 'objects of recognition' as 'isolated brains' at the same time. Accordingly, the epistemic distinction between 'subject and object of recognition' can no longer be considered as a analogous to the one between 'embedded brain' and 'isolated brain' with respect to the own and others' brains. However, the epistemic distinction between ‘subject and object of recognition’ with respect to the own and others’ brains is a necessary condition for the possibility of the ‘brain paradox’ as an ‘antinomy’: If this distinction can no longer be maintained, the ‘brain paradox’ as an **‘antinomy’** becomes impossible and must be considered as resolved.

The brain as an ‘embedded brain‘ recognizes all ‘embedded brains‘ as ‘isolated brains‘.

The **Kantian version** of the ‘brain paradox’ can be resolved in the following way.

A1: The ‘embedded brain’ indirectly recognizes all ‘embedded brains’ as ‘embedded brains’ but not as ‘isolated brains’.
A2: The ‘embedded brain’ directly recognizes all ‘embedded brains’ as ‘isolated brains’ but not as ‘embedded brains’.

A1 reflects the possibility of ‘indirect epistemic self-reference’ (3.3.4) by means of which we have indirect epistemic access to our own and others’ brains as an ‘embedded brain’. A2, on the other hand, is accounted for by the impossibility of ‘direct epistemic self-reference’ (see 3.3.4) by means of which we have no direct epistemic access to our own and others’ brains as ‘embedded brains’. Instead, we can directly recognize our own and other’s brains only as ‘isolated brains’.

The ‘brain paradox’ as a **‘veridical paradox’** (see 1.2.2) may be resolved in the following way.

The brain as an ‘embedded brain‘ recognizes all (‘embedded‘) brains as ‘isolated brains‘ if and only if it does not recognize all (‘embedded‘) brains as ‘embedded brains‘.

The contradiction between the recognition of one’s own and others’ brains is resolved. Both own and others’ brains cannot be directly recognized as ‘embedded brains‘ but only as ‘isolated brains‘. Since both can only be recognized as ‘isolated brains‘, the assumption of a principal epistemic difference between one’s own and others’ brains can no longer be maintained.

The ‘brain paradox‘ as a **‘falsidical paradox‘** (see 1.2.2) may be resolved in the following way.

The brain as an ‘embedded brain‘ does not recognize all (‘embedded‘) brains as ‘embedded brains‘ if and only if it does recognize all (‘embedded‘) brains as ‘isolated brains‘.

The false underlying presupposition is replaced by the true assumption of the epistemic inability of the brain to recognize one’s own and others’ brains as ‘embedded brains’. The first part reflects the impossibility of ‘direct epistemic self-reference’ while the second part is accounted for by the possibility of ‘indirect epistemic self-reference' (see 3.3.4) by means of which the 'embedded brain' recognizes itself i.e. the 'embedded brain' as an 'isolated brain'.

In philosophy, the 'logical dilemma' has been avoided thanks to the distinction between mind and brain. We philosophize about the mind while we philosophize with the brain. The content i.e. mind has thus been detached from its underlying vehicle i.e. the brain. Due to this dissociation between mind and brain with the consecutive confusion between content and vehicle, the 'logical dilemma' as a problem of 'self-reference' of the brain (see 3.3.4) has been avoided. However, the price philosophy had to pay for the avoidance of the 'logical dilemma' and the problem of the 'self-reference' of the brain consisted in the 'ontological mind-brain relationship problem'. In contrast, the resolution of the 'logical dilemma' through the distinction between 'isolated and embedded brain' does not result in the mind-brain problem within the framework of an 'embedded ontology'. 'Subject of recognition' and 'object of recognition' are neither exclusively distinguished from each other in epistemic regard (see 3.3.3) nor are they associated with different 'ontological properties' i.e. 'mental and physical properties' and consecutively with mind and brain. Instead, they reflect distinct 'dynamic configurations', which account for the various epistemic abilities and inabilities characterizing 'subject and object of recognition' (see 3.3.3), within the 'intrinsic' brain-environment relationship as an 'ontological relation'. The focus is thus shifted from the mind-brain relationship as an ontological problem to the brain-environment relationship as an epistemic problem (see 3.3.3).

4.3 Hypothesis of 'Embedment'

The hypothesis of 'embedment' essentially contains three parts (see 1.3.3): (i) the definition of the brain in empirical, epistemic, and ontological respect; (ii) the development of novel, appropriate, and corresponding concepts in neuroscience, epistemology, and ontology; (iii) the demonstration of a direct linkage between the 'brain problem' (see 1.1.2) and the 'mind problems' (see 1.1.1).

It should be noted that these three parts built upon each other. The definition of the brain is a necessary condition for the possible development of novel concepts which, in turn, makes the direct linkage between the 'brain problem' and the 'mind problems' possible. Moreover, it should be pointed out that the present investigation starts with the empirical definition of the brain, which can be considered as the starting point for the epistemic and ontological determination. Both epistemic and ontological determination subsequently built and rest upon the empirical definition of the brain so that they remain empirically plausible.

4.3.1 The definition of the brain

Empirically, the brain is defined as a 'dynamic brain'. The 'dynamic brain' is characterized by dynamic states and 'event coding' (see 3.1.2). Since dynamic states account for 'event coding', they must be distinguished from neuronal states as physical states which can be characterized by 'stimulus coding'. Dynamic states can subsequently not be regarded as (classical) physical states. The 'dynamic brain', as characterized by dynamic states, must therefore be distinguished from the 'physical brain', as characterized by (classical) physical states i.e. neuronal states. The 'dynamic brain' can be described as a 'biological brain' rather than a 'physical brain'. Accordingly, the **'dynamic brain'** as a 'biological brain' as characterized by dynamic states must be distinguished from the **'physical brain'** as characterized by neuronal states. Dynamic states reflect the functional organisation of neuronal states which is oriented on 'observable and to-be effectuated events within the environment'. Dynamic states can therefore account for 'event coding' but must be distinguished from neuronal states since the latter reflect stimuli rather than events i.e. 'stimulus coding'. Whereas the 'dynamic brain' with its dynamic states, as characterized by 'event coding', is 'intrinsically' linked to and integrated with events in the environment, this is not the case in the 'physical brain' with its neuronal states, as characterized by 'stimulus coding'. Accordingly, the 'dynamic brain' presupposes 'embedment' while the 'physical brain' can rather be characterized by 'isolation'.

Epistemically, the brain is defined by a particular epistemic inability i.e. 'autoepistemic limitation'. 'Event coding' and the brain as a 'dynamic brain' are necessary conditions for the possibility of a brain with 'autoepistemic limitation'. 'Stimulus coding' and the brain as a 'physical brain', on the other hand, can be considered as necessary conditions for the possibility of a brain without 'autoepistemic limitation'. Accordingly, the 'dynamic brain' as a **brain with 'autoepistemic limitation'** must be distinguished from the 'physical brain' as a **brain without 'autoepistemic limitation'**. Due to 'autoepistemic limitation', the brain remains unable to detect and recognize its own brain states as brain states; instead, the own brain states are experienced as mental states. This epistemic inability is empirically accounted for by 'event coding' and thus by the brain as a 'dynamic brain'. Due to 'event coding', the organisation of neuronal states is oriented on 'observable and to-be effectuated events within the environment'. The First-Person Perspective and the whole epistemic apparatus are therefore 'intrinsically' integrated within the environment. This is not the case in the 'physical brain' as a brain without 'autoepistemic limitation' which, due to 'stimulus coding', can no longer 'intrinsically' integrate the epistemic apparatus within the environment. Accordingly, the 'dynamic brain' as a brain with 'autoepistemic limitation' presupposes 'embedment' while the 'physical brain' as a brain without 'autoepistemic limitation' can rather be characterized by 'isolation'.

Ontologically, the brain is defined as an 'embedded brain'. The 'embedded brain' is characterized by the 'intrinsic' integration within both body and environment. This 'intrinsic' relationship can be accounted for by 'dynamic configurations' which, in turn, reflect an 'ontological relation'. The 'dynamic brain' must therefore be regarded as an 'embedded brain' as characterized by 'ontological relation'. The 'physical brain', in contrast', is no longer 'intrinsically' integrated within body and environment which makes its characterization by 'ontological properties', as distinguished from 'ontological relation', necessary. Accordingly, the 'dynamic brain' as an **'embedded brain'** must be distinguished from the 'physical brain' as an **'isolated brain'**. The 'dynamic brain' as an 'embedded brain' presupposes 'embedment' since otherwise neither 'dynamic configurations' nor 'ontological relation' are possible. In contrast, the 'physical brain' as an 'isolated brain' presupposes 'isolation' since the ontological definition by 'ontological properties' remains otherwise impossible (see 3.3.3). It should be noted that 'ontological properties' do not necessarily refer to 'physical properties'. Since they may also characterize 'mental and/or informational properties' (see 3.3.1). Independent from the type of 'ontological properties', these brains may ontologically nevertheless be defined as 'isolated brains'. Accordingly, the 'dynamic brain' as an 'embedded brain' presupposes 'embedment' while the 'physical/informational/mental brain' can rather be characterized by 'isolation'.

4.3.2 Development of novel, corresponding and appropriate concepts in neuroscience, epistemology and ontology

The empirical definition of the brain as a 'dynamic brain' makes the development of a particular method for the empirical investigation of dynamic states and 'event coding' necessary. This novel method is called 'First-Person Neuroscience' and is the appropriate and corresponding method for the empirical investigation of dynamic states and 'event coding'. In contrast, the brain as a 'physical brain' can be fully accounted for by traditional 'Third-Person Neuroscience' because of its exclusive definition by neuronal states i.e. physical states. However, unlike neuronal states i.e. physical states, dynamic states cannot be accounted for in Third-Person Perspective i.e. 'Third-Person Neuroscience'. Instead, dynamic states can only be accounted for by the linkage between mental states, as experienced in First-Person Perspective, and neuronal states, as recognized in Third-Person Perspective. This linkage between neuronal and mental states is provided by 'First-Person Neuroscience'. Accordingly, traditional **'Third-Person Neuroscience'** is undermined and complemented (see 1.1.2 and 3.2.1 for definition) by the novel method of **'First-Person Neuroscience'** which broadens the empirical focus with regard to the type of brain states (see also Figure 24).

The epistemic definition of the brain by 'autoepistemic limitation' makes the development of a novel concept of epistemology for the epistemic linkage between the First-Person Perspective and the brain necessary. This novel concept is called 'embedded epistemology' which as an 'epistemology of the brain' is the appropriate and corresponding concept for the epistemic linkage between the First-Person Perspective and the brain through 'autoepistemic limitation'. In contrast, only the brain without 'autoepistemic limitation' can be considered in traditional 'isolated epistemology': Due to the fact that the First-Person Perspective is detached and isolated from the brain itself and consecutively attributed to a mind, 'autoepistemic limitation' as an epistemic inability of the brain cannot be accounted for in 'isolated epistemology'. More generally, it remains principally impossible to link the First-Person Perspective and other epistemic abilities and inabilities to the brain itself within the framework of 'isolated epistemology' which therefore has to be characterized as an 'epistemology of the mind'. In contrast, 'embedded epistemology' as an 'epistemology of the brain' can account for the epistemic linkage between the First-Person Perspective and the brain through 'autoepistemic limitation' which makes the attribution of the First-Person Perspective to a mind superfluous. Accordingly, traditional **'isolated epistemology'** is undermined and complemented by the novel concept of **'embedded epistemology'** which broadens the epistemic focus with regard to the brain and its epistemic abilities and inabilities.

The ontological definition of the brain as an 'embedded brain' makes the development of a novel concept of ontology for the 'intrinsic' integration of the brain within body and environment necessary. This novel concept is called 'embedded ontology'. It is the appropriate and corresponding concept for the ontological determination of the 'intrinsic' relationship between brain, body, and environment as an 'ontological relation' which is reflected in different 'dynamic configurations'. The brain as an 'isolated brain', in contrast, is accounted for by 'ontological properties' as presupposed in the traditional 'isolated ontology': Due to the detachment and 'isolation' of the brain from both body and environment, their 'intrinsic' relationship and thus 'ontological relation' are neglected in 'isolated ontology'. As a result, the brain as an 'isolated brain' is ontologically characterized by 'ontological properties' as 'physical and/or mental properties'. In contrast, 'embedded ontology' considers the 'intrinsic' relationship between brain, body, and environment and thus 'ontological relation' which makes the assumption of 'ontological properties' i.e. 'physical and/or mental properties' for the characterization of the brain superfluous. Accordingly, traditional **'isolated ontology'** is undermined and complemented by the novel concept of **'embedded ontology'** which broadens the ontological focus with regard to 'ontological relation'.

4.3.3 The linkage between 'brain problem' and 'mind problems'

Empirically, the brain as a 'dynamic brain' is characterized by dynamic states as distinguished from neuronal states. Dynamic states account for 'event coding' by means of which the organization of neuronal states is oriented on 'observable and to-be effectuated events within the environment'. Similar to dynamic states, mental states refer to events within the environment and, in addition, it has to be assumed that dynamic and mental states refer to identical event(s) within the environment which implies the empirical accessibility of mental states: If dynamic states can be investigated empirically, as accounted for by 'First-Person Neuroscience', mental states may also be accessible to the empirical investigation (though indirectly through dynamic states). The first part of the **'empirical mind problem'**, which consists in the problem of the empirical accessibility of mental states in relation to the (i.e. our own) brain, is thus solved. Meanwhile its second part, the empirical relation between brain states and mental states, is transformed into an **'empirical event problem'** – being concerned with the empirical relation between events (within the environment) to which both dynamic and mental states refer (see 3.1.3 and Figure 25).

The exclusive determination of brain states through neuronal states and the definition of the brain as a 'physical brain' (see also 1.1.1) with the consecutive neglect of dynamic states and the brain as a 'dynamic brain' can be considered as necessary conditions for the possibility of the 'empirical mind problem'. The characterization of the brain by neuronal states makes an elucidation of 'event coding' impossible. Unlike dynamic states, neuronal states refer to 'stimuli' rather than to 'observable and to-be effectuated events within the environment'; neuronal states presuppose 'stimulus coding' rather than 'event coding'. Since they no longer refer to events but stimuli, neuronal states cannot be related to the events in the environment as experienced in mental states; this implies an empirical dissociation between neuronal and mental states. This led to the first part of the 'empirical mind problem', the question for the empirical accessibility of mental states in relation to the brain (see 1.1.1). Due to the determination of the brain as a 'physical brain', the brain became detached and isolated from the events in the environment which implies an empirical dissociation between brain states and (events as experienced in) mental states. This led to the second part of the 'empirical mind problem', the question for the empirical relation between brain states and mental states.

Epistemically, the brain is characterized by 'autoepistemic limitation'. Due to 'autoepistemic limitation', we experience our own brain states as mental states in First-Person Perspective. Accordingly, we have no direct epistemic access to our own brain states as brain states in First-Person Perspective whereas indirect access to our own brain i.e. its 'First-Brain Perspective' remains nevertheless possible. Indirect access to the 'First-Brain Perspective' is possible through linkage

'Isolated brain': 'Mind problems'	***'Embedded brain'***	***Transformation of 'Mind problems'***
'Empirical mind problem' (Brain as 'physical brain')	*Brain as 'dynamic brain'* →	**'Empirical event problem'**
'Epistemic mind problem' (Brain with 'physical abilities')	*Brain with 'autoepistemic limitation'* →	**'Epistemic environment problem'**
'Ontological mind-brain problem' (Brain with 'ontological properties')	*Brain with 'ontological relation'* →	**'Epistemic brain-environment problem'**

Figure 25. Determination of the brain and transformation of the 'Mind problems'

between First- and Third-Person Perspective as it is methodologically provided by 'First-Person Neuroscience'. The 'First-Brain Perspective' can account for (our own) brain states (as dynamic states) which are supposed to refer to the identical (events within the) environment as (our experience of events within the environment in) mental states in First-Person Perspective. We therefore have epistemic access to our own brain states as brain states (i.e. dynamic states) though only indirectly through mental states; this implies epistemic accessibility of our own brain i.e. its 'First-Brain Perspective' in First-Person Perspective (the latter being linked to the Third-Person Perspective; see above). The first part of the **'epistemic mind problem'**, consisting in the problem of epistemic accessibility of our own brain in First-Person Perspective, is thus solved. Meanwhile its second part, the epistemic reference of mental states, is transformed into an '**epistemic environment problem'** – being concerned with the epistemic relation between (events within the) environments to which both First-Person Perspective and 'First-Brain Perspective' refer (see 3.2.1 and Figure 25).

The exclusive determination of the brain through physical abilities with the consecutive neglect of the 'First-Brain Perspective' and presupposition of an epistemic dichotomy between First- and Third-Person Perspective can be considered as necessary conditions for the possibility of the 'epistemic mind problem'. Characterizing the brain solely by physical abilities (see also 1.1.1) makes the elucidation of 'autoepistemic limitation' as an epistemic inability of the brain impossible. In this case, the First-Person Perspective is only related to the experience of mental states but not to the own brain – 'autoepistemic limitation' as an epistemic inability of the own brain remains necessarily hidden. However, if 'autoepistemic limitation' as an epistemic inability of the own brain cannot be revealed, elucidation of the 'First-Brain Perspective' remains impossible too which, in turn, prevents indirect epistemic access to the (own) brain in the First-Person Perspective (as linked to the Third-Person Perspective (see above)). This led to the first part of the 'epistemic mind problem', the question for the empirical accessibility of our own brain in First-Person Perspective. Due to the epistemic detachment of the First-Person Perspective from the (own) brain, the experience of mental states in First-Person Perspective dissociated from the observation of neuronal states in Third-Person Perspective. This led to an epistemic dichotomy between First- and Third-Person Perspective with regard to their respective epistemic referents: The neuronal states, as observed in Third-Person Perspective, were related to the brain whereas the epistemic reference of mental states, as experienced in First-Person Perspective, remained unclear which often resulted in their attribution to a mind. The epistemic dichotomy between First- and Third-Person Perspective subsequently provided the ground for the second part of the 'epistemic mind problem', the question for the epistemic reference of mental states.

Ontologically, the brain is characterized by 'dynamic configurations'. 'Dynamic configurations' presuppose 'ontological relation' rather than 'ontological properties'. The ontological characterization of mind and brain by different 'ontological properties' i.e. 'mental and physical properties' remains subsequently impossible. Instead, mind and brain must be defined by different 'dynamic configurations' as 'ontological relation' which is reflected in the 'intrinsic' relationship between brain, body, and environment. The first part of the **'ontological mind-brain relationship problem'**, consisting in the ontological determination of the mind (and brain), is thus solved (see also 1.1.1). Meanwhile its second part, consisting in the ontological relationship between brain and mind, is transformed into an **'epistemic brain-environment problem'** - being concerned with the relationship between brain and environment with respect to epistemic abilities and inabilities as reflected in different 'dynamic configurations' (see also 3.3.3 and Figure 25).

The exclusive determination of the brain through 'physical properties' with the consecutive neglect of 'ontological relation' and the presupposition of an ontological dichotomy between 'mental and physical ontology' can be considered as necessary conditions for the possibility of the 'ontological mind-brain relationship problem'. The ontological characterization of the brain by 'physical properties' and thus 'ontological properties' makes the elucidation of 'dynamic configurations' and thus 'ontological relation' impossible. Since mental states and brain states can be distinguished from each other in phenomenal and epistemic respect, different underlying ontological correlates and thus different 'ontological properties' were supposed to be necessary to account for the difference between brain and mind. As a result, the mind was ontologically distinguished from the 'physical properties' of the brain by the assumption of 'mental properties'. This led to the first part of the 'ontological mind-brain relationship problem', the question for the ontological determination of the mind (and the brain). The concurrent assumption of 'physical and mental properties' implied however an ontological dichotomy between 'physical and mental ontology'. Brain and mind were subsequently associated with different ontologies which implies the question for their ontological relationship. This led to the second part of the 'ontological mind-brain relationship problem', the question for the ontological relationship between brain and mind.

4.4 'Paradigm shift'

Replacing the traditional definition of the brain as an 'isolated brain' with the novel definition of the brain as an 'embedded brain' leads to the development of novel concepts in neuroscience, epistemology and ontology (see 4.3.2). This is reflected in the development of 'First-Person Neuroscience', 'embedded epistemology', and 'embedded ontology'. These novel concepts undermine and complement the traditional concepts of 'Third-Person Neuroscience', 'isolated epistemology', and 'isolated ontology' (see 4.3.2). Moreover, the importance of the 'brain problem' for the solution and transformation of the 'mind problems' (see 4.3.3) implies a shift in the focus from 'philosophy of the mind' to 'philosophy of the brain' (see also 1.1.2). Taken together, the definition of the 'embedded brain' bears crucial relevance for the development of novel concepts in all four disciplines: neuroscience, epistemology, ontology, and philosophy. These novel concepts undermine and complement the traditional concepts: They undermine them by showing their necessary conditions which leads to the 'relativization' of their validity (see also 3.3.3 for more extensive discussion). They complement them by filling a gap which was opened when neglecting the brain in traditional philosophical discussions. The novel concepts therefore provide a broader and more foundational framework (see 3.3.3 for definition), which integrates the traditional concepts. The development of these novel concepts may subsequently lead to a 'paradigm shift' in neuroscience, epistemology, ontology, and philosophy. According to Kuhn (1962), a 'paradigm shift' can be characterized by three related changes: (i) the domain of phenomena accounted for; (ii) the nature of explanation that are acceptable; (iii) the very concepts and issues at the centre of theory. These criteria shall be applied to our concepts in the following in all four discipline.

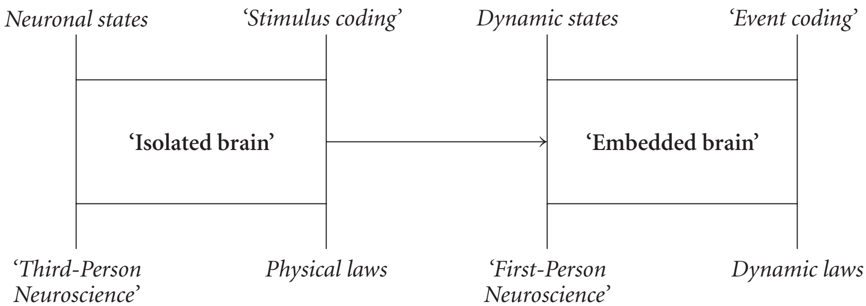


Figure 26. 'Paradigm shift' in neuroscience

4.4.1 The 'Paradigm shift' in neuroscience

The domain of neuroscience consists no longer in neuronal states and stimuli but rather in dynamic states and events. The nature of the acceptable explanation shifts from (classical) physical states and 'physical laws' to dynamic states and 'dynamic laws'. The traditional 'Third-Person Neuroscience' is undermined and complemented by the novel concept of 'First-Person Neuroscience' (see also Figure 26). Instead of separating them from each other, 'First-Person Neuroscience' puts the linkage between neuronal and mental states in dynamic states at the centre of empirical investigation. 'First-Person Neuroscience' therefore provides a broader and more foundational framework for 'Third-Person Neuroscience'.

4.4.2 The 'paradigm shift' in epistemology

The domain of epistemology consists no longer in the epistemic abilities/inabilities of the mind but rather in the epistemic abilities/inabilities of the brain like, for example, 'autoepistemic limitation'. Moreover, the epistemic dichotomy between First- and Third-Person Perspective is 'relativized' by the emphasis on 'epistemic dependence' between the different perspectives. The acceptable explanation for the relation between the different perspectives shifts from 'epistemic hierarchy' to 'epistemic pluralism'. The traditional 'isolated epistemology' is undermined and complemented by the novel concept of 'embedded epistemology'. Instead of isolating them from each other, 'embedded epistemology' puts the relation between epistemic abilities/inabilities and the environment at the centre of epistemic theory. 'Embedded epistemology' consequently provides a broader and more foundational framework for 'isolated epistemology' (see also Figure 27).

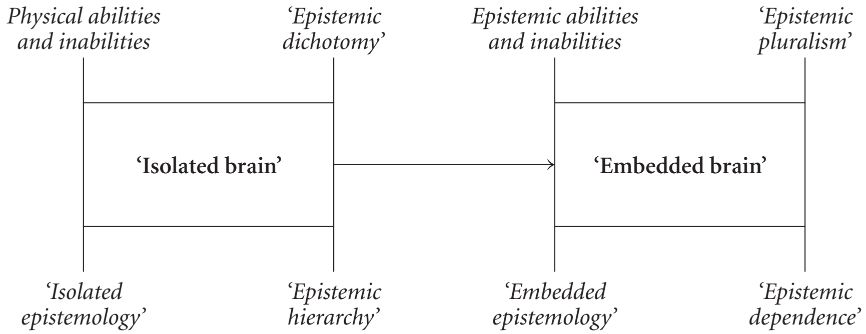


Figure 27. 'Paradigm shift' in epistemology

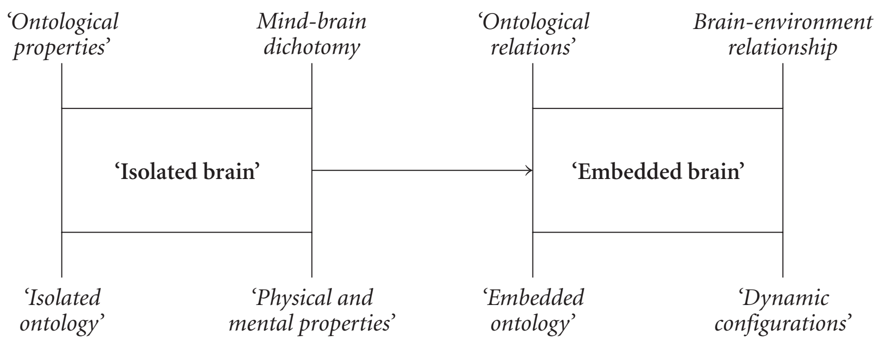


Figure 28. 'Paradigm shift' in ontology

4.4.3 The 'paradigm shift' in ontology

The domain of ontology consists no longer in 'ontological properties' but rather in 'ontological relations'. The nature of the acceptable explanation shifts from the development of different types of ontological mind-brain relationship to the epistemic description of 'dynamic configurations' within the 'intrinsic' brain, body, and environment relationship. The traditional 'isolated ontology' is undermined and complemented by the novel concept of 'embedded ontology'. Instead of isolating them from each other, 'embedded ontology' puts the relationship between brain, body, and environment at the centre of ontological theory. 'Embedded ontology' thus provides a broader and more foundational framework for 'isolated ontology' (see also Figure 28).

4.4.4 The 'paradigm shift' in philosophy

The domain of philosophy consists no longer in the mind and the 'philosophy of mind' but rather in the brain and the 'philosophy of the brain'. The nature of acceptable explanation shifts from purely and exclusive logical accounts, focusing solely on logical conditions, to naturally plausible logical accounts, focusing on the linkage between natural and logical conditions. The traditional philosophy is undermined and complemented by the novel concept of 'neurophilosophy'. Instead of separating them from each other, neurophilosophy puts the linkage between science and philosophy at the centre of this theory. Neurophilosophy may therefore provide a broader and more foundational framework for philosophy (see also Figure 29).

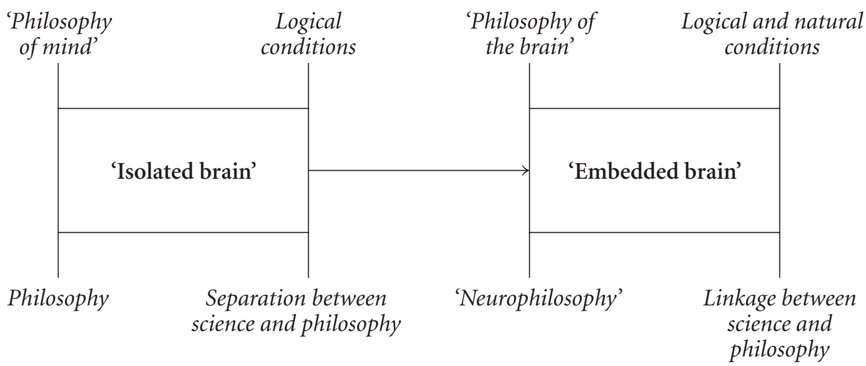


Figure 29. 'Paradigm shift' in philosophy

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Author index

A
Akins 193, 199, 200, 307
Aristotle 137, 290

B
Beckermann 292
Bechtel 26, 201, 221
Berkeley 137, 235, 325
Bickle 25, 26, 186
Birnbacher 9, 171
Block 247

C
Chalmers 4, 10, 27, 48, 94, 117, 148, 157, 158, 170, 171, 232, 246, 270, 272, 273, 283, 298, 311–313, 323, 330
Charland 123, 125
Churchland 25, 29–31, 37, 160, 186, 268
Clark 117, 200–202, 260, 276, 279
Conway 152–154

D
Damasio 62, 72, 77, 79, 122–125, 132, 135, 248
Davidson 232, 288
Dennett 136, 137, 266
Descartes 68, 146, 147, 192, 216, 239, 254, 269, 274, 276

E
Edelman and Tononi 110, 134, 145, 153, 155, 188, 189, 202, 204, 258, 259, 280, 309

F
Fodor 259
Friston 194, 195
Frith 64, 93, 110, 151, 155, 166

G
Gadenne 64, 86, 157, 158, 241
Goodman 43

H
Hardcastle 192
Hill 324
Hornsby 117, 272, 301, 307, 308
Hume 26, 40, 41, 49, 112, 135, 222, 239, 256, 274, 294, 297, 324, 325
Hurely 25, 85–87, 105–107, 109, 110, 182
Husserl 86, 135, 225, 236, 241, 244, 249

J
Jackson 159
James 39
Jeannerod 64, 90–92, 94, 98, 143, 144

K
Kant 18, 65, 66, 72, 73, 87, 88, 100, 101, 115, 210, 211, 213, 229, 230, 235, 239, 243, 244
Keijzer 200, 259, 282
Kelso 182, 183, 188, 199, 285, 312, 313
Kim 232, 287–289
Kitcher 210
Kosslyn 144
Kripke 51

Kuhlenbeck 16, 17, 39, 211

L

Lakoff and Johnson 117, 202, 259, 279, 286
LeDoux 122–125
Levine 169
Libet 91
Locke 40, 64, 65, 85, 87, 111, 126, 128, 156, 222, 246, 274, 324, 325
Lycan 148

M

Mackie 262
Markowitsch 154
McDowell 308, 309
McGinn 116, 283
Melzack 61, 62, 68–70
Merleau-Ponty 65, 87, 135, 136, 192, 228–230, 233, 236, 244, 255, 274
Metzinger 25, 62, 72, 79, 80, 86, 145, 146, 156, 158, 209, 212, 242, 258

N

Nagel 4, 5, 10, 11, 51, 147, 148, 158, 170, 189, 198, 216, 225, 227, 232, 272, 273, 283, 298, 301, 310, 313, 315, 323, 325, 330
Nida-Ruemelin 160

P

Panksepp 122–125
Papineau 148
Parfit 36, 37, 48, 262
Pihlstroem 43–45
Prinz 90, 91, 105–108, 134
Putnam 202

Q

Quine 17, 18, 31, 33, 42, 49, 50, 147, 231, 256

R

Ramachandran 70
Rizzolatti 83, 98–100
Rolls 123–125, 132

S

Schacter 152, 154
Schopenhauer 11, 16, 17, 64, 113, 115, 116, 210, 211, 234–236, 248, 249, 276, 285, 290, 299, 300, 317
Seager 203, 307, 313, 314
Searle 2, 9, 11, 136, 137, 147, 183, 198, 205, 227, 246, 285, 297, 298, 309–311, 313, 338
Shoemaker 158, 277, 279
Singer 155
Solms 78, 92

T

Thelen and Smith 63, 184, 259, 260, 280
Tononi 110, 134, 145, 153, 155, 188, 189, 202, 204, 258, 259, 280, 309

V

Van Gelder 37, 48, 59, 184, 185, 200, 280, 283
Van Gulick 136, 137
Varela 32, 190, 195, 221–224, 241, 243, 292, 312
Velmans 301

Subject index

A

Absent qualia argument 127, 128

Action 25, 76, 90–103, 107–112, 116, 117, 119, 120, 122, 131–135, 137–141, 143–145, 149, 151, 152, 163, 164, 173, 174, 181, 188, 190, 204–206, 244, 254, 255, 259, 260, 277, 284, 324

Action judgement 92

Amygdala 75, 76, 82, 122, 123, 128, 129, 131, 132, 153, 165, 246

As-if functions 207

Autobiographical memory 142, 152–156, 160, 163, 204

Autoepistemic limitation 24, 104, 105, 111–113, 115–121, 124, 127–131, 138, 142, 146, 147, 189, 190, 193, 196, 201–203, 206, 217–221, 237, 250, 258, 271, 278, 283–285, 294, 304–307, 315, 316, 318, 319, 322, 323, 327, 329, 333, 342–345, 348, 349, 355, 357, 358, 360, 362

- Embedded epistemology 24, 168, 175, 207–209, 211–215, 225–228, 230, 234, 237, 238, 240, 250–252, 275, 286, 297, 307, 308, 316, 318, 341, 357, 361, 362
- Emotions 13, 69, 75, 77–80, 82, 121–125, 131–133, 142, 152, 153, 156, 163–165, 223, 224, 246, 257

Empirical mind problem 1, 2, 5, 9, 23, 191, 198, 199, 338, 358

Epistemic mind problem 3, 5, 9, 23, 209, 219, 220, 338, 359, 360

Event coding 21, 128, 169–171, 175–178, 180, 182, 191–194, 196, 198–201, 206, 218, 265, 268, 271, 277, 290, 291, 316, 327, 341, 342, 344, 348, 349, 355, 356, 358

Feelings 62, 63, 68, 70, 77, 79, 80, 104, 121, 123–133, 142, 152, 153, 156, 157, 160–164, 246, 254, 256

First-Brain Perspective 117–120, 124, 127, 138, 180, 183, 186, 189, 190, 197–199, 209, 215–221, 225–227, 260, 270, 271, 278, 284, 286, 301, 314, 318, 319, 321, 322, 327, 333–335, 338, 340, 341, 343, 345, 358–360

First-Person Neuroscience 24, 190, 197, 198, 209, 221–223, 225, 226, 250, 253, 267, 270, 271, 295, 308, 314, 318, 321, 338, 341, 343, 356, 358, 359, 361, 362

First-Person Perspective 1–3, 5, 9, 10, 12, 14, 15, 39, 44, 52, 72, 112–115, 117–120, 125–131, 135, 136, 141, 143, 145–149, 151, 167, 189, 190, 196, 197, 209–213, 215–222, 224, 226, 232, 240–243, 245, 246, 248–255, 259, 264, 267, 270, 271, 278, 284, 286, 295–297, 302, 309, 313, 314, 322, 323, 326, 327, 333–335, 338, 341, 344, 345, 348, 349, 355–360

Mental states 1–6, 9, 10, 12, 14, 15, 39, 60, 86, 104, 105, 111, 113–121, 124, 127, 129, 130, 138, 139, 142, 143, 145–152, 165–170, 173, 186–191, 193, 194, 196–203, 206, 209, 217–227, 229, 232, 237, 238, 240, 241, 245, 249–252, 257, 258, 262–266, 268–271, 273, 278, 279, 281–289, 291–295, 297, 303–305, 314–316, 318, 320–324, 326, 327, 329–333, 335, 338, 340, 341, 343–345, 347–350, 355, 356, 358–360, 362

Mind-brain problem 10, 17, 29, 41, 250

Ontological mind-brain relationship problem 4, 6, 10, 249, 250, 298, 303–305, 314, 340, 354, 360, 361

Qualia 104, 121, 123, 126–131, 134, 136–142, 156, 161, 204, 246, 247, 249, 250

Self-reference of the brain 21, 115, 215, 260, 261, 316, 317, 319–322, 328–330, 332, 333, 335, 340, 344–346, 354

B

Bilateral dependency 19, 81, 136, 234, 254, 280, 300

Body 16, 19, 20, 60–68, 70–83, 86–90, 98, 101, 104, 106, 112, 115, 116, 118, 119, 121–124, 126–132, 135, 137–142, 145–147, 149–152, 176, 183, 185, 193, 199–203, 207, 211, 212, 214, 216, 227–230, 233, 234, 244, 251, 256, 259, 262, 273–286, 289, 291, 292, 294–296, 298–304, 306–316, 325, 326, 331, 332, 341–345, 349, 350, 356, 357, 360, 363

Body as spatial centre 71, 73

Body image 61–63, 66–68, 70–73, 75, 76, 78, 79, 82, 146

Bottom-up modulation 109, 110, 118–122, 131, 142, 179, 182

Brain 1–25, 27, 29, 30, 36, 37, 39, 41, 48, 50, 52–54, 56, 57, 59–62, 64, 65, 68, 70, 71, 75, 77, 83, 84, 87, 88, 90, 97, 104–106, 108, 110, 112–124, 126–132, 134, 135, 137, 138, 142–152, 163, 170, 171, 175–183, 185–221, 223–230, 233, 234, 244, 248, 250–252, 256, 258–271, 273–286, 289–292, 294–296, 298–323, 325–335, 337–364

Biological brain 251, 276, 355

Dilemma of the brain 6, 8, 9, 13, 337, 347

Dynamic brain 21, 24, 60, 138, 175–178, 180, 181, 183, 186–188, 193, 194, 199, 200, 218, 264, 265, 271, 276, 280, 290, 309, 318, 319, 332, 338, 349, 350, 355, 356, 358

Embedded brain 21, 23–25, 175, 176, 199, 212, 215, 217, 218, 227, 228, 234, 251, 256, 260, 261, 264, 273–276, 279, 281, 282, 284, 295, 298, 303, 308, 309, 318, 319, 337–341, 347, 349, 350, 352–354, 356, 357, 361

Isolated brain 21, 25, 176, 212, 213, 215, 218, 219, 251, 252, 261, 262, 274–276, 284, 295, 303–305, 318, 338–340, 347, 349, 350, 352, 354, 356, 357, 361

Physical brain 9, 15, 52, 54, 56, 186, 187, 193, 205, 218, 219, 251, 262–266, 269, 276, 281, 332, 338, 355, 356, 358
Self-reference 16, 21, 22, 114, 115, 215, 260–262, 316–322, 328–330, 332, 333, 335, 340, 344–346, 353, 354
Brain in the vat 278, 279
Brain paradox 16–19, 353
Brain paradox as veridical paradox 353
Brain paradox as falsidical paradox 353
Brain paradox as antinomy 17, 18, 353
Brain problem 1, 4–9, 13, 22, 23, 25, 337, 347, 354, 358, 361
Brain states 1, 2, 5, 6, 12, 14, 15, 112, 113, 115–117, 119, 120, 124, 127, 130, 142, 146, 149, 185–190, 194, 196–199, 202, 203, 217–221, 224, 225, 250, 258, 271, 278, 282–285, 303, 304, 315, 318–320, 322, 323, 327, 329–332, 338, 340–344, 347–350, 355, 356, 358–360
Biological states 187
Dynamic states 5, 176, 183, 185–190, 193–195, 197–199, 201, 202, 211, 212, 215, 217, 220, 221, 223, 225–227, 244, 245, 265, 271, 273, 275, 276, 280, 284, 285, 288, 289, 293, 307, 314, 315, 320, 321, 333, 335, 338, 340, 342, 343, 345, 347–349, 355, 356, 358, 359, 362
Mental states 1–6, 9, 10, 12, 14, 15, 39, 60, 86, 104, 105, 111, 113–121, 124, 127, 129, 130, 138, 139, 142, 143, 145–152, 165–170, 173, 186–191, 193, 194, 196–203, 206, 209, 217–227, 229, 232, 237, 238, 240, 241, 245, 249–252, 257, 258, 262–266, 268–271, 273, 278, 279, 281–289, 291–295, 297, 303–305, 314–316, 318, 320–324, 326, 327, 329–333, 335, 338, 340, 341, 343–345, 347–350, 355, 356, 358–360, 362
Neuronal states 1–3, 5, 9, 10, 12, 14, 15, 104, 111, 112, 117–121, 129, 143, 148–151, 170, 176, 186, 187, 190, 193–199, 205, 209, 215–217, 219, 221, 223, 224, 226, 227, 251, 252, 269–271, 275, 276, 285, 290, 291, 293, 304, 315, 320, 321, 338, 340–345, 347–349, 355, 356, 358, 360, 362
Physical states 3–5, 10, 12, 39, 116, 147, 148, 158, 159, 167–170, 173, 174, 187, 189, 193, 206, 212, 215, 227, 238, 240, 249, 251, 253, 276–278, 281, 286–289, 292–294, 340, 342, 343, 345, 355, 356, 362

C

Catatonia 78, 92, 159
Categories 53, 54, 210, 224, 235, 243, 244, 292, 326, 340, 341
Causality 26, 138–142, 189, 197, 210, 217, 227, 232, 282, 283, 287, 289–295, 300, 307, 308, 314
Causa efficiencs 138, 189, 217, 282, 283, 300, 308, 314
Causa finalis 138, 189, 217, 308, 314
Causa formalis 189, 217, 300, 308, 314
Dynamic causation 273, 287, 291–294, 300, 308
Efficient causality 138–142, 289–291, 293, 295

Final causality 138, 139, 290
Formal causality 138–140, 142, 289, 290
Mental causation 9, 104, 131, 134, 137, 139, 141, 142, 273, 282, 283, 287–289, 291–295, 308
Physical causation 137, 141, 287–289, 292–295
Co-constitution and co-occurrence 300, 308
Coding 21, 66, 67, 71, 73–75, 82, 105, 107, 108, 111, 118–122, 127–131, 133, 134, 138–142, 149–151, 160–162, 169–178, 180, 182, 191–196, 198–201, 206, 218, 265, 268, 271, 277, 290, 291, 316, 327, 341, 342, 344, 348, 349, 355, 356, 358
Action code 107, 108, 110, 112, 116, 119, 120, 122, 131, 132, 134, 140
Common coding 105, 107, 108, 119, 121, 127, 129, 131, 139, 141, 149, 161, 172
Distal neglect 119, 120, 129, 140, 141, 150, 151
Distal reference 108–111, 118, 119, 122, 123, 126, 129, 133, 140, 143, 155
Embedded coding 105, 108, 111, 118–122, 127–131, 133, 134, 138, 140–142, 150, 151, 161, 162, 170, 173
Environmental coding 119, 130, 139, 149, 161, 172
Event and action code 107, 108, 110, 116, 119, 120, 122, 131
Event code 107, 111, 129, 130, 171
Event coding 21, 128, 169–171, 175–178, 180, 182, 191–194, 196, 198–201, 206, 218, 265, 268, 271, 277, 290, 291, 316, 327, 341, 342, 344, 348, 349, 355, 356, 358
Goal-orientation 91, 93–97, 99–104, 108–111, 120, 121, 123, 128, 129, 137, 138, 142–144, 149–151, 153–156, 160–169, 171–174, 176–178, 180, 202, 204, 207, 245, 247, 248, 255, 258, 290, 291, 293, 334
Isolated coding 108, 118, 120, 128, 130, 139, 141, 149, 160, 172
Motor code 105–108, 110, 112, 116, 119, 120, 131–134, 139, 140
Proximal neglect 108–111, 118, 119, 122, 123, 126, 129, 133, 139, 140, 143, 144, 151, 155, 165, 166
Proximal reference 108, 118, 119, 129, 133, 139, 140, 150, 151, 165
Reversed embedded coding 119, 120, 129, 140, 141, 150, 151, 161, 173
Sensory code 105, 106, 111, 119, 122, 126, 128–130
Separate coding 105, 107, 108, 118, 121, 127, 128, 131, 139, 140, 149, 150, 160, 172
Stimulus coding 169, 171, 177, 178, 182, 191–193, 196, 198, 200, 206, 218, 265, 277, 341, 342, 344, 355, 358
Coevolution 30, 31, 37, 185
Cognitive systems 184, 200
Computer 11, 183, 203–207, 265, 266, 313, 338
Conditional fallacy 28–30
Connectionist systems 111, 185, 203–205, 265, 268
Consciousness 16, 17, 26, 113, 124, 125, 152–154, 168, 178, 190, 201, 204, 206, 222, 223, 225,

240, 241, 245–251, 259, 260, 284, 311, 313, 314, 317
Non-consciousness 249
Non-phenomenal qualia 161, 246, 247
Ontological mind-brain relationship problem 4, 6, 10, 249, 250, 298, 303–305, 314, 340, 354, 360, 361
Qualia 104, 121, 123, 126–131, 134, 136–142, 156, 161, 204, 246, 247, 249, 250
Second-Person Epistemology 159, 208, 223, 240, 245, 251–254
Second-Person Perspective 152, 156–160, 163, 167, 222, 223, 228, 240–243, 245–249, 251, 253, 254, 320, 326
Ultimate knot 250
Unconsciousness 168, 178, 223, 245, 247–250, 314
Consistency 25, 30, 31, 33, 34, 45–51, 54, 55, 164, 255, 256
Empirical consistency 25, 30, 33, 34, 45–51, 54
Logical consistency 31, 33, 34, 45, 47, 49–51, 54, 55
Constructivism 209, 213, 214, 228, 233, 234, 237, 238, 253
Context-dependence 74, 75, 176, 199, 203, 206, 207
As-if functions 207
Brain 1–25, 27, 29, 30, 36, 37, 39, 41, 48, 50, 52–54, 56, 57, 59–62, 64, 65, 68, 70, 71, 75, 77, 83, 84, 87, 88, 90, 97, 104–106, 108, 110, 112–124, 126–132, 134, 135, 137, 138, 142–152, 163, 170, 171, 175–183, 185–221, 223–230, 233, 234, 244, 248, 250–252, 256, 258–271, 273–286, 289–292, 294–296, 298–323, 325–335, 337–364
Computer 11, 183, 203–207, 265, 266, 313, 338

D
Deduction 323
Defence mechanisms 153
Definition of the brain 4, 5, 8, 9, 13, 19, 22–24, 48, 56, 187, 205, 218, 260, 262–267, 269, 273, 274, 303, 315, 337, 338, 340, 347, 354–358, 361
Definitorial shifting 31, 47, 48, 51, 54
Dependence 3, 5, 37, 60, 68, 75, 89, 90, 97, 104–107, 120–122, 125, 131, 132, 136, 149, 150, 162, 168, 169, 171, 172, 174, 179, 182, 185, 188, 199, 212, 213, 224, 229, 234, 235, 249, 251–254, 256, 257, 274–277, 279, 289, 290, 300, 302, 318, 322, 323, 325, 329, 340, 362
Instrumental dependence 105, 106
Non-instrumental dependence 105–107, 121, 122, 131, 132
Depression 164
Dilemma of the brain 6, 8, 9, 13, 337, 347
Disciplinary dilemma 13, 15, 351, 352
Empirical dilemma 13, 14, 347
Epistemic dilemma 13, 14, 348, 349
Logical dilemma 13, 16, 352, 354
Ontological dilemma 13, 15, 349, 350
Disciplinary dilemma 13, 15, 351, 352
Disembeddedness 128, 130
Disembodiment 19, 128, 130, 278, 279, 325
Dualism 4, 171, 269, 288, 289, 298, 313, 330

Property dualism 298
Substance dualism 298
Dynamic brain 21, 24, 60, 138, 175–178, 180, 181, 183, 186–188, 193, 194, 199, 200, 218, 264, 265, 271, 276, 280, 290, 309, 318, 319, 332, 338, 349, 350, 355, 356, 358
Dynamic brain organisation 177, 178, 180, 181, 188, 199, 264
Dynamic causation 273, 287, 291–294, 300, 308
Dynamic naturalism 288, 307, 309, 310, 313
Dynamic processes 178, 182
Dynamic systems 183–185, 189

E

Embedded brain 21, 23–25, 175, 176, 199, 212, 215, 217, 218, 227, 228, 234, 251, 256, 260, 261, 264, 273–276, 279, 281, 282, 284, 295, 298, 303, 308, 309, 318, 319, 337–341, 347, 349, 350, 352–354, 356, 357, 361
Biological brain 251, 276, 355
Biopsychosocial historicity 280, 281, 299, 300
Dynamic brain 21, 24, 60, 138, 175–178, 180, 181, 183, 186–188, 193, 194, 199, 200, 218, 264, 265, 271, 276, 280, 290, 309, 318, 319, 332, 338, 349, 350, 355, 356, 358
Dynamic configuration 184, 200, 212, 244, 274, 282, 291, 292, 295, 303, 315, 316, 340–343, 350
Dynamic states 5, 176, 183, 185–190, 193–195, 197–199, 201, 202, 211, 212, 215, 217, 220, 221, 223, 225–227, 244, 245, 265, 271, 273, 275, 276, 280, 284, 285, 288, 289, 293, 307, 314, 315, 320, 321, 333, 335, 338, 340, 342, 343, 345, 347–349, 355, 356, 358, 359, 362
Embedded epistemology 24, 168, 175, 207–209, 211–215, 225–228, 230, 234, 237, 238, 240, 250–252, 275, 286, 297, 307, 308, 316, 318, 341, 357, 361, 362
Embedded ontology 24, 175, 213, 250, 260, 261, 264, 274, 282, 284, 289, 295, 298–316, 319, 328, 331, 332, 335, 340, 345, 346, 349, 350, 354, 357, 361, 363
Embodied brain 273, 276–278
Epistemic hierarchy 44, 212, 213, 240, 274, 275, 296, 297, 301, 302, 362
Epistemic pluralism 37, 44, 212, 213, 225, 226, 240, 274, 275, 289, 297, 301, 308, 326, 362
Event coding 21, 128, 169–171, 175–178, 180, 182, 191–194, 196, 198–201, 206, 218, 265, 268, 271, 277, 290, 291, 316, 327, 341, 342, 344, 348, 349, 355, 356, 358
Mental states 1–6, 9, 10, 12, 14, 15, 39, 60, 86, 104, 105, 111, 113–121, 124, 127, 129, 130, 138, 139, 142, 143, 145–152, 165–170, 173, 186–191, 193, 194, 196–203, 206, 209, 217–227, 229, 232, 237, 238, 240, 241, 245, 249–252, 257, 258, 262–266, 268–271, 273, 278, 279, 281–289, 291–295, 297, 303–305, 314–316, 318, 320–324, 326, 327, 329–333, 335, 338, 340, 341, 343–345, 347–350, 355, 356, 358–360, 362

Neuronal states 1–3, 5, 9, 10, 12, 14, 15, 104, 111, 112, 117–121, 129, 143, 148–151, 170, 176, 186, 187, 190, 193–199, 205, 209, 215–217, 219, 221, 223, 224, 226, 227, 251, 252, 269–271, 275, 276, 285, 290, 291, 293, 304, 315, 320, 321, 338, 340–345, 347–349, 355, 356, 358, 360, 362
Ontological relation 6, 244, 273, 274, 282, 291, 298, 300, 303, 304, 308, 332, 333, 341–343, 345, 346, 349, 350, 354, 356, 357, 360
Physical states 3–5, 10, 12, 39, 116, 147, 148, 158, 159, 167–170, 173, 174, 187, 189, 193, 206, 212, 215, 227, 238, 240, 249, 251, 253, 276–278, 281, 286–289, 292–294, 340, 342, 343, 345, 355, 356, 362
Embedded Epistemology 24, 168, 175, 207–209, 211–215, 225–228, 230, 234, 237, 238, 240, 250–252, 275, 286, 297, 307, 308, 316, 318, 341, 357, 361, 362
Epistemic dependence 172, 174, 212, 213, 249, 251–253, 274, 275, 323, 362
Epistemic hierarchy 44, 212, 213, 240, 274, 275, 296, 297, 301, 302, 362
Epistemic pluralism 37, 44, 212, 213, 225, 226, 240, 274, 275, 289, 297, 301, 308, 326, 362
Epistemology of the brain 12, 175, 207, 208, 210, 211, 215, 219, 227, 261, 343, 357
Embedded epistemology 24, 168, 175, 207–209, 211–215, 225–228, 230, 234, 237, 238, 240, 250–252, 275, 286, 297, 307, 308, 316, 318, 341, 357, 361, 362
Embedded Ontology 24, 175, 213, 250, 260, 261, 264, 274, 282, 284, 289, 295, 298–316, 319, 328, 331, 332, 335, 340, 345, 346, 349, 350, 354, 357, 361, 363
Autoepistemic limitation 24, 104, 105, 111–113, 115–121, 124, 127–131, 138, 142, 146, 147, 189, 190, 193, 196, 201–203, 206, 217–221, 237, 250, 258, 271, 278, 283–285, 294, 304–307, 315, 316, 318, 319, 322, 323, 327, 329, 333, 342–345, 348, 349, 355, 357, 358, 360, 362
Dynamic configuration 184, 200, 212, 244, 274, 282, 291, 292, 295, 303, 315, 316, 340–343, 350
Dynamic ontology 299, 300, 307, 309
Epistemic brain-environment problem 304, 305, 360
Epistemic pluralism 37, 44, 212, 213, 225, 226, 240, 274, 275, 289, 297, 301, 308, 326, 362
Epistemic-ontological relativity 302, 303, 305, 306, 329
Foundational relation 306
Ontological mind-brain relationship problem 4, 6, 10, 249, 250, 298, 303–305, 314, 340, 354, 360, 361
Ontological pluralism 41–45, 302, 303, 329
Ontological relation 6, 244, 273, 274, 282, 291, 298, 300, 303, 304, 308, 332, 333, 341–343, 345, 346, 349, 350, 354, 356, 357, 360

Relational ontology 274, 282, 291, 298, 299
Relative ontologies 302, 329
Embedded ontology 24, 175, 213, 250, 260, 261, 264, 274, 282, 284, 289, 295, 298–316, 319, 328, 331, 332, 335, 340, 345, 346, 349, 350, 354, 357, 361, 363
Embedment 1, 8, 19–23, 25, 60, 61, 65, 66, 68, 72, 75, 82, 83, 88, 90, 97, 104, 105, 108, 118, 121, 127, 131, 135–138, 140–144, 152, 163, 175, 193, 200, 201, 206, 208, 211, 234, 235, 238, 255, 258, 273, 277, 279, 280, 288, 307, 313, 316–320, 325, 337, 341, 342, 354–356
Act-oriented embeddment 104, 131
Bodily embedment 61
Embeddedness 19, 127, 129–131
Embodiment 19, 127, 129–131, 277–279, 325
Emotional embedment 61, 75
Environmental embedment 83
Goal-oriented embedment 104, 105
Individual embedment 61, 68
Inter-subjective embedment 83, 97
Intra-subjective embedment 83, 90
Mental embedment 60, 104, 142
Neural embedment 142, 143, 279
Personal embedment 142, 152
Reflexive embedment 60, 104, 142–144
Social embedment 143, 163
Spatial embedment 60, 61, 82
State-oriented embedment 104, 121
Temporal embedment 60, 82, 104, 105, 142
Embodiment 19, 127, 129–131, 277–279, 325
Biological embedment 277
Epistemic embodiment 277–279
Ontological embodiment 278, 279
Sensory embodiment 277
Volitional embodiment 277
Emergentism 263, 272, 313
Emotions 13, 69, 75, 77–80, 82, 121–125, 131–133, 142, 152, 153, 156, 163–165, 223, 224, 246, 257
Autoepistemic limitation 24, 104, 105, 111–113, 115–121, 124, 127–131, 138, 142, 146, 147, 189, 190, 193, 196, 201–203, 206, 217–221, 237, 250, 258, 271, 278, 283–285, 294, 304–307, 315, 316, 318, 319, 322, 323, 327, 329, 333, 342–345, 348, 349, 355, 357, 358, 360, 362
Consciousness 16, 17, 26, 113, 124, 125, 152–154, 168, 178, 190, 201, 204, 206, 222, 223, 225, 240, 241, 245–251, 259, 260, 284, 311, 313, 314, 317
Feelings 62, 63, 68, 70, 77, 79, 80, 104, 121, 123–133, 142, 152, 153, 156, 157, 160–164, 246, 254, 256
Unconsciousness 168, 178, 223, 245, 247–250, 314
Empirical dilemma 13, 14, 347
Empirical hypothesis 20, 21, 35–37, 45–49, 55–57, 175, 176, 193, 207, 208, 260, 261
Empirical mind problem 1, 2, 5, 9, 23, 191, 198, 199, 338, 358
Empiricism 209, 213, 215, 228, 229, 233, 238, 249, 253, 258

Environment 1, 12, 13, 19, 20, 60–62, 64, 65, 68, 71–73, 82–84, 88, 90, 101, 104, 107, 108, 110–112, 114–119, 121, 126–132, 134–142, 148, 151, 152, 159, 160, 167, 176, 178, 183, 186, 187, 190, 191, 196–203, 207, 209, 211, 212, 215, 217, 219, 220, 223, 225, 227–237, 239, 241, 244, 245, 247, 251, 252, 256–259, 262, 273–286, 289–292, 295, 296, 298–316, 321, 328, 331–335, 338, 341–350, 355–360, 362, 363
  Embedded environment 233, 235, 274
  Isolated environment 229, 233, 235, 274
Epiphenomalism 263
Epistemic conceivability 323–327
Epistemic dichotomy 3, 209, 213, 230, 234, 359, 360, 362
Epistemic dilemma 13, 14, 348, 349
Epistemic mind problem 3, 5, 9, 23, 209, 219, 220, 338, 359, 360
Epistemic monism 213, 225, 226, 240, 249, 275, 296, 297, 301, 302
Epistemic pluralism 37, 44, 212, 213, 225, 226, 240, 274, 275, 289, 297, 301, 308, 326, 362
Epistemic primacy 37–44, 52
Epistemic-empirical relationship 8, 24, 59, 60, 175, 208–211, 251
Epistemic-ontological inferences 286, 329, 330
Epistemological turn 40, 210
  Neuroepistemological turn 210
  Epistemology 5, 7–10, 12, 22, 24, 25, 37–41, 147, 159, 167, 168, 175, 207–215, 218, 219, 223, 225–228, 230, 233, 234, 236–238, 240, 243, 245, 250–254, 256, 261, 275, 286, 297, 307, 308, 311, 312, 316, 318, 337, 341, 343, 354, 356, 357, 361–363
  Constructivism 209, 213, 214, 228, 233, 234, 237, 238, 253
  Embedded epistemology 24, 168, 175, 207–209, 211–215, 225–228, 230, 234, 237, 238, 240, 250–252, 275, 286, 297, 307, 308, 316, 318, 341, 357, 361, 362
  Empiricism 209, 213, 215, 228, 229, 233, 238, 249, 253, 258
  Epistemology of the brain 12, 175, 207, 208, 210, 211, 215, 219, 227, 261, 343, 357
  Epistemology of mind 12, 209–211, 213, 214, 256, 343, 357
  First-Person Epistemology 10, 167, 208–211, 213, 215, 219, 252–254, 308
  Idealism 209, 213, 214, 228, 229, 233, 238, 249, 253
  Isolated epistemology 175, 208, 209, 211, 213–215, 218, 219, 226–228, 238, 240, 251, 253, 275, 286, 357, 361, 362
  Realism 45, 209, 213, 215, 228, 233, 234, 237, 238, 253, 258
  Second-Person Epistemology 159, 208, 223, 240, 245, 251–254
  Third-Person Epistemology 10, 147, 159, 168, 207, 212, 213, 215, 240, 251–254
Epistemology of events and environments 207, 209, 227, 228, 230, 233, 234, 236–238
Epistemology of the brain 12, 175, 207, 208, 210, 211, 215, 219, 227, 261, 343, 357
Event coding 21, 128, 169–171, 175–178, 180, 182, 191–194, 196, 198–201, 206, 218, 265, 268, 271, 277, 290, 291, 316,

327, 341, 342, 344, 348, 349, 355, 356, 358
Autoepistemic limitation 24, 104, 105, 111–113, 115–121, 124, 127–131, 138, 142, 146, 147, 189, 190, 193, 196, 201–203, 206, 217–221, 237, 250, 258, 271, 278, 283–285, 294, 304–307, 315, 316, 318, 319, 322, 323, 327, 329, 333, 342–345, 348, 349, 355, 357, 358, 360, 362
Dynamic brain 21, 24, 60, 138, 175–178, 180, 181, 183, 186–188, 193, 194, 199, 200, 218, 264, 265, 271, 276, 280, 290, 309, 318, 319, 332, 338, 349, 350, 355, 356, 358
Dynamic transients 175, 195, 197, 268, 271, 285, 293
Empirical mind problem 1, 2, 5, 9, 23, 191, 198, 199, 338, 358
Events 1, 14, 20, 41, 63, 64, 68, 71, 75, 84–86, 98, 100, 105, 107–109, 111, 112, 115–118, 120–128, 130–143, 148, 149, 151–157, 160–162, 167, 169, 172, 173, 176–178, 182, 183, 186, 187, 190–199, 201–204, 206, 207, 209, 210, 217–220, 223, 225, 227–241, 244, 245, 247, 251, 252, 256, 257, 275, 277–280, 282–286, 292, 293, 300, 301, 320, 321, 333, 335, 338, 341, 342, 344, 347, 348, 355, 358, 359, 362
First-Brain Perspective 117–120, 124, 127, 138, 180, 183, 186, 189, 190, 197–199, 209, 215–221, 225–227, 260, 270, 271, 278, 284, 286, 301, 314, 318, 319, 321, 322, 327, 333–335, 338, 340, 341, 343, 345, 358–360
First-Person Neuroscience 24, 190, 197, 198, 209, 221–223, 225, 226, 250, 253, 267, 270, 271, 295, 308, 314, 318, 321, 338, 341, 343, 356, 358, 359, 361, 362
First-Person Perspective 1–3, 5, 9, 10, 12, 14, 15, 39, 44, 52, 72, 112–115, 117–120, 125–131, 135, 136, 141, 143, 145–149, 151, 167, 189, 190, 196, 197, 209–213, 215–222, 224, 226, 232, 240–243, 245, 246, 248–255, 259, 264, 267, 270, 271, 278, 284, 286, 295–297, 302, 309, 313, 314, 322, 323, 326, 327, 333–335, 338, 341, 344, 345, 348, 349, 355–360
Mental code 196, 197, 220, 271, 273
Mental states 1–6, 9, 10, 12, 14, 15, 39, 60, 86, 104, 105, 111, 113–121, 124, 127, 129, 130, 138, 139, 142, 143, 145–152, 165–170, 173, 186–191, 193, 194, 196–203, 206, 209, 217–227, 229, 232, 237, 238, 240, 241, 245, 249–252, 257, 258, 262–266, 268–271, 273, 278, 279, 281–289, 291–295, 297, 303–305, 314–316, 318, 320–324, 326, 327, 329–333, 335, 338, 340, 341, 343–345, 347–350, 355, 356, 358–360, 362
Neural code 11, 13, 22, 191, 194, 271, 273, 341
Sensori-motor integration 89, 110
Events 1, 14, 20, 41, 63, 64, 68, 71, 75, 84–86, 98, 100, 105, 107–109, 111, 112, 115–118, 120–128, 130–143, 148, 149, 151–157, 160–162, 167, 169,

172, 173, 176–178, 182, 183, 186, 187, 190–199, 201–204, 206, 207, 209, 210, 217–220, 223, 225, 227–241, 244, 245, 247, 251, 252, 256, 257, 275, 277–280, 282–286, 292, 293, 300, 301, 320, 321, 333, 335, 338, 341, 342, 344, 347, 348, 355, 358, 359, 362
Embedded events 231, 234, 235, 238
Isolated events 229, 231, 235, 237, 238
Experiments 49, 50, 60, 91, 92, 106, 107, 176, 177, 193, 196, 222, 317
Empirical experiments 49, 50
Logical experiments 49, 50
Explanatory gap argument 169
Epistemic continuity 170, 240
Epistemic gap 117, 169–171, 240
Explanatory gap 169, 171, 172, 174
Functional continuity 169
Functional gap 169, 171
Ontological continuity 170, 171
Ontological gap 170, 171

F
Facts 116, 148, 153, 167, 169, 232, 235, 252, 283
Factual certainty 167
False ontologization 147–152, 170–172
Falsification 25, 47–49, 193
Empirical falsification 25, 47, 48, 193
Logical falsification 47, 193
Transdisciplinary falsification 47–49, 193
Fast system 90–95, 178
Feedback loops 84, 85, 88, 90, 110, 118, 119, 154, 179, 188
Feedforward loops 155
Feelings 62, 63, 68, 70, 77, 79, 80, 104, 121, 123–133, 142, 152, 153, 156, 157, 160–164, 246, 254, 256
Autoepistemic limitation 24, 104, 105, 111–113, 115–121, 124, 127–131, 138, 142, 146, 147, 189, 190, 193, 196, 201–203, 206, 217–221, 237, 250, 258, 271, 278, 283–285, 294, 304–307, 315, 316, 318, 319, 322, 323, 327, 329, 333, 342–345, 348, 349, 355, 357, 358, 360, 362
Feelings and emotions 124, 125, 132, 142, 152, 153, 156, 164
Feelings and qualia 104, 121, 123, 128–130
First-Brain Perspective 117–120, 124, 127, 138, 180, 183, 186, 189, 190, 197–199, 209, 215–221, 225–227, 260, 270, 271, 278, 284, 286, 301, 314, 318, 319, 321, 322, 327, 333–335, 338, 340, 341, 343, 345, 358–360
Dynamic brain 21, 24, 60, 138, 175–178, 180, 181, 183, 186–188, 193, 194, 199, 200, 218, 264, 265, 271, 276, 280, 290, 309, 318, 319, 332, 338, 349, 350, 355, 356, 358
Dynamic states 5, 176, 183, 185–190, 193–195, 197–199, 201, 202, 211, 212, 215, 217, 220, 221, 223, 225–227, 244, 245, 265, 271, 273, 275, 276, 280, 284, 285, 288, 289, 293, 307, 314, 315, 320, 321, 333, 335, 338, 340, 342, 343, 345, 347–349, 355, 356, 358, 359, 362
Embedded epistemology 24, 168, 175, 207–209, 211–215,

225–228, 230, 234, 237, 238, 240, 250–252, 275, 286, 297, 307, 308, 316, 318, 341, 357, 361, 362
Event coding 21, 128, 169–171, 175–178, 180, 182, 191–194, 196, 198–201, 206, 218, 265, 268, 271, 277, 290, 291, 316, 327, 341, 342, 344, 348, 349, 355, 356, 358
First-Person Mentoscience 226, 270
First-Person Neuroscience 24, 190, 197, 198, 209, 221–223, 225, 226, 250, 253, 267, 270, 271, 295, 308, 314, 318, 321, 338, 341, 343, 356, 358, 359, 361, 362
Mental states 1–6, 9, 10, 12, 14, 15, 39, 60, 86, 104, 105, 111, 113–121, 124, 127, 129, 130, 138, 139, 142, 143, 145–152, 165–170, 173, 186–191, 193, 194, 196–203, 206, 209, 217–227, 229, 232, 237, 238, 240, 241, 245, 249–252, 257, 258, 262–266, 268–271, 273, 278, 279, 281–289, 291–295, 297, 303–305, 314–316, 318, 320–324, 326, 327, 329–333, 335, 338, 340, 341, 343–345, 347–350, 355, 356, 358–360, 362
Viewing the brain from within 189
First-Person Epistemology 10, 167, 208–211, 213, 215, 219, 252–254, 308
Embedded brain 21, 23–25, 175, 176, 199, 212, 215, 217, 218, 227, 228, 234, 251, 256, 260, 261, 264, 273–276, 279, 281, 282, 284, 295, 298, 303, 308, 309, 318, 319, 337–341, 347, 349, 350, 352–354, 356, 357, 361
Embedded epistemology 24, 168, 175, 207–209, 211–215, 225–228, 230, 234, 237, 238, 240, 250–252, 275, 286, 297, 307, 308, 316, 318, 341, 357, 361, 362
First-Person Perspective 1–3, 5, 9, 10, 12, 14, 15, 39, 44, 52, 72, 112–115, 117–120, 125–131, 135, 136, 141, 143, 145–149, 151, 167, 189, 190, 196, 197, 209–213, 215–222, 224, 226, 232, 240–243, 245, 246, 248–255, 259, 264, 267, 270, 271, 278, 284, 286, 295–297, 302, 309, 313, 314, 322, 323, 326, 327, 333–335, 338, 341, 344, 345, 348, 349, 355–360
Phenomenal experience 9, 66, 73, 77, 88, 95–97, 101, 114, 136, 146–148, 151, 152, 158, 159, 162, 167, 168, 173, 174, 178, 186, 196, 213, 219, 232, 234, 235, 241–247, 250–252, 255, 258, 270, 278, 282, 285, 309, 313, 314, 321, 322, 327
First-Person Neuroscience 24, 190, 197, 198, 209, 221–223, 225, 226, 250, 253, 267, 270, 271, 295, 308, 314, 318, 321, 338, 341, 343, 356, 358, 359, 361, 362
Autoepistemic limitation 24, 104, 105, 111–113, 115–121, 124, 127–131, 138, 142, 146, 147, 189, 190, 193, 196, 201–203, 206, 217–221, 237, 250, 258, 271, 278, 283–285, 294, 304–307, 315, 316, 318, 319, 322, 323, 327, 329, 333, 342–345, 348, 349, 355, 357, 358, 360, 362

Dynamic states 5, 176, 183, 185–190, 193–195, 197–199, 201, 202, 211, 212, 215, 217, 220, 221, 223, 225–227, 244, 245, 265, 271, 273, 275, 276, 280, 284, 285, 288, 289, 293, 307, 314, 315, 320, 321, 333, 335, 338, 340, 342, 343, 345, 347–349, 355, 356, 358, 359, 362

First-Brain Perspective 117–120, 124, 127, 138, 180, 183, 186, 189, 190, 197–199, 209, 215–221, 225–227, 260, 270, 271, 278, 284, 286, 301, 314, 318, 319, 321, 322, 327, 333–335, 338, 340, 341, 343, 345, 358–360

Mental states 1–6, 9, 10, 12, 14, 15, 39, 60, 86, 104, 105, 111, 113–121, 124, 127, 129, 130, 138, 139, 142, 143, 145–152, 165–170, 173, 186–191, 193, 194, 196–203, 206, 209, 217–227, 229, 232, 237, 238, 240, 241, 245, 249–252, 257, 258, 262–266, 268–271, 273, 278, 279, 281–289, 291–295, 297, 303–305, 314–316, 318, 320–324, 326, 327, 329–333, 335, 338, 340, 341, 343–345, 347–350, 355, 356, 358–360, 362

Neuronal states 1–3, 5, 9, 10, 12, 14, 15, 104, 111, 112, 117–121, 129, 143, 148–151, 170, 176, 186, 187, 190, 193–199, 205, 209, 215–217, 219, 221, 223, 224, 226, 227, 251, 252, 269–271, 275, 276, 285, 290, 291, 293, 304, 315, 320, 321, 338, 340–345, 347–349, 355, 356, 358, 360, 362

First-Person Perspective 1–3, 5, 9, 10, 12, 14, 15, 39, 44, 52, 72, 112–115, 117–120, 125–131, 135, 136, 141, 143, 145–149, 151, 167, 189, 190, 196, 197, 209–213, 215–222, 224, 226, 232, 240–243, 245, 246, 248–255, 259, 264, 267, 270, 271, 278, 284, 286, 295–297, 302, 309, 313, 314, 322, 323, 326, 327, 333–335, 338, 341, 344, 345, 348, 349, 355–360

- Autoepistemic limitation 24, 104, 105, 111–113, 115–121, 124, 127–131, 138, 142, 146, 147, 189, 190, 193, 196, 201–203, 206, 217–221, 237, 250, 258, 271, 278, 283–285, 294, 304–307, 315, 316, 318, 319, 322, 323, 327, 329, 333, 342–345, 348, 349, 355, 357, 358, 360, 362
- Events 1, 14, 20, 41, 63, 64, 68, 71, 75, 84–86, 98, 100, 105, 107–109, 111, 112, 115–118, 120–128, 130–143, 148, 149, 151–157, 160–162, 167, 169, 172, 173, 176–178, 182, 183, 186, 187, 190–199, 201–204, 206, 207, 209, 210, 217–220, 223, 225, 227–241, 244, 245, 247, 251, 252, 256, 257, 275, 277–280, 282–286, 292, 293, 300, 301, 320, 321, 333, 335, 338, 341, 342, 344, 347, 348, 355, 358, 359, 362
- First-Person Epistemology 10, 167, 208–211, 213, 215, 219, 252–254, 308
- From the inside 157, 162, 189, 242, 284, 311, 312
- I 2, 3, 5–10, 12–24, 26, 27, 29–31, 33–42, 44, 46–57, 60–124, 126–174, 176, 178, 179, 181, 183–192, 194–213,

215–227, 229–250, 252, 253, 255–261, 263–280, 282–298, 300–308, 310–320, 322–328, 330, 332–335, 338, 340–347, 349–352, 354–361
Mental analogue 146, 149, 152
Mental states 1–6, 9, 10, 12, 14, 15, 39, 60, 86, 104, 105, 111, 113–121, 124, 127, 129, 130, 138, 139, 142, 143, 145–152, 165–170, 173, 186–191, 193, 194, 196–203, 206, 209, 217–227, 229, 232, 237, 238, 240, 241, 245, 249–252, 257, 258, 262–266, 268–271, 273, 278, 279, 281–289, 291–295, 297, 303–305, 314–316, 318, 320–324, 326, 327, 329–333, 335, 338, 340, 341, 343–345, 347–350, 355, 356, 358–360, 362
Phenomenal experience 9, 66, 73, 77, 88, 95–97, 101, 114, 136, 146–148, 151, 152, 158, 159, 162, 167, 168, 173, 174, 178, 186, 196, 213, 219, 232, 234, 235, 241–247, 250–252, 255, 258, 270, 278, 282, 285, 309, 313, 314, 321, 322, 327
Qualia 104, 121, 123, 126–131, 134, 136–142, 156, 161, 204, 246, 247, 249, 250
What is it like argument 147–152, 159
What is the event like 148, 167
Fronto-parietal circuits 83, 84
Functional connectivity 78, 177, 179, 181, 182, 188

G

Goal-orientation 91, 93–97, 99–104, 108–111, 120, 121, 123, 128, 129, 137, 138, 142–144, 149–151, 153–156, 160–169, 171–174, 176–178, 180, 202, 204, 207, 245, 247, 248, 255, 258, 290, 291, 293, 334

H

Hypothesis of embedment 1, 8, 19–22, 316–320, 337, 354

I

I think therefore I am 147, 216, 255
Idealism 209, 213, 214, 228, 229, 233, 238, 249, 253
Identity 25, 26, 36, 37, 46, 48–50, 52, 158, 163, 166, 220, 262, 263, 271, 288, 332
Brain identity 262, 263
Personal identity 25, 26, 36, 37, 48–50, 158, 163, 262, 263
Imagery 91, 142–146, 149–153, 155, 163, 178–180, 182, 195
Information 4, 76, 83, 92, 100, 106, 134, 154, 164, 165, 170, 171, 191, 194, 198, 199, 201, 246, 263, 270, 272, 298, 310–313, 342
Embedded information 310–313
Informational ontology 4, 266, 267, 272, 310–313, 330
Isolated information 311–313
Intentionality 29, 104, 131, 134–142, 277
Aboutness 135, 136
Embedment 1, 8, 19–23, 25, 60, 61, 65, 66, 68, 72, 75, 82, 83, 88, 90, 97, 104, 105, 108, 118, 121, 127, 131, 135–138, 140–144, 152, 163, 175, 193, 200, 201, 206, 208, 211, 234, 235, 238, 255, 258, 273, 277, 279, 280, 288, 307, 313, 316–320, 325, 337, 341, 342, 354–356
Fungierende Intentionalitaet 135

Qualia 104, 121, 123, 126–131, 134, 136–142, 156, 161, 204, 246, 247, 249, 250
Inter-subjective communication 100–104, 167, 168, 173, 240, 251, 252, 254, 258
Internal and external states 185–188, 200, 202, 203
Intra-subjective communication 102, 103, 158, 167, 168, 245–247, 254
Introspection 116, 158, 161, 222, 224, 283
Intuition 145, 213, 235, 243, 244
Isolated brain 21, 25, 176, 212, 213, 215, 218, 219, 251, 252, 261, 262, 274–276, 284, 295, 303–305, 318, 338–340, 347, 349, 350, 352, 354, 356, 357, 361
Functional brain 17, 68, 75, 83, 90, 97, 105, 113, 114, 121, 152, 183, 186, 262, 265–267, 295
Fundamental essence 170, 272, 273, 298
Mental brain 52, 186, 187, 219, 262, 265–269, 273, 295, 310, 330, 356
Mental properties 3–5, 10–13, 15, 249, 270–274, 282, 285, 291, 292, 295–299, 303, 304, 308, 310, 313, 315, 326, 332, 340–343, 350, 357, 361
Physical properties 3, 5, 10–13, 15, 100, 106, 109, 142, 167, 171, 177, 187, 205, 232, 249, 262, 264–266, 270–274, 276, 281, 282, 293, 295–298, 300, 303, 307–312, 314, 315, 326, 330, 340–343, 349, 350, 354, 356, 360, 361
Protomental properties 272, 315
Stimulus coding 169, 171, 177, 178, 182, 191–193, 196, 198, 200, 206, 218, 265, 277, 341, 342, 344, 355, 358
Structural brain 262–265, 295
Isolated epistemology 175, 208, 209, 211, 213–215, 218, 219, 226–228, 238, 240, 251, 253, 275, 286, 357, 361, 362
Isolated ontology 175, 261, 274, 284, 285, 289, 295, 296, 299–307, 310, 312, 313, 315, 319, 328, 330–332, 335, 340, 346, 357, 361, 363
Epistemic monism 213, 225, 226, 240, 249, 275, 296, 297, 301, 302
Informational ontology 4, 266, 267, 272, 310–313, 330
Mental ontology 3, 4, 10, 13, 15, 39, 44, 52, 167, 261, 267, 272, 288, 289, 295–298, 302, 304, 305, 307, 308, 310, 311, 313–315, 330, 340, 346, 361
Mental properties 3–5, 10–13, 15, 249, 270–274, 282, 285, 291, 292, 295–299, 303, 304, 308, 310, 313, 315, 326, 332, 340–343, 350, 357, 361
Ontological mind-brain relationship problem 4, 6, 10, 249, 250, 298, 303–305, 314, 340, 354, 360, 361
Ontological properties 5, 11, 171, 232, 271, 274, 282, 285, 291, 293, 295–300, 303, 304, 306, 310, 313, 315, 330, 332, 341–343, 346, 349, 350, 354, 356, 357, 360, 361, 363
Physical ontology 3, 4, 10, 39, 44, 52, 167, 261, 263, 264, 266, 267, 288, 295–298, 302, 304, 307–313, 315, 330, 340, 360

Physical properties 3, 5, 10–13, 15, 100, 106, 109, 142, 167, 171, 177, 187, 205, 232, 249, 262, 264–266, 270–274, 276, 281, 282, 293, 295–298, 300, 303, 307–312, 314, 315, 326, 330, 340–343, 349, 350, 354, 356, 360, 361
Static ontology 296, 299
Isomorphism 105, 107, 108, 119, 121, 122, 131, 132, 140, 149, 298, 311, 312

J
Judgements 136
Analytic judgements 50, 51
A priori judgements 51
A posteriori judgements 51
Synthetic judgements 50, 51

K
Knowledge argument 159, 163

L
Language 33, 39, 76, 98, 100, 103, 104, 201, 202, 251, 254, 258–260
Language of thought 202, 259
Laws 9, 27, 188, 222, 244, 287, 288, 308, 309, 311–313, 338, 362
Biological laws 27, 338
Dynamic laws 188, 288, 309, 312, 313, 338, 362
Physical laws 9, 188, 287, 288, 309, 312, 313, 362
Logical conditions 15, 16, 23, 27–32, 34, 35, 37, 47, 49, 50, 53–57, 126, 207, 253, 260, 261, 328, 329, 351, 352, 364
Logical dilemma 13, 16, 352, 354
Lucidity 79–81, 157

M
Materialism 263, 266, 267, 288, 298, 307, 308
Meaning 47, 59, 71, 73, 91, 98, 100, 106, 116, 121, 134, 165, 168, 172, 173, 177, 188, 190, 196, 202, 205, 207, 223, 246, 251, 253, 255, 259, 278, 287, 289, 308, 309, 323
Mental causation 9, 104, 131, 134, 137, 139, 141, 142, 273, 282, 283, 287–289, 291–295, 308
Mental code 196, 197, 220, 271, 273
Mental presentation 176, 199–203
Mental representation 199–203, 265, 279
Mental states 1–6, 9, 10, 12, 14, 15, 39, 60, 86, 104, 105, 111, 113–121, 124, 127, 129, 130, 138, 139, 142, 143, 145–152, 165–170, 173, 186–191, 193, 194, 196–203, 206, 209, 217–227, 229, 232, 237, 238, 240, 241, 245, 249–252, 257, 258, 262–266, 268–271, 273, 278, 279, 281–289, 291–295, 297, 303–305, 314–316, 318, 320–324, 326, 327, 329–333, 335, 338, 340, 341, 343–345, 347–350, 355, 356, 358–360, 362
Autoepistemic limitation 24, 104, 105, 111–113, 115–121, 124, 127–131, 138, 142, 146, 147, 189, 190, 193, 196, 201–203, 206, 217–221, 237, 250, 258, 271, 278, 283–285, 294, 304–307, 315, 316, 318, 319, 322, 323, 327, 329, 333, 342–345, 348, 349, 355, 357, 358, 360, 362
Biological states 187
Dynamic configurations 212, 230, 232, 244, 289, 291, 292, 299–301, 303, 304, 308, 312, 314, 315, 332, 340–343, 349, 350, 354, 356, 357, 360, 363
Dynamic states 5, 176, 183, 185–190, 193–195, 197–199,

201, 202, 211, 212, 215, 217, 220, 221, 223, 225–227, 244, 245, 265, 271, 273, 275, 276, 280, 284, 285, 288, 289, 293, 307, 314, 315, 320, 321, 333, 335, 338, 340, 342, 343, 345, 347–349, 355, 356, 358, 359, 362
Dynamic transients 175, 195, 197, 268, 271, 285, 293
Embedded epistemology 24, 168, 175, 207–209, 211–215, 225–228, 230, 234, 237, 238, 240, 250–252, 275, 286, 297, 307, 308, 316, 318, 341, 357, 361, 362
Embedded ontology 24, 175, 213, 250, 260, 261, 264, 274, 282, 284, 289, 295, 298–316, 319, 328, 331, 332, 335, 340, 345, 346, 349, 350, 354, 357, 361, 363
Event coding 21, 128, 169–171, 175–178, 180, 182, 191–194, 196, 198–201, 206, 218, 265, 268, 271, 277, 290, 291, 316, 327, 341, 342, 344, 348, 349, 355, 356, 358
Mental causation 9, 104, 131, 134, 137, 139, 141, 142, 273, 282, 283, 287–289, 291–295, 308
Neuronal states 1–3, 5, 9, 10, 12, 14, 15, 104, 111, 112, 117–121, 129, 143, 148–151, 170, 176, 186, 187, 190, 193–199, 205, 209, 215–217, 219, 221, 223, 224, 226, 227, 251, 252, 269–271, 275, 276, 285, 290, 291, 293, 304, 315, 320, 321, 338, 340–345, 347–349, 355, 356, 358, 360, 362
Ontological properties 5, 11, 171, 232, 271, 274, 282, 285, 291, 293, 295–300, 303, 304, 306, 310, 313, 315, 330, 332, 341–343, 346, 349, 350, 354, 356, 357, 360, 361, 363
Ontological relation 6, 244, 273, 274, 282, 291, 298, 300, 303, 304, 308, 332, 333, 341–343, 345, 346, 349, 350, 354, 356, 357, 360
Physical states 3–5, 10, 12, 39, 116, 147, 148, 158, 159, 167–170, 173, 174, 187, 189, 193, 206, 212, 215, 227, 238, 240, 249, 251, 253, 276–278, 281, 286–289, 292–294, 340, 342, 343, 345, 355, 356, 362
Stimulus coding 169, 171, 177, 178, 182, 191–193, 196, 198, 200, 206, 218, 265, 277, 341, 342, 344, 355, 358
Methodological naturalism 41, 42
Mind 1–10, 12, 13, 15, 17, 22, 23, 25, 27, 29, 30, 40, 41, 53, 54, 56, 69, 86, 112, 115, 118, 121, 135, 146–148, 150, 156, 169, 170, 191, 198, 199, 207, 209–211, 213–216, 218–220, 222, 226, 227, 229, 235, 236, 248, 254, 256, 257, 260, 261, 269, 270, 276, 282–286, 292, 295–298, 303–305, 316–318, 325, 326, 330, 332, 337, 338, 340, 341, 343, 349, 350, 354, 357–362, 364
Mind problems 1, 4, 6–8, 22, 23, 25, 337, 354, 358, 359, 361
Empirical mind problem 1, 2, 5, 9, 23, 191, 198, 199, 338, 358
Epistemic mind problem 3, 5, 9, 23, 209, 219, 220, 338, 359, 360
Ontological mind-brain relationship problem 4, 6, 10, 249, 250, 298, 303–305, 314, 340, 354, 360, 361

Modulation 70, 109, 110, 118–123, 128, 131, 142, 144, 145, 152, 155, 177–179, 182, 184, 189, 207, 264, 268, 291–293
Bottom-up modulation 109, 110, 118–122, 131, 142, 179, 182
Horizontal modulation 110, 121
Top-down modulation 109, 121, 123, 128, 144, 145, 155
Vertical modulation 109, 110, 121
Monism 4, 44, 213, 225, 226, 240, 249, 266, 275, 288, 296–298, 301, 302, 330, 332
Mysterianism 314–316
Epistemic mysterianism 316
Ontological mysterianism 315, 316

N
Natural conditions 15, 16, 23, 27, 29–31, 33–35, 37, 49, 50, 53–56, 59, 126, 148, 207, 208, 260, 323, 327, 328, 333, 351, 352
Naturalism 41, 42, 65, 87, 288, 307–310, 313
Biological naturalism 309, 310, 313
Dynamic naturalism 288, 307, 309, 310, 313
Methodological naturalism 41, 42
Naive naturalism 307, 308
Premodern Naturalism 308, 309
Scientific naturalism 307
Neural code 11, 13, 22, 191, 194, 271, 273, 341
Neuroepistemology 24, 39, 40, 59, 208–210, 261
Neuronal states 1–3, 5, 9, 10, 12, 14, 15, 104, 111, 112, 117–121, 129, 143, 148–151, 170, 176, 186, 187, 190, 193–199, 205, 209, 215–217, 219, 221, 223, 224, 226, 227, 251, 252, 269–271, 275, 276, 285, 290, 291, 293, 304, 315, 320, 321, 338, 340–345, 347–349, 355, 356, 358, 360, 362
Neuroontology 40, 260–262, 273
Neurophilosophical hypothesis 20, 21, 31, 36, 37, 46–51, 54–57, 193, 318
Neurophilosophical method 1, 323, 327
Neurophilosophy 8, 23, 25–27, 30, 37, 38, 40, 41, 52, 53, 55, 56, 210, 221, 262, 318, 351, 352, 364
Empirical Neurophilosophy 25, 26
Neuroscience of philosophy 26
Phenomenal or Cognitive Neurophilosophy 25, 26
Philosophy of neurophilosophy 26, 27
Philosophy of neuroscience 26
Theoretical Neurophilosophy 25–27
Neuroscience of philosophy 26
Neuroscientific hypothesis 25–27, 30–37, 46, 47, 49–51, 55, 56
Neutral vantage point 44, 216, 272, 301

O
Observation execution/matching system 98, 99, 103, 259
Observation of action 97, 99–101, 103, 143
Ontological circularity 42–44, 52, 53
Ontological dilemma 13, 15, 349, 350
Ontological iterativity 46, 53
Ontological pluralism 41–45, 302, 303, 329
Ontological primacy 37, 38, 40, 43, 44, 46, 52

Ontological properties 5, 11, 171, 232, 271, 274, 282, 285, 291, 293, 295–300, 303, 304, 306, 310, 313, 315, 330, 332, 341–343, 346, 349, 350, 354, 356, 357, 360, 361, 363
Ontological relations 232, 274, 282, 291, 293, 297, 299, 310, 315, 363
Ontology 3–5, 7–10, 12, 13, 15, 22, 24, 25, 37–40, 44, 52, 147, 167, 175, 213, 250, 256, 260–264, 266, 267, 272, 274, 278, 282, 284, 285, 288, 289, 291, 295–316, 319, 328–333, 335, 337, 340, 343, 345, 346, 349, 350, 354, 356, 357, 360, 361, 363
  Embedded ontology 24, 175, 213, 250, 260, 261, 264, 274, 282, 284, 289, 295, 298–316, 319, 328, 331, 332, 335, 340, 345, 346, 349, 350, 354, 357, 361, 363
  Isolated ontology 175, 261, 274, 284, 285, 289, 295, 296, 299–307, 310, 312, 313, 315, 319, 328, 330–332, 335, 340, 346, 357, 361, 363
Ontology of the brain 12, 175, 260–262, 295, 316, 343
Orbitofrontal cortex 75–78, 80–82, 122, 123, 132, 139, 140, 142, 178, 179, 182
Order parameters 184, 187, 188, 312

P

Panpsychism 4, 10, 170, 298, 330
Paradigm shift 8, 25, 361–364
  Paradigm shift in epistemology 362, 363
  Paradigm shift in neuroscience 8, 361, 362
  Paradigm shift in ontology 363
  Paradigm shift in philosophy 364
Personal identity 25, 26, 36, 37, 48–50, 158, 163, 262, 263
Perspective 1–3, 5, 9, 10, 12, 14, 15, 25, 39, 44, 52, 59, 72, 112–115, 117–120, 124–131, 135, 136, 138, 141, 143, 145–152, 156–161, 163, 166, 167, 172–174, 180, 183, 186, 189, 190, 196–199, 208–213, 215–228, 232, 240–243, 245–255, 258–260, 264, 267, 270–272, 278, 284, 286, 289, 290, 295–297, 301, 302, 307, 309, 313, 314, 318–323, 326, 327, 333–335, 338, 340, 341, 343–345, 348, 349, 355–360, 362
Phantom limb 68, 69
Phenomenal certainty 79–82, 157, 161, 167
Phenomenal experience 9, 66, 73, 77, 88, 95–97, 101, 114, 136, 146–148, 151, 152, 158, 159, 162, 167, 168, 173, 174, 178, 186, 196, 213, 219, 232, 234, 235, 241–247, 250–252, 255, 258, 270, 278, 282, 285, 309, 313, 314, 321, 322, 327
Phenomenal judgement
  Introspection 116, 158, 161, 222, 224, 283
  Second-Person Perspective 152, 156–160, 163, 167, 222, 223, 228, 240–243, 245–249, 251, 253, 254, 320, 326
  Temporal heterogeneity 87, 88, 94–96, 100, 104
  Unity in time 86–89, 94, 95, 97, 100, 101
Phenomenal knowledge 160, 163
Phenomenal space 59–61, 63–68, 71–73, 75, 78–80, 82, 167
  Biomechanical markers 63–68, 71, 134, 192
  Emotional markers 79–82
  Intra-individual markers 71–75, 79, 81
  Intra-subjective character 61, 68, 71–75, 79, 80, 82

Non-structural homogeneity 64, 66, 67
Phenomenal-qualitative character 61, 75, 78, 80–82
Spatial homogeneity 63, 64, 67
Unity in space 64–67, 72, 73
Phenomenal time 59, 60, 82, 83, 85–90, 96, 100, 101, 157, 161, 167, 180, 225
Presence 86, 88, 89, 95, 100, 108, 117, 120, 157, 161, 193, 200, 213, 240, 274, 275, 323
Protention 86, 88, 89, 94, 96, 100, 157, 161
Retention 86, 88, 89, 94, 96, 100, 157, 161
Temporal homogeneity 85, 86, 88, 89, 94, 96, 100, 157
Phenomenal uncertainty 157, 161
Phenomenal-qualitative character 61, 75, 78, 80–82
Phenomenological reduction 236, 249
Phenomenology 135, 222, 241, 249
Philosophical theory 20, 21, 26, 30–37, 45–50, 193
Philosophy 1, 2, 4, 5, 7–9, 15, 16, 22, 23, 25–27, 34, 37, 38, 40–42, 44, 46, 49, 52–56, 59, 169, 175, 207, 208, 210, 231, 240, 260, 261, 297, 316–318, 320, 326, 337, 351, 352, 354, 361, 364
Philosophy of neurophilosophy 26, 27
Philosophy of neuroscience 26
Philosophy of the brain 4, 7, 8, 22, 23, 54, 175, 361, 364
Physical knowledge 160, 163
Physical space 64–68, 73, 74, 167
Diversity in space 66, 67, 73
Mechanical markers 63–67, 79, 100, 134, 192
Spatial heterogeneity 63, 66
Physical states 3–5, 10, 12, 39, 116, 147, 148, 158, 159, 167–170, 173, 174, 187, 189, 193, 206, 212, 215, 227, 238, 240, 249, 251, 253, 276–278, 281, 286–289, 292–294, 340, 342, 343, 345, 355, 356, 362
Physical time 83, 87–90, 100, 101, 104, 167
Diversity in time 86, 95, 100, 101, 104
Momentary time slices 86, 88, 89, 100
Temporal atomism 87–89, 100
Temporal heterogeneity 87, 88, 94–96, 100, 104
Physicalism 260, 287–289
Posttraumatic Stress Disorder 153
Pragmatic representation 90, 91, 93, 94
Pre-reflexive self-confidence 79, 82
Prefrontal cortex 76, 84, 90–92, 99, 108–110, 123, 128, 131, 132, 143, 151–155, 162, 163, 165, 166, 172, 178, 195, 223, 224
Prefronto-parietal circuits 88, 90, 121
Principle of asymmetry 27, 29, 46, 56, 177
Principle of bidirectionality 30, 31, 46, 56
Principle of transdisciplinary circularity 31, 36, 37, 46, 56
Principles of dynamic brain organisation 177, 181, 188, 264
Principles of dynamic brain organization
Principle of contradictory complementarity 177, 180
Principle of economy 177, 178, 264
Principle of event coding 176, 177
Principles of transdisciplinary methodology 26, 27, 46, 47, 56
Physical causality 138, 139, 141, 197, 227, 282, 289, 290, 300, 308, 314

Physical causation 137, 141, 287–289, 292–295
Property Dualism 298
Psychoanalysis 158, 241
Psychodynamics 153, 250

Q

Qualia 104, 121, 123, 126–131, 134, 136–142, 156, 161, 204, 246, 247, 249, 250
  Absent qualia 126–128
  Autoepistemic limitation 24, 104, 105, 111–113, 115–121, 124, 127–131, 138, 142, 146, 147, 189, 190, 193, 196, 201–203, 206, 217–221, 237, 250, 258, 271, 278, 283–285, 294, 304–307, 315, 316, 318, 319, 322, 323, 327, 329, 333, 342–345, 348, 349, 355, 357, 358, 360, 362
  Consciousness 16, 17, 26, 113, 124, 125, 152–154, 168, 178, 190, 201, 204, 206, 222, 223, 225, 240, 241, 245–251, 259, 260, 284, 311, 313, 314, 317
  Embedded qualia 127
  Embeddedness 19, 127, 129–131
  Embedment 1, 8, 19–23, 25, 60, 61, 65, 66, 68, 72, 75, 82, 83, 88, 90, 97, 104, 105, 108, 118, 121, 127, 131, 135–138, 140–144, 152, 163, 175, 193, 200, 201, 206, 208, 211, 234, 235, 238, 255, 258, 273, 277, 279, 280, 288, 307, 313, 316–320, 325, 337, 341, 342, 354–356
  Embodiment 19, 127, 129–131, 277–279, 325
  Emotions 13, 69, 75, 77–80, 82, 121–125, 131–133, 142, 152, 153, 156, 163–165, 223, 224, 246, 257
  Event coding 21, 128, 169–171, 175–178, 180, 182, 191–194, 196, 198–201, 206, 218, 265, 268, 271, 277, 290, 291, 316, 327, 341, 342, 344, 348, 349, 355, 356, 358
  Feelings 62, 63, 68, 70, 77, 79, 80, 104, 121, 123–133, 142, 152, 153, 156, 157, 160–164, 246, 254, 256
  First-Person Perspective 1–3, 5, 9, 10, 12, 14, 15, 39, 44, 52, 72, 112–115, 117–120, 125–131, 135, 136, 141, 143, 145–149, 151, 167, 189, 190, 196, 197, 209–213, 215–222, 224, 226, 232, 240–243, 245, 246, 248–255, 259, 264, 267, 270, 271, 278, 284, 286, 295–297, 302, 309, 313, 314, 322, 323, 326, 327, 333–335, 338, 341, 344, 345, 348, 349, 355–360
  Goal-orientation 91, 93–97, 99–104, 108–111, 120, 121, 123, 128, 129, 137, 138, 142–144, 149–151, 153–156, 160–169, 171–174, 176–178, 180, 202, 204, 207, 245, 247, 248, 255, 258, 290, 291, 293, 334
  Inverted qualia 127, 128, 130, 131
  Isolated qualia 127, 128
  Non-phenomenal qualia 161, 246, 247
  Second-Person Perspective 152, 156–160, 163, 167, 222, 223, 228, 240–243, 245–249, 251, 253, 254, 320, 326
  Unconsciousness 168, 178, 223, 245, 247–250, 314
Qualia and consciousness 246, 247
Qualia and emotions 123
Qualities 68, 111, 126, 254

Primary 62, 63, 83, 91, 92, 109–111, 121, 124, 126, 128, 129, 136, 144, 145, 149–152, 163, 166, 174, 184, 185, 248, 323
Secondary 62, 63, 83, 111, 122, 124, 126, 136, 216, 230, 231, 302, 323

R

Rationality 255, 256
Raw feeling 79–82
Realism 45, 209, 213, 215, 228, 233, 234, 237, 238, 253, 258
Reentrant circuits 188
Reentry 155, 156, 161–163, 166
Relation of minessness 158, 161
Representation 70, 83, 84, 90–94, 115, 124, 143, 166, 183–185, 199–204, 236, 265, 279, 280, 311
Embedded representation 199, 200, 265
Mental presentation 176, 199–203
Mental representation 199–203, 265, 279
Revolution 210
Copernican 210
Neural 11, 13, 22, 25, 26, 62, 63, 66–76, 78, 82, 84, 85, 90, 94, 96, 97, 101–104, 109–111, 122–124, 133, 142–144, 151, 155, 166, 177, 180, 181, 188, 190, 191, 193–195, 210, 221–225, 246, 248, 253, 260, 271, 273, 279, 290, 291, 307, 323, 341

S

Science of experience 222, 241
Second-Person Epistemology 159, 208, 223, 240, 245, 251–254
Embedded epistemology 24, 168, 175, 207–209, 211–215, 225–228, 230, 234, 237, 238, 240, 250–252, 275, 286, 297, 307, 308, 316, 318, 341, 357, 361, 362
Phenomenal judgment 83, 93–97, 99, 100, 101, 102, 103, 157, 158, 161, 162, 168, 240, 241, 243, 246, 325
Second-Person Perspective 152, 156–160, 163, 167, 222, 223, 228, 240–243, 245–249, 251, 253, 254, 320, 326
Switch between perspectives 244, 247
Second-Person Perspective 152, 156–160, 163, 167, 222, 223, 228, 240–243, 245–249, 251, 253, 254, 320, 326
From the outside 157, 158, 161, 162, 189, 190, 284, 311, 312
Knowledge argument 159, 163
Mental states 1–6, 9, 10, 12, 14, 15, 39, 60, 86, 104, 105, 111, 113–121, 124, 127, 129, 130, 138, 139, 142, 143, 145–152, 165–170, 173, 186–191, 193, 194, 196–203, 206, 209, 217–227, 229, 232, 237, 238, 240, 241, 245, 249–252, 257, 258, 262–266, 268–271, 273, 278, 279, 281–289, 291–295, 297, 303–305, 314–316, 318, 320–324, 326, 327, 329–333, 335, 338, 340, 341, 343–345, 347–350, 355, 356, 358–360, 362
Non-phenomenal qualia 161, 246, 247
Phenomenal uncertainty 157, 161
Physical states 3–5, 10, 12, 39, 116, 147, 148, 158, 159, 167–170, 173, 174, 187, 189, 193, 206, 212, 215, 227, 238, 240, 249, 251, 253, 276–278,

281, 286–289, 292–294, 340, 342, 343, 345, 355, 356, 362
Relation of minessness 158, 161
Second-Person Epistemology 159, 208, 223, 240, 245, 251–254
Semi-transparence 156, 161
Selective-adaptive coupling 19, 20, 71, 185, 233, 234, 256, 280, 281, 291, 299, 300, 344
Self-organization 138, 189, 190, 195, 285
Self-reference of the brain 21, 115, 215, 260, 261, 316, 317, 319–322, 328–330, 332, 333, 335, 340, 344–346, 354
Autoepistemic limitation 24, 104, 105, 111–113, 115–121, 124, 127–131, 138, 142, 146, 147, 189, 190, 193, 196, 201–203, 206, 217–221, 237, 250, 258, 271, 278, 283–285, 294, 304–307, 315, 316, 318, 319, 322, 323, 327, 329, 333, 342–345, 348, 349, 355, 357, 358, 360, 362
Direct and indirect 21, 251, 320–322, 329
Distinction between natural and logical conditions 50, 54, 126, 329
Empirical self-reference 319–321, 344
Epistemic conceivability 323–327
Epistemic self-reference 215, 319, 322, 329, 330, 340, 345, 353
Epistemic-ontological inferences 286, 329, 330
Neurophilosophical method 1, 323, 327
Ontological self-reference 319, 328–330, 332, 335, 346
Semantic representation 91, 93, 94
Sensori-motor integration 89, 110
Simulation 91, 143–146, 149–153, 155–157, 159–161, 163–165, 177, 178, 180, 181, 190, 202, 204, 207, 225, 245, 254, 324
Slow system 91–95, 97, 178
Social cognition 80, 142, 163, 165–167, 172–174
Somatic markers 77, 79, 80
Standard arguments 52
Argument of categorical fallacy 53, 54
Argument of general irrelevance 55
Argument of logical circularity 52, 53
Argument of principal validity 54
Argument of transitory relevance 56
State parameters 183–185, 187, 188, 190, 195, 244, 245, 285
State-orientation 121–123, 128, 129, 131–133, 152, 153, 155, 163–165, 204
Stimulus 106, 107, 112, 118, 128, 129, 133, 134, 139, 140, 165, 167, 169, 171, 172, 177, 178, 182, 191–193, 195, 196, 198, 200, 206, 218, 219, 265, 277, 341, 342, 344, 355, 358
Stimulus coding 169, 171, 177, 178, 182, 191–193, 196, 198, 200, 206, 218, 265, 277, 341, 342, 344, 355, 358
Substance 137, 209, 269, 270, 297–299
Substance dualism 298
Supervenience 4, 272, 289, 313
Synthesis 244

T

Theoretical Neurophilosophy 25–27

Third-Person Epistemology 10, 147, 159, 168, 207, 212, 213, 215, 240, 251–254
  Embedded epistemology 24, 168, 175, 207–209, 211–215, 225–228, 230, 234, 237, 238, 240, 250–252, 275, 286, 297, 307, 308, 316, 318, 341, 357, 361, 362
  Epistemic dependence 172, 174, 212, 213, 249, 251–253, 274, 275, 323, 362
  Physical judgement 83, 95, 97, 100, 101, 103, 136, 148, 158, 167, 232, 243, 245, 325
  Third-Person Perspective 1–3, 9, 10, 14, 39, 44, 113, 114, 125, 129, 135, 136, 146, 148, 163, 166, 167, 172, 174, 189, 190, 208, 209, 212, 213, 215, 217, 219, 221, 222, 224–226, 232, 240–243, 245, 249, 251–255, 259, 264, 267, 270, 271, 278, 286, 290, 295–297, 301, 302, 309, 320, 323, 326, 338, 340, 341, 343–345, 356, 359, 360, 362
  Thought and Language 100, 254, 258
Third-Person Perspective 1–3, 9, 10, 14, 39, 44, 113, 114, 125, 129, 135, 136, 146, 148, 163, 166, 167, 172, 174, 189, 190, 208, 209, 212, 213, 215, 217, 219, 221, 222, 224–226, 232, 240–243, 245, 249, 251–255, 259, 264, 267, 270, 271, 278, 286, 290, 295–297, 301, 302, 309, 320, 323, 326, 338, 340, 341, 343–345, 356, 359, 360, 362
  Explanatory gap argument 169
  Facts 116, 148, 153, 167, 169, 232, 235, 252, 283
  Factual certainty 167
  Physical space 64–68, 73, 74, 167
  Physical time 83, 87–90, 100, 101, 104, 167
  Third-Person Epistemology 10, 147, 159, 168, 207, 212, 213, 215, 240, 251–254
  What are the facts 167
Thought 40, 49, 50, 60, 66, 67, 73, 74, 80, 81, 88, 89, 92, 95, 96, 100–103, 118–120, 128–130, 135, 138–141, 149, 150, 161–164, 172, 173, 176, 177, 185, 196, 201, 202, 213, 222, 236, 251, 254–259, 280, 284, 317, 324
  Action 25, 76, 90–103, 107–112, 116, 117, 119, 120, 122, 131–135, 137–141, 143–145, 149, 151, 152, 163, 164, 173, 174, 181, 188, 190, 204–206, 244, 254, 255, 259, 260, 277, 284, 324
  Autoepistemic limitation 24, 104, 105, 111–113, 115–121, 124, 127–131, 138, 142, 146, 147, 189, 190, 193, 196, 201–203, 206, 217–221, 237, 250, 258, 271, 278, 283–285, 294, 304–307, 315, 316, 318, 319, 322, 323, 327, 329, 333, 342–345, 348, 349, 355, 357, 358, 360, 362
  Cold thoughts 257
  Emotions 13, 69, 75, 77–80, 82, 121–125, 131–133, 142, 152, 153, 156, 163–165, 223, 224, 246, 257
  Hot thoughts 257
  Language 33, 39, 76, 98, 100, 103, 104, 201, 202, 251, 254, 258–260
  Language of thought 202, 259
  Simulation 91, 143–146, 149–153, 155–157, 159–161,

163–165, 177, 178, 180, 181, 190, 202, 204, 207, 225, 245, 254, 324

Thought experiments 49, 50, 60, 176, 177, 196, 317

Thresholding 177–179, 182

Top-down modulation 109, 121, 123, 128, 144, 145, 155

Transcendental approach 210

Neurotranscendental 210

Transcendental ideality 65, 73, 87, 100, 101

U

Unconsciousness 168, 178, 223, 245, 247–250, 314

Understanding 8, 64, 98, 99, 134, 159, 184, 190, 205, 213, 235, 239, 243, 244, 290

Unifying theoretical principle 11, 22, 23, 25, 342

W

What is it like argument 147–152, 159

Working memory 76, 77, 124, 125, 154, 155, 160–163, 165, 178

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