



OXFORD

VICTORIAN GLASSWORLDS

GLASS CULTURE and
THE IMAGINATION 1830–1880

ISOBEL ARMSTRONG

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For A. S. Byatt

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Introduction

The Poetics of Transparency

We can surely talk about a 'culture of glass'. The new glass milieu will transform humanity utterly.
Walter Benjamin, quoting Paul Scheerbart¹

The nineteenth century was the era of public glass. One of the oldest artificial materials in the world suddenly became a modern material as an environment of mass transparency, never before experienced, came rapidly into being.² A huge increase in production, new methods of working, and falling prices, worked together to change the way cities looked.³ The gleam and lustre of glass surfaces, reflecting and refracting the world, created a new glass consciousness and a language of transparency. The glass fountain at the Crystal Palace epitomized this environment and drew out a poetics of glass. '[S]hining, as the sun's rays came slanting down through the crystal roofs, as if it had been carved out of icicles, or as if water streaming from the fountain had been made suddenly solid, and transfixed into beautiful forms' (Henry Mayhew); '[T]he beauty of this transparent shaft, with its streams of water falling like a veil around it, when the slanting sunlight from the roof touched it, and sent thousands of gleams and sparkles through it' (Harriet Martineau).⁴ The central spectacle of the Great Exhibition of 1851, Osler's 27-foot-high glass fountain, was cast as if from huge blocks of translucent masonry forming vitreous shells and crustacea. It created two kinds of interacting transparency, moving water, static glass. At the same time it sculpted water and made glass mobile. It was the emblem of a glassworld and the sign of a new glass culture.⁵

A dazzling semantics of glass evolved. This constellation of statements indicates its range: '[A]n inordinate love of plate glass . . . doors knocked into windows, a dozen squares of glass into one' (in shops and gin palaces); a five-ton 'looking-glass curtain' reflected 'every Form and Face in the gorgeous house' (public spectacle: the proscenium mirror at the Coburg theatre of the 1820s); 'Here were no mirrors, not even a scrap of glass to reflect the light and answer the same purpose as water in a landscape' (mirroring became an environmental need in the domestic environment);

Figure 1 Osler's glass fountain, Exhibition of 1851, as illustrated by the *Art Journal Illustrated Catalogue*

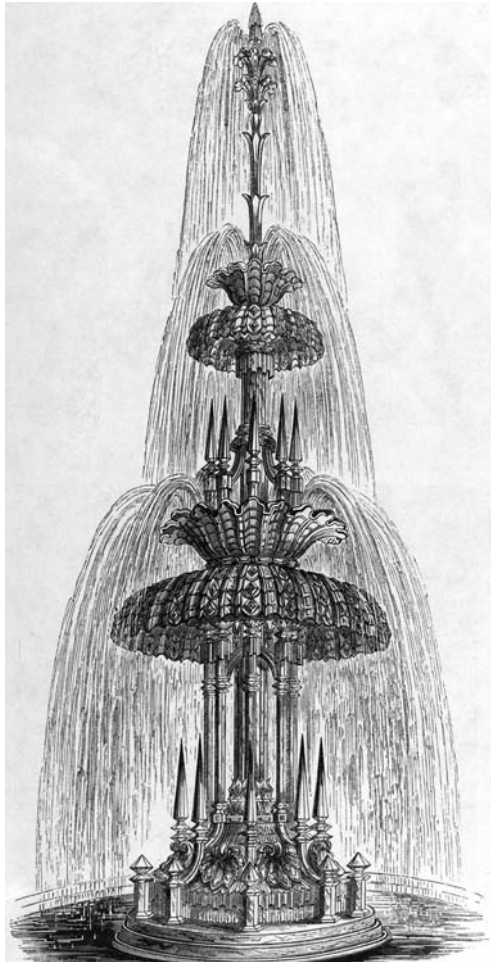
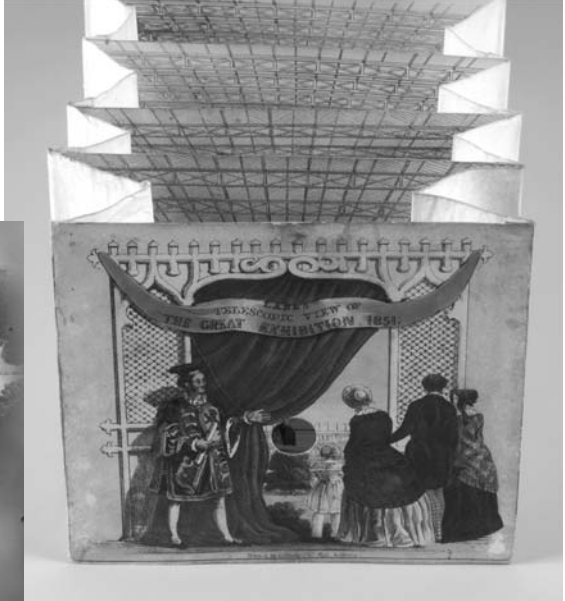


Figure 2 The glass fountain. 'The Transept of the Crystal Palace on the 1st of May', engraved by the *Illustrated London News*



Figure 3 Lane's telescopic view of the interior of the Great Exhibition, 1851. The glass fountain through the peephole



‘When coloured glass is cut, the brilliancy of the effect is heightened, and the soft floating character of the lights is broken up into a thousand scintillations’ (cut glass passed from luxury to necessity); ‘a shower of glass-drops hanging in silver chains from the centre, and shimmering with little soft tapers’ (chandelier lustres figured attainable opulence); ‘We now come to speak of sun-pictures on glass, the perfect transparency and evenness of which, renders it peculiarly fitted for photographic purposes’ (the photographic plate); ‘a ray of light passing from one transparent medium, such as air, to another which in this instance is glass, becomes refracted or bent in proportion to the relative density of the two mediae’ (a popular explanation of the lens, technology’s near relation of the prismatic lustre, which bent light and formed images to serve both the research needs of the telescope and microscope, and the ludic purposes of spectacle).⁶

A scopic culture developed from the possibilities of just three vitreous elements combined and recombined, the glass panel, the mirror, and the lens. These had been available for centuries but they now took different forms. This scopic period lasted for six decades or so, from the 1830s more or less to the end of the century, but its dominant period was between 1830 and 1880. Such a world, newly mediated by glass, was one of the projects of Victorian modernism, or, more exactly, a place where related and complex Victorian modernities played out their concerns. In the nineteenth century glass became a third or middle term: it interposed an almost invisible layer of matter between the seer and the seen—the sheen of a window, the silver glaze of the mirror, the convexity or concavity of the lens. The repercussions of this optical mediation and its ‘triadic’ nature are my theme. ‘The modern world is one of simulacra’: Deleuze, like many others, took this for granted in 1968.⁷ Yet the glassworld of nineteenth-century modernisms is not simply a naïve form of later optical culture and its virtuality. It is different. When speaking of a culture of glass Benjamin did not distinguish between what are actually two phases of glass culture, that of nineteenth-century modernity and twentieth-century modernism. To mark out this nineteenth-century glassworld I set out briefly seven theses about its elements. This book develops them, reading glass and its immanent and literal presence in artefacts, building types, and texts. Each thesis is prefaced with a collage of quotation. Some, but not all, reappear later in the book.

Breath and Sand: Theses 1 and 2

Thesis 1: Breath

A gallon of air is now blown into it [a glass vessel in the making] from the lungs of an assistant . . . (*The Leisure Hour*, 1853). Human labour power . . . crystals of the social substance . . . congealed labour time . . . the amount of

labour crystallised in that article . . . (Karl Marx). Such a contour, a curve . . . a petrified blossom bell . . . flexibility itself or motion . . . arrested. Inert glass moulded from within caught the semblance of such an alien grace (Christina Rossetti). You drink my blood . . . I blow glass from dawn till dusk . . . With my part of the sky [the air] I shape contours, as the breath of my lungs brings these bottles to life . . . their colour was made with my energy (Morris Maugre). Methinks we do as fretful children do, | Leaning their faces on the window pane | To sigh the glass dim with their own breath's stain . . . (Elizabeth Barrett Browning). I fell to breathing on the frost-flowers with which the window was fretted, and thus clearing a space in the glass through which I might look out on the grounds, where all was still and petrified under the influence of a hard frost (Charlotte Brontë).⁸

Most glass in the nineteenth century was blown by human breath. It was partly 'petrified' breath and partly frozen liquid, a breakable liquid. Four out of the six types of nineteenth-century glass depended on exhalations from the glassworker's lungs acting on molten glass from the furnace. The earliest mass production of glass in the industrial workplace of the factory came about through atavistic artisanal methods and not through mechanization. In the heavy glass industry—we will hear more about manufacturing processes in the following section—Crown glass, the production of large round 'tables' of glass, demanded this skill with breath. Likewise Cylinder glass was blown to a hollow cylinder of up to and beyond four feet, cut and flattened. The prefabricated panels of the Crystal Palace in 1851 were made up of 956,000 square feet of such breath-created glass. Bottle glass required moulds and breath, as the workman blew the molten glass into a mould. Flint glass (requiring lead for its special radiance), used in the manufacture of wineglasses, tableware, cut glass crystal, engraved and decorated glass, relied on the workman's lungs to produce the hollowed forms of flask and container. Plate glass, too heavy for most domestic windows, was manufactured by casting, poured and spread onto a flat iron surface, and did not require blowing. Pressed glass, regarded as a cheap surrogate for Flint glass, only required moulds. By the last quarter of the century machine-made rolled sheet glass was beginning to supersede blown techniques. But Pilkington's did not introduce machine-blown Cylinder glass, using compressed air, developed in America, until 1909.⁹ Its last glass blowers left the firm in 1926.

To look through glass in the mid-nineteenth century was most likely to look through and by means of the breath of an unknown artisan. The congealed residues of somebody else's breath remained in the window, decanter, and wineglass, traces of the workman's body in the common bottle, annealed in the substance he worked. Held up to the light a piece of common nineteenth-century window glass will display small blemishes, blisters, almost invisible striae, spectral undulations that are the mark of

bodily labour and a brief expectation of life. About ‘30% of glass makers in Stourbridge [the Flint glass centre] died before the age of forty, and about half before fifty’, the historian of Victorian Flint glassmakers, Tao Matsu-mura, observed.¹⁰ This knowledge was immanent in nineteenth-century consciousness and is inscribed in its works. The glassworker was rarely described agonistically, to be sure: on the contrary, he was often mythologized as a figure capable of heroic feats of labour. Yet glass was the spectre of his breath. So it insisted on both material and ontological meanings, a substance invoking matter and spirit, and the tension between them, ‘inert matter’ and the breath moulding it from within. Glass was literally a paradoxical ethereal *substance*.

What makes something ‘historical’, Heidegger asked. ‘What *were* these ‘Things’ which today they are no longer?’¹¹ Contemplating the posthumous life of a nineteenth-century glass artefact in the twenty-first century, a contemporary reader of its material presence might well ask this question. But a glass artefact always arrived with a history of labour and transformation embedded in its material prior to its existence as a finished product. And so it addressed its immediate users. This history was a kind of unconscious of the artefact. It waited for recognition, an extreme case of many commodities. The casual act of breathing on a window pane immanently awakened the dormant breath in the frozen substance of glass. In the glass industry a predominantly male workforce would be associated with this history. There were women in the factory, providing much of its support work (the cheap labour of women and children was increasingly used in nineteenth-century industry, historians have shown),¹² but the sempstress and millinery trades are analogous with glassworkers in the way products were fused with the physical lives of their makers: the story of a rich woman’s demands on two ‘wasted’ milliners by Douglas Jerrold tells how she went into society ‘with almost the last sigh of the girls in her fine dress’.¹³ What is metaphorical here was literal in the glass factory.

Thesis 2: Sand

Who, when he first saw the sand and ashes by a casual intensesness of heat melted into metalline form, rugged with excrescences and clouded with impurities, would have imagined that in this shapeless lump lay concealed so many conveniences (Samuel Johnson). What can be meaner in appearance than sand and ashes? . . . the furnace transforms this into that transparent crystal we call *glass*, than which nothing is more sparkling, more brilliant, more full of lustre. It throws about the rays of light as if it had life and motion (Anna Laetitia Barbauld). For how much mankind depend on this elegant material produced from seemingly the most useless of the *debris* of our globe . . . (John Claudius Loudon). [A] material which owes its value

entirely to the labour expended on its production, the sand, soda, and chalks being almost valueless of themselves (*Illustrated Exhibitor*, 1852) [At the crystal palace I] felt of no more account in the multitudes than as one grain of sand to the million millions of grains that shone crystallised above and around me (Douglas Jerrold).¹⁴

Sand, the ‘useless’ *debris* of our globe’ worn away from siliceous rocks and eroded into progressively finer grains in aeons of geological time, is the prime constituent of glass. Its transformation, pure transparent matter derived from waste matter, artificial matter derived from primary matter, confirmed the magic of a transition from nature to culture: it even appeared to reverse the process of mortality, moving from death to life, a form of resurrection seizing the imagination with aesthetic wonder. It was at the same time the limit case of modern manufacture, its nature as finished product as far distant from that of its ‘raw’ components as it was possible to be, and, since the gap between origin and product was a deficit entirely made up by the results of human labour, its virtuosic transition was a practical demonstration of the transformative power of work, the principles of manufacture, political economy, and civil society’s dependence on glass as a commodity. Nevertheless, glass’s transparency made the move between seemingly valueless matter and exchange value seem almost invisible, the transformation of that which is nothing into a substance that can be seen through. Converting what was not valuable into objects of value, it confounded by seeming to be more valuable than it actually was—‘every drop of cut glass’ deriving from sand seemed ‘worth a prince’s ransom’, Anna Barbauld’s catechism on glass production hyperbolically concluded. It followed that to provide a taxonomy of the useful and the luxurious became increasingly difficult.

Far from being ‘valueless’, sand was already an industrial commodity in the eighteenth and nineteenth centuries. Likewise the alkalis obtained from wood ash or burning seaweed. Pursuit of the finest white sand moved from Lynn in Norfolk to St-Gobain in France, and to the sandfields of Moll in Belgium.¹⁵ The classification of these materials as worthless was a fallacy. Indeed, the process of combining the components of glass was a highly sophisticated matter.

Glasses belong to a group of supercooled liquids which have passed into a rigid state without undergoing any noticeable structural change. Glass is a congealed solution of a number of substances, of which silica and alkali are invariables. The temperature at which fusion takes place is governed by the amount of alkali present, since this acts as a flux which promotes the melting of the remaining ingredients. Although all glasses have the common property of being amorphous and not crystalline, where lead is used as an additional flux a crystalline structure may develop. The principal source of

silica is sand although certain kinds of rock may be used. For the finest glass sand which is virtually free from iron is essential.¹⁶

Exact proportions of the constituents of glass were generally a firm's secret. The tensions here are between the 'debris' of matter and its value, the 'aesthetic' of crystal and economics.

Looking through, Looking on: Theses 3 and 4

Thesis 3: Looking through

Through optics Glass leads us to Him! The limits of refracted rays are not false (Mikhail V. Lomonosov). Vitriifiable earth . . . experiments that have convinced him that man, as well as animals, is glass and can return to glass (Jean Jacques Rousseau). In looking at objects of Nature while I am thinking, as at yonder moon dim-glimmering thro' the dewy window pane, I seem rather to be seeking . . . a symbolical language (Samuel Taylor Coleridge). . . . glass is the most brilliant, and yet the cheapest . . . To that which is ordinary, it lends grace; and to that which is graceful it gives a double lustre. Like a good advertisement, it multiplies your stock (Anthony Trollope).¹⁷

Glass's pellucid transitivity—you can see through it—represents at the same time the first gradation of opacity. It is both *medium and barrier*. Transparency, technology, and transcendence were not incompatible for Enlightenment thinkers. 'Glass leads us to Him!' The dewy window pane is no final obstacle to symbol. But glass creates an aura of glamour and duplicity—a 'double lustre'—in the two-way passage of vision. Gazing out, or gazing in, experience is invisibly shaped from both sides of the film of glass. The commercialized window offers public access to spectacle and display and a fantasmatic vicarious ownership of its contents. An answering withdrawal to individual ownership of the window space from the inside is the dominant rhythm of the century. Public gaze provokes a reciprocal movement to the ever-increasing privacy of the pane of glass through which the isolated figure at the window, an endemic image of nineteenth-century iconography, gazes from a hidden interior. The gazer from within claims ownership of the space not only in the room behind but also of the optical field of the street or park beyond the window. Thus the function of the panel as barrier and medium never works as smooth interchange but always points up mismatched relations. The hiatus of the window dramatizes the uneven relation of subject and object, from whatever side. Always the source of anxiety, it is *the* disputed space of the century. The lyrical moment of the gaze from a window discloses contrary states.

Thesis 4: Looking on

Thus was the first artificer in glass . . . enabling the student to contemplate nature, and the beauty to contemplate herself (Samuel Johnson). It's more like a corkscrew than a path! Well, *this* turn goes to the hill, I suppose—no, it doesn't! This goes straight back to the house! (Lewis Carroll). All my walls are lost in mirrors, whereupon I trace | Self to right hand, self to left hand, self in every place (Christina Rossetti). At the back of the barmaids rose bevel-edged mirrors, with glass shelves running along their front, on which stood precious liquids that Jude did not know the name of. The barmaid . . . was invisible to Jude's direct glance, though a reflection of her back in the glass behind her was occasionally caught by his eyes . . . when she turned her face for a moment to the glass . . . he was amazed . . . (Thomas Hardy). Beneath the windows of the bellied glass-urns of chemical wash . . . She might have seen his figure in the shop-mirror! (George Meredith). He 'sees his own physiognomy flash by': the eyes of passers by become 'veiled mirrors' (Walter Benjamin). He repeatedly smiled at my image and his own in a mirror [but at six months old] perfectly understood that it was an image; for if I made silently any odd grimace, he would suddenly turn round to look at me . . . [at seven months] being out of doors he saw me on the inside of a large plate-glass window, and seemed in doubt whether or not it was an image' (Charles Darwin). 'Don't *you* see that face?' . . . 'Who is the coward now? Wake up! That is the glass—the mirror, Mrs Linton; and you see yourself in it' (Emily Brontë). A movement of something ghostly . . . by chance the looking-glass had swung itself vertical, so that what he saw was his own shape. The recognition startled him. The person he appeared was too grievously far, chronologically, in advance of the person he felt himself to be (Thomas Hardy). I was sitting alone in my *wagon-lit* compartment . . . and an elderly gentleman in a dressing gown and a travelling cap came in . . . by mistake. Jumping up with the intention of putting him right, I at once realised to my dismay that the intruder was nothing but my own reflection in the looking-glass on the open door (Sigmund Freud).¹⁸

No one owns a reflection. In the glazed urban phantasmagoria reflections are random and arbitrary, mirages of the body in public space. They cannot be controlled as in a personal mirror. Mediated by reflections it is possible to see without being seen and to be seen without knowing that you are seen. The accidental reflection of one's body in public glass can betray or erotically entice. In the city both mirrors and window glass produce deceptive palimpsests of images: in glass, forward-moving figures come from the opposite direction of their originals; the helix reverses in the mirror, a phenomenon Lewis Carroll made axiomatic to *Through the Looking-Glass*. Glass *looks*. *Surfaces* become alive with images and traces of images, losing their trustworthy solidity. The observer is accompanied continuously by a secondary world of figment. On the one hand the physics of light endows the reflection with material being and empirical reality, but the laws of physics also make it evanescent. What then *is* a material in these conditions and what is an image?

Glass Spaces, Glass Images: Theses 5 and 6

Thesis 5: Glass Spaces

glass-covered ways, street-galleries of Harmony: noone knows 'whether it is rainy or windy, hot or cold' (Charles Fourier). The eye, accustomed to the solid heavy details of stone . . . wanders along those extensive and transparent aisles [of the Crystal Palace], almost distrusting its own conclusions on the reality of what it sees, for the whole looks like a splendid phantasm, which the heat of the noonday sun would dissolve (*The Times*, 1851). a church . . . too lucid to perceive (Elizabeth Barret Browning). . . space is the abstract multiplicity . . . of the points which are differentiable in it . . . Though it is differentiated by differentiable points which are space themselves, space remains, for its part, without any differences (Martin Heidegger).¹⁹

Glass and iron structures offer, sensationally, strength without mass. In ferrovitreous architecture light flooded interiors through glass roofs, annihilating the simple gradations of shadow, rinsing out shade. Spatial boundaries became indeterminate, as wall mass manifested itself as a simple translucent marker. The free-standing, boundary-less space or 'light-space' as the ideal of construction in translucent glass and iron, actually destroyed form by making it impossible to 'see' the glass building as an opaque entity. Whether seen from outside or inside, space becomes abstract, or, as one critic put it, 'without intermediaries'.²⁰ Glass construction produced simultaneously an ideal, bodiless space that could not be grasped, and an empty, abstract space that presented itself as there to be filled, seized, or possessed. This was Heidegger's critique of Hegelian space. It was also behind Ruskin's furious attack on the Crystal Palace's abandonment of 'lustreless matter', where glass erased the fact of its mediation.²¹

Thesis 6: Images

the strange distortion and discrepancies [of the lens] . . . all the passions of the heart breathing upon it in cross ripples (John Ruskin). [T] The office of the telescope being only to prepare them [the eyes] for forming on the retina a picture larger and clearer than would be formed without its help. [An imaginary picture, or what in optics is called an image, is, or may be conceived to be, formed in the air, but it is not visible as a thing to an eye situated out of the direction of the rays which go to form it.] (John Herschel). I cannot urge you too strongly to meditate on the science of optics . . . peculiar in that it attempts by means of instruments to produce that strange phenomenon known as *images*, unlike other sciences which carry out on nature a division, a dissection, an anatomical breakdown (Jacques Lacan).²²

The lens did two things. It bent and deflected light, creating anamorphosis and distortion by virtue of refraction: it formed an ‘ideal’ image, ‘in the air’, coming into being by means of matter but not coincident with it, which could be displaced from one surface to another. Astronomy showed that experience may *depend* on anamorphosis, that distortion is a structural element of perception. Sir John Herschel pointed out that a prerequisite of astronomy was to understand that the rays of light you received were bent so that the astral object appeared to the side of the place it occupied in reality, and the ‘actual’ rays of light from the object fell behind the viewing subject, who ‘actually’ experienced other rays of light. Such a displacement of the viewing subject is connected with the earth’s motion, so that the idea of a fixed point has to be given up. He insisted that the telescope did not create an image ‘*as a thing*’. ‘An imaginary picture, or what in optics is called an image, is, or may be conceived to be, formed in the air.’ It is ‘uninterrupted by any screen’. The refracting powers of the atmosphere, the lens writ large, could be a model for the ‘cross ripples’ of ideology, as Ruskin saw. Freud saw the immaterial microscope image as an analogy for ‘psychical reality’. But what is an ‘image’ when the *norms* of the lens were the action of bending light, ungroundedness, ideality and dissociation from matter?

Pleasures, Violence: Thesis 7

Thesis 7: The Jouissance of Violence and the Violence of Pleasure

none of the Belgravia window breakers have been caught, except one captured by Mr Whitehead . . . The mob seems to have dispersed. The streets are still full, but of well-dressed people seeing what was going on, and attracted by the broken plate glass windows (Sir George Grey to Palmerston, 1855). ink stands, paper weights, knives, pen trays, lamp pedestals, candelabra, candle sticks, salt cellars, knife-rests, mustard pots, sugar basins, butter coolers, smelling-bottles, flower-vases, door knobs, mouldings, panels, chandeliers, surgeons’ speculae, railway and other reflectors (*Illustrated Exhibitor*). MAGIC LANTERNS & MICROSCOPES. IMPORTANT IMPROVEMENTS. PRICES GREATLY REDUCED. Our celebrated Lantern for use of Schools, Band of Hope Meetings, &c., gives a brilliant 10-feet Disc, has 3-3/8 double condensers, Argand or Silver Light, Price only £1 1s.²³

The *Illustrated Exhibitor*, marketed to a popular readership, listed a large range of available glass articles and delighted in the democratization of glass, now, in the middle of the century, widely and cheaply available. The proliferation of glass-based culture extended to spectacle and the ludic devices of popular entertainment, as technologies of the magic lantern and lens-made toys grew more sophisticated. But there was another and more violent form of jouissance available, window-breaking. This was the

rioter's habitual protest. The sound, politically motivated, of breaking glass was familiar enough to provide an argument against the Crystal Palace: it would be stoned.

The Dialectic of Glass

Glass is an antithetical material. It holds contrary states within itself as barrier and medium. The riddles it proposes arise from the logic of its material and sensuous nature. 'My prison is transparent', Bentham said, claiming modernity for his panoptical glass prison.²⁴ But transparent consciousness, Hegel, his contemporary, said, equally claiming modernity, is suspect: of the closed consciousness of the 'beautiful soul' he wrote that it was incapable of creating a true 'antithesis' between itself and the world, with the result that 'it is just this object that is perfectly transparent, is its own *self*, and its consciousness is only this knowledge of itself'.²⁵ Transparency enables a perceiver to make a seemingly unbroken transit from subject to object. This facile transparency is what Ruskin, and later Dostoevsky, found absolutely maddening about the Crystal Palace.²⁶ Transparency is something that eliminates itself in the process of vision. It does away with obstruction by not declaring itself as a presence. But the paradox of this self-obliterating state is that we would not call it transparent but for the presence of physical matter, however invisible—its visible invisibility is what is important about transparency. It must be both barrier and medium.

Bentham rejoiced in the apparent immediacy of transparency as it created a peremptory transition from looker to looked at that facilitated power, he thought. Hegel, on the contrary, often used glass distrustfully to indicate the summary abolition of a middle term. He wrote respectfully yet critically of Spinoza's occupation as a lens grinder, because it stood for his reservations about the latter's understanding of the 'absolute identity' of finite and infinite. '[H]e gained a livelihood for himself by grinding optical glasses. It was no arbitrary choice that led him to occupy himself with light, for it represents in the material sphere the absolute identity which forms the foundation of the Oriental view of things.'²⁷ Transparency encourages a simple dualism, or, what is the opposite form of the same thing, the collapse of seer and seen into one another. Clearly aware of its history, Merleau-Ponty took up this structural metaphor of transparency: the 'classical' Cartesian (or perhaps pseudo-Cartesian or Benthamite) subject, appears to take an unproblematical transparency as the condition of perception. Thus it lives without friction or contradiction. It is a 'self-transparent thought, absolutely present to itself', 'perfectly transparent for

itself, like an essence' living over against the world.²⁸ It ignores a 'natal pact between our body and the world, between ourselves and our body'. A 'constituting subject which is transparent to itself' fails to see that thought, corporeality, and the world they are in are bound together as 'thought in act... which *feels* rather than *sees* itself' (p. 22). The transparent subject fails to see that the body is incorporated in the act of perception and that they mediate one another. He pointed out that, strangely, Descartes really thought of seeing as a kind of blindness. The Cartesian analogy for the way light rays move from an object to the eye is a blind man whose stick represents the dissociated geometrical lines of light from world to self.²⁹

In fact, Merleau-Ponty recognized that transparency is a much more active agent of knowing than Cartesian models suggest. It is a middle term interposed between the 'pure' relations of the self and world and prevents a disembodied self from standing over against experience. Why should this matter? One reason is that an unmediated transit between subject and object produces an abstraction and aestheticization of the pure experience, rinsed of the 'rugged' excrescences, to use Johnson's language, that we encounter in experience—Hegel's beautiful soul. More fundamental, an unproblematical transitivity neglects the third or middle term—the mediating pane of glass—by withholding the moment of difficulty, the resistant obstruction that requires recognition before the work of rethinking can occur. The workman's breath, the grit of sand, the 'double lustre' of glass, its secondary world of reflection, the boundarylessness of glass structures, the ideality of the image, the democratic pleasure principle and glass's invitation to violence, all call paradoxes and contradictions into play that have to be worked through. They are perceived at a purely formal or aesthetic level unless they generate a 'restlessness', which both reorders a problem and the mind that works on it. This mediation is, in Heidegger's words, 'the form of the very thinking which thinks itself'. It is 'the conceiving of *oneself*—as *the grasping* of the not-I', the resistant elements of the world that are in friction with consciousness.³⁰ The real function of a mediating transparency is as much to reflect as to be seen through. Consciousness, doubled as reflection, can achieve *reflective awareness*. This is a state that is both metaphor and pun and a literal condition. Conflict is immanent, for thinking can be its own obstacle as well as the world outside it. But thought cannot be free unless it enters into this mediation, becoming critically aware of itself, nor can the world it works on be changed. Choices—ethical, economic, social—cannot be fully known either. Hegel and Marx are at one on this, despite the opposite poles of their thinking.

Glass raises the problem of mediation by its very nature. Nineteenth-century modernity was confronted with it in the practice of everyday life—looking through a window, picking up a glass, posing for the

photographer's glass plate. Nineteenth-century glass culture does not accept the pure formal aesthetic transitivity we associate with later twentieth-century modernism, the traceless purity Benjamin assigned to glass culture. On the other hand, the burden of mediation could be agonistic. The move between absolute transparency and the barrier of glass, glass as pure transitivity and glass as barrier, the grit in the crystal, was played out in many ways, but this movement between transparent medium and barrier *is* one of the forms of nineteenth-century modernism. The vitreous world instantiated a *structure* of contradiction and also *represented* contradiction through iconography and image. Writers came up against this triadic mediation. 'With my brow to the glass': Edgar Allan Poe's 'The Man of the Crowd' (1840), peering through a coffee house's 'smoky panes', sees 'the wild effects of the light' imbricating the crowd and its reflections. '[A]s if some giant had hewn a great lump out of the earth and put it under a glass case, with all its inhabitants': when he meditated on Nathaniel Hawthorne's description of his novels Anthony Trollope left out the glass case, as if attempting to simplify triadic experience. For Henry James, Maisie's estranged spectatorship of her life when discussed by adults has an 'odd air of being present at her history in as separate a manner as if she could only get at experience by flattening her nose against a pane of glass'.³¹ The experience of contradiction was built into everyday life. And it was a new experience. In no other era is an invisible medium interposed between the seer and seen. When Lytton Strachey and the Bloomsbury group looked back on the age from which they had just, to their relief, escaped, and described its encumbered high seriousness, the labours of mediation are partly what they meant.³² Their aesthetic modernism disliked the cumbersome struggles of nineteenth-century modernism.

To speak of the glass culture of nineteenth-century modernity is to speak of a state or a condition rather than a set of beliefs or values. It is a condition, I argue, peculiar to this time. Marshall Berman was the first critic to use the term 'nineteenth-century modernism' (so far as I know) in his account of the experience of modernity as an inherently contradictory dialectic, using Marx's famous formulation from the Communist Manifesto, *All that is solid melts into Air*.³³ He associated the Crystal Palace with architectural modernism, however, and elided this with twentieth-century glass culture and its will to purism. Some teleological readings make our own twentieth-century and post twentieth-century modernism a sophisticated development going beyond the nineteenth century. Or else they credit 'our' modernism with a break from a more cumbersome Victorian world. Others cautiously posit continuities: Gary Day, for instance, in his introduction to a collection of essays on the varieties of Victorianism argues that Victorian values were transmuted into postmodern states; we

see the ‘concerns of our culture anticipated’ in the nineteenth century’s combination of grand narrative and relativism, and a laissez-faire individualism that looks to a postmodern concern with self-invention.³⁴ (Though in a postmodern way he forgets the grand narrative of socialism.) In the same volume Chris Hopkins, like many writers using the Crystal Palace as a crux of cultural modernism, sees Victorian modernism in terms of a new global mobility, and the collapse of boundaries, which elicited a fierce resistance to this destabilizing movement. For him, this is a constitutive conflict that led both to the erasing of history and to an obsessive concern with it.³⁵ Of course, all the components of twentieth-century mobility were in place in the nineteenth century—mechanized industrial production, technologies of transport via the railway, commodity, capital, colonial exploitation. Commentators correspondingly provide, to some extent with justice, an overarching narrative that spans two centuries: Robert Pippin’s *Modernism as a Philosophical Problem* is a distinguished example.³⁶ Benjamin himself believed that an ‘empty’ homogeneous glass culture evolved in the nineteenth century. He was fascinated by Scheerbarth’s new glassworld but never certain he wanted it. My strategy has been to postpone, hold up, or syncopate these continuities in the interests of allowing a glass culture peculiar to the nineteenth century to be disclosed. The glassworlds this book speaks of belong to the mid-nineteenth century, when a glass dialectic marked contradiction, a subject in difficulties, rather than a smooth transitivity. Transparency posited an oppositional world, not invisible mediation but marks on the surface, scratches, fingerprints. Minuscule impurities and bubbles of air, internal impediments to vision, signified and *created* internal contradictions.

Reading Glass

Reading a culture’s physical world, particularly architecture, has a long tradition, from Ruskin to Walter Benjamin and before. Glass inscribed its language on the environment in the nineteenth century, and this book reads glass over the brief but intense scopic period between 1830 and 1880 before new methods of production altered its nature. Because the Great Exhibition was both cause and effect of an extraordinary self-consciousness about glass, the 1850s are an inevitable focus, but this book belongs only partially to Crystal Palace studies. I attend to the language *of* glass in the physical world and texts, rather than finding a language *for* it. Glass used as metaphor or trope, though important to the iconographies of materials and texts, takes a secondary place to an exploration of a syntax that

discloses the way cultural meanings of glass in both technology and texts were structured.

Construction plays the role of the subconscious, Benjamin said, quoting Sigfried Giedion, at the start of his *Arcades* project, meaning that it discloses both overt and hidden meanings.³⁷ Glass structures and artefacts have a subtext. Currently ways of making material culture legible, particularly through a reading of things, are being explored. (I take up theories of the ‘thing’ in a later chapter.) Uppermost in these readings are socio-political and economic meanings. However, though I want to honour these meanings, it is equally important to push analysis beyond the category of the economic. One way of doing this is to pursue the kind of semiological analysis derived from architectural theory. Chris Brooks, working with the theory of Charles Jencks, succinctly described the way materials could be seen as overt texts, with a readable syntax and semantics.³⁸ Intrinsic, synchronic readings are concerned with the structural and functional aspect of the object—its materials, its fitness for its purpose. Extrinsic reading is diachronic: it establishes the boundaries of the cultural universe of discourse in which the artefact exists, theoretical and aesthetic debates, political controversy, class, gender, economic values. Style becomes readable as a language, and the material object endowed with a legible semantics and vocabulary. Architecture’s semantic transactions—and those of all material objects—take place within the boundaries of the universe of discourse established by both intrinsic and extrinsic reading. In the same way, we can read glass’s language intrinsically and extrinsically. But a building’s meaning, and likewise the meaning of a glass artefact, also depends on the way it ‘physically determines our lifespaces’ and thus psychically orders our lifespaces.³⁹ It functions expressively. A buttress is both a symbol of and *is* force. A glass container beckons to the primal experience of holding at the same time as literally containing fluids and materials.

Another way of moving from the exclusively economic is to see how Benjamin’s ‘subconscious’ of construction adds something to this expressive model. If material objects have a subtext in the cultural imaginary, their meanings will not be free of affective life or ever rinsed clear of desire. Walter Benjamin recognized that all objects have a public and an oneiric life. And importantly the dream for him is both longing and critique. The public language of artefacts is also the site of the syntax of the dreamwork of the artefact, sometimes working with, sometimes against the schemata of public discourse. Attention to the dreamwork’s syntax, to symbol, condensation, displacement, inversion, ought to clarify its language. A dream cannot think, but its juxtapositions can point to connections. The transparent surface, the glass fountain or the chandelier, might speak an

interpretable language in which, as Benjamin recognized: ‘all the forces and interests of history enter on a reduced scale’ as the dreaming collective speaks.⁴⁰ (‘The same memory runs out of every fountain’, Bachelard said, writing of the way water intimates culturally shared depths and secrets emerging from matter.)⁴¹

The four-ton glass fountain ‘speaks’, declaring the sheer power of technology in alliance with natural energy: it asserts the union of technology and beauty, a utopian irrigated world for democracy. More broodingly its dreamwork reconciles ‘dead’ sand and ‘living’ shell, raw materials of manufacture and the creative imagination. But it also posits the utter contradiction of glass and water, and above all, the fragility of glass. A hidden flaw causes the crystal vessel to shatter in Henry James’s *The Golden Bowl* (1904). The violent smashing of a miniature glass ship forms the crisis of one of Charlotte Brontë’s earliest stories (‘The Silver Cup’ 1829). As a child G. K. Chesterton shuddered ‘when the heavens were compared to the terrible crystal’, afraid that ‘God would drop the cosmos with a crash’.⁴²

In this book I explore glass culture and nineteenth-century modernisms in a number of contexts. Seeing a period through glass means that a writer sees through to numerous histories, histories that can carry her far away from the first glass moment—into the histories of revolutions, gardens, astronomy, for example. But the notion of a glass culture that both generates and circumscribes these histories is the dominant theme of the book.

There are three sections. The first is a series of case studies in the making and breaking of glass, production and conflict, using the periodical genre of the glass factory visit, accounts of the Chance factory from the Chance archive, the first firm to manufacture blown Cylinder glass (thus reviving a lost art), the glassmakers’ trade union journal, and the tensions of the 1860s around the Commission on Trades Unions as glassworkers and industrialists put their cases. Both glass factory owners and workers speak in the texts of the first section, as do the non-verbal acts of glass breakers in one of the most frequent forms of protest in the period. The second section is built round the glassworlds of the panel, the conservatory and the window, and the exhibition. The third moves from fabric to images, and brings the lens of high science together with the optical toys that derived from the same technologies. The screen practice of optical devices extends to the moment of cinema, the time when the scopic culture of mid-century ends. I read many kinds of document and object as *texts* to elicit the languages of glass. Throughout, Victorian glassworlds provide a material and conceptual site for nineteenth-century modernisms to play out their concerns. Victorian glassworlds produced a many-faceted poetics of glass. This book is a response to it.



PART I

FACETS OF GLASS CULTURE

Making and Breaking Glass



Figure 4 A glass blower in 'a world of its own, a place of roaring fires and monstrous shadows', drawing by Mervyn Peak of glass blowing at Chance, still using human breath in the 1940s, *The Glassblowers* series, no. 24

Factory Tourism

Morphology of the ‘Visit to a Glass Factory’



The ‘visit’ genre, a sub-set of which is ‘A day at a factory’, was well established, with narrative conventions of its own, by the time glass attracted attention from documentary journalism.¹ Glass factory visits pre-date the Exhibition of 1851, but this of course precipitated visits. Visits to factories were staged as journeys of sociological discovery, spectacle, courses of instruction in new technologies, and anatomies of work. Such visits constructed work and the factory for the culture. They drew upon both empirical and aesthetic registers to do so. Factory tourism was an art of describing, one of the earliest journalistic attempts at an ethnography of work. It was passional and fact-loaded. Its strange mixture of positivist information and affect, empirical data coexisting with a poesis of glass, is an attempt both to document and mythologize. Statistics combine with iconographical language that derives from the Arabian Nights, Dante, and the biblical fiery furnace.

A narrative of progress has to be reconciled with a narrative of suffering. Glamour and squalor, bodily pain and a celebration of the abstract powers of industrial invention, physical oppression and technological advance, have to be accommodated in the same discourse. The narratives of factory tourism struggle to formulate a language that recognizes suffering at the same time as it displaces an appalled response to physical endurance and tries to put it elsewhere. The body in pain and beauty (‘exquisite beauty’, as Harriet Martineau described the incandescent furnace), translucency and the darkness of the factory, purity and dirt, these were the contraries that coexisted in factory narratives. Factory research, while it documented modern glass culture, became in the process a document of glass culture itself. It mediated industrial glassmaking and described it *as* mediation. It circulated a supreme myth of the every day, glassmaking as transformation. At the same time it could not avoid darker meanings. In particular, the

‘crisis’ at the furnace, a technical term, Apsley Pellatt explained, for the moment when the molten glass or ‘metal’ reached the optimum heat for successful fusion and subsequent working, was seen by factory tourists as a climactic peak of endurance for the workers. The crisis spreads outwards to the observer. Workers themselves describe the heat of the furnace as the ultimate test of glassmaking.²

Five mid-century accounts of glass factory visits show how knowledge of glassmaking was disseminated and how this knowledge was structured and mediated: they are also a poetics of glasswork: George Dodd, ‘A Day at a Flint-Glass Factory’ (*Penny Magazine*, 1841); Charles Dickens with W. H. Wills, ‘Plate Glass’ (*Household Words*, 1851); ‘A Visit to Apsley Pellatt’s Flint Glass Works’ (*Illustrated Exhibitor and Magazine of Art*, 1852); Harriet Martineau, ‘Birmingham Glass Works’ (*Household Words*, 1852); ‘Glass Works of Messrs. Chance at Spon-Lane’ (*Leisure Hour*, 1853).³ These visits were directed to a range of readerships, from educated artisans (a category difficult to define in practice) and working-class to middle-class readers, and are as revealing of the glass industry to modern readers, serving as an introduction to it, as they were to their original audiences. They are ways of imagining glass and its production. They frequently use the same material (Pliny’s account of the origin of glass, Johnson’s description of the properties of glass, for example), and borrow from one another with unselfconscious plagiarism.⁴ Though they were often authored by—sometimes radical—middle-class writers encountering glass production, perhaps for the first time, at close quarters, their authors included George Dodd, a professional factory tourist writing across the spectrum of industry. Two of these pieces, the *Exhibitor* and the *Penny Magazine*, describe a visit to Apsley Pellatt.⁵ Harriet Martineau and the *Leisure Hour* describe visits to the Chance factory in Smethwick, near Birmingham, first manufacturer of Cylinder glass and the subject of the next section of this book. Through their empirical surface they address and create the cultural imaginary of work in general and glassmaking in particular. Their narratives represent a moment of scholarship and poetics in glass research before a more anecdotal journalism took over, and before the magic lantern appropriated the instructional element of glass visits.⁶

The visit genre rarely directly addresses the questions that currently interest historians, whether these are empirical or theoretical enquiries.⁷ Factory size (the relation of the large factory to the small enterprise), the vertical hierarchical organization of the factory or otherwise, and power structures within it, the division of labour and its relation to machinery, the place of the artisan in an ‘aristocracy’ of skilled labour, and the definition of skilled and unskilled, the existence of a ‘deference’ culture

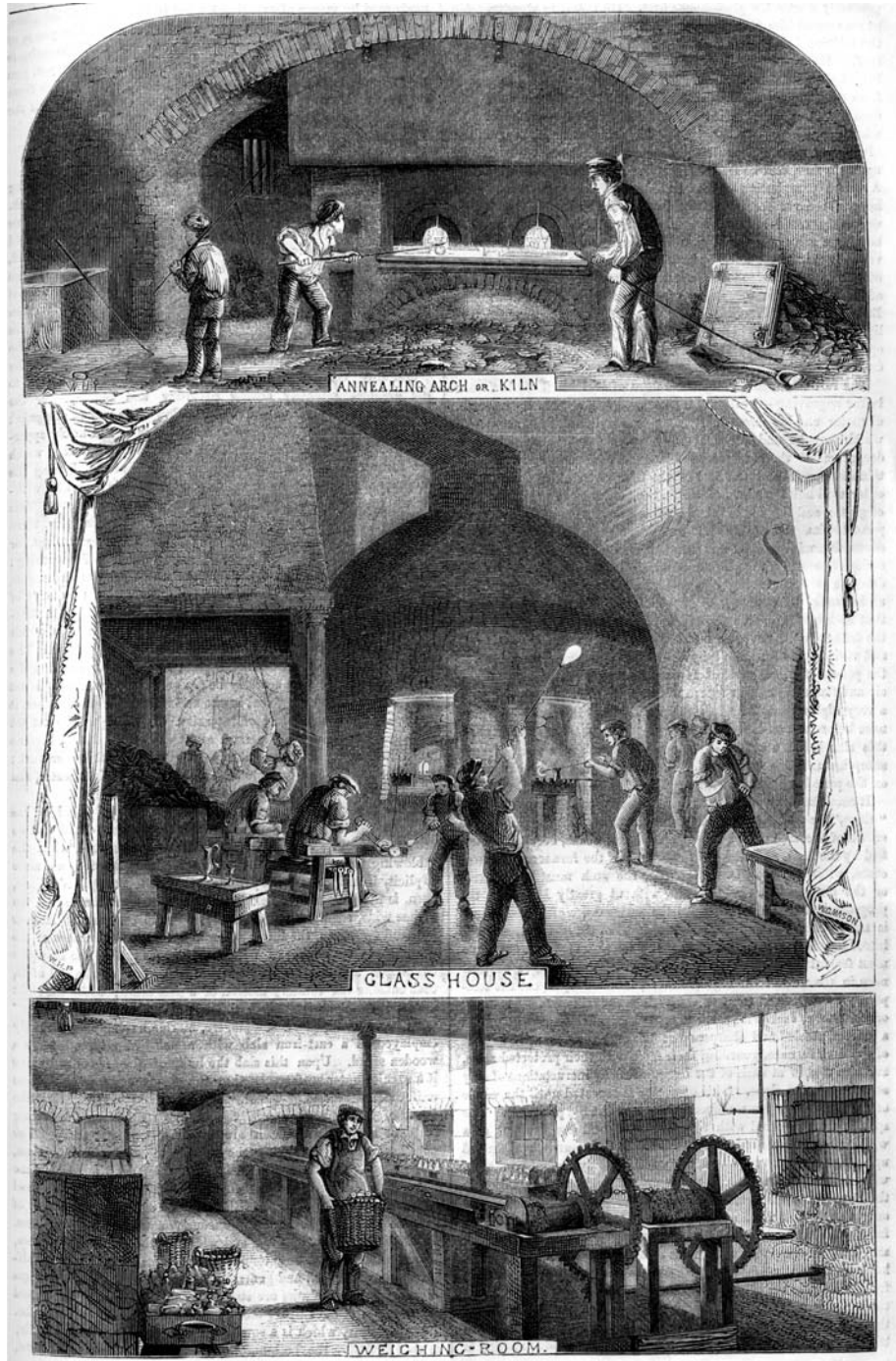


Figure 5 Glassmaking, Apsley Pellatt's Glass Works, Blackfriars, engraved for artisanal readers by the *Illustrated Exhibitor and Magazine of Art*

that created consensus rather than conflict, factory legislation, the politics and economics of wage structures, trade unionism, strikes, these questions do not have a place in factory narratives. There is little to affirm or deconstruct contemporary twentieth- and twenty-first century positions on these issues.⁸ Visit narratives, respectful of industrial work as they are and appearing to presuppose a docile workforce, could be mistaken for manifestations of deference culture. But their prodigiously fact-loaded (and usually accurate) accounts of glass production, rather than being seen as the didacticism of a disciplinary culture, or as misrecognitions founded on bourgeois ideology, need to be respected as attempts to explain and interrogate the glassmaker's place in industrial labour and industrial labour itself. If we think of these narratives as myths of glasswork, and of myth as a request for knowledge, then the questions that can and cannot be asked are equally important.

These implicitly asked and unasked questions can be charted through the poetics of the visit narrative. There is a distinct morphology to the visit story. The glass factory visit included a number of sequences, not invariably present or always in the same order and sometimes conflated, but constituting eight recognizable narrative phases. These eight phases were: induction, the entry into unfamiliar industrial territory by the stranger narrator; the journey through factory space and the unfolding discovery of technological process; a short history of glass (three reports quote Johnson on glass) and its modern-day constituents; the journey into darkness and the central drama or crisis of the furnace heat—this was the climax of the narrative, and figured as a passion, as I have observed—the infernal choreography of workers round the furnace; the magical skill of the glassworker; the emergence of a final glass artefact as commodity; the movement of safe return to familiar territory. All these narratives share strategies for deferring the moment of confrontation with the furnace. Syncopations, displacements, and hesitancy occur. The figuring of an agony at the mouth of the furnace, the central moment of the glass factory tour, becomes a dialectical image in which the most heroic and terrible meanings of glasswork and of those who undertake it open out together. The subtext is anxiety rather than critique. These attempts to understand labour are no less significant because they are presented as cultural reportage, an aesthetic of information for the industrial tourist. They preface my account of glassmaking by the great Chance enterprise.

I will begin with the central moment of the furnace, the axis on which the narratives turn, and then show how the glass visit's morphological phases lead up to and away from the crisis. It is important to see that all the stages of the visit are predicated on the narrator as stranger. The glass visitor is an outsider. The first phase of the visit acts as a journey into the

unknown, which is a context for the whole visit. The place of production is outside the normal social space: it is elsewhere, a nowhere, a sequestered, decaying industrial wasteland. Glass and dirt, glass and waste, belong together. The detached observer is prepared for defamiliarization as if entering a strange land. 'It is not the cleanest neighbourhood in the world... we must not travel in shiny boots and white kid gloves', the Apsley Pellatt visitor comments (p. 55). 'Tracking our guide through dock gates, over narrow drawbridges, along quays; now, dodging the rigging of ships... now, falling foul of warping posts... that desolate region of mud and water... dirty lanes... roofless houses' (p. 434). Dickens and Wills, in the persona of business men, are led by the owner of the Thames Plate Glass Company to the factory frontier, the 'tall gates' of the factory boundary (or barrier). Harriet Martineau enters the industrial terrain through the mediation of a modern window unknown to previous eras, almost as if she is walking *through* the window into the industrial space. She asks the reader to imagine the 'fire caverns, the dim vaults, the scorching air, the rush, the roar, glare, and appalling handicraft from amidst which that light and graceful creation came forth to lie down on the grass of Hyde Park'. The rainy terrain on arrival is 'inches deep in black mud and puddles' (p. 33). The *Penny Magazine* has no such induction (it begins with a taxonomy of manufactured glass), but the *Leisure Hour*, whose author has been on a 'flying visit' (p. 9) to Birmingham, 'capital' of the midlands, prefaces his series of factory visits, after a calmly factual history of the city, with a landscape of ecological disaster covering over four columns of print. The two accounts, empirical and ecological, are strangely incompatible: conventional local history precedes 'chimneys vomiting clouds of black smoke... a dismal canopy... a sulphurous curtain... The soil beneath our feet is ink black; the air we breathe is hot and stifling, as though every inspiration we draw had first gone through the process of singeing for our particular benefit... The whole surface of the land... has been turned upside down... the deep channel of mire through which we flounder on... vitrified scoria, the faecula of unnumbered furnaces... stagnant pools of dark brown water... wretched huts' (p. 25).

Unsaid questions open out here: with the exception of Martineau, these conditions are described unjudgementally: this is how it is. 'We are in the Iron Country' (*Leisure Hour*, p. 25). But is industrial terrain cordoned off, a periphery isolated from centre? How possible is it to isolate and quarantine its dirt and mire? Work by a 'foul creek' of the Thames (Dickens and Wills) produces a striking paradox, 'the beautiful substance that makes our modern rooms so glittering and bright; our streets so dazzling, and our windows at once so radiant and so strong' (p. 434). The 'light and graceful' Crystal Palace originated in Martineau's 'fire caverns'. How are we to think of the

gap between origin and product? How far is the observer, under the guise of disinterested reporter, responsible to and for this environment? How far is reportage, presented simply as information, ethically deployed? (As if in recognition of the problem Dickens and Wills triangulate their narration so that responsibility for observations is shared between three men.)

The Crisis of the Furnace: On not Being Able to Breathe

These unsaid questions are the subtext of the fourth phase of the factory visit, the furnace. A white-hot furnace-cave in darkness, and the passion of heat, call out frankly affective language. All the resources of allusion and iconography, from the Bible, from Dante and Milton, from melodrama and ritual, are summoned to do justice to the terrible energies of fire, and conjure an underworld where elemental fires burn eternally in the shades. 'Once lit, the furnace-fire of a glass house is never extinguished' (*Exhibitor*, p. 58). This is an industrial mythos, the climax of the worker's heroic endurance and a crisis of physical and mental experience for worker and onlooker alike. The entry into the furnace arena is one of intense perceptual extremes and disruption of the sensoria: 'the eye of an artist might be directed' to the 'dimly lighted' 50 or 60 feet square furnace room, 'for some striking effects of light and shade' (*Penny Magazine*, p. 83); 'a fearful row of roaring furnaces, white hot' (Dickens and Wills, p. 435); 'He is lost in wonder . . . He cannot reconcile the dimness of the place with the bright glow . . .' (*Exhibitor*, p. 58); 'These are the great pots, transparent with heat' (Martineau, p. 34). The central 'glass-house' of the factory is in fact the darkest place.

As usual, the *Penny Magazine* reports on the furnace with its customary accuracy, but even its understatements convey the power of 'heat-endurance':

The withdrawal of an old pot [of molten glass] and replacing it with a new one is called 'setting a pot,' and constitutes the most arduous and indeed fearful operation of the glass-house, and the one to which the men are wont to refer as proof of their power of heat-endurance. It frequently happens that the old pot breaks, and the pieces, becoming partially vitrified, adhere to the bottom of the furnace: in such case the men stand in front of the fiercely heated openings, and dig up and remove the broken fragments of pot by means of crow-bars and other instruments. While the removal of the old pot is in progress, the new one is kept at a white heat in the 'pot-arch,' a pot-furnace within a few yards of the melting-furnace; and when the transference is to take place, the door of the arch is opened, a low iron carriage is wheeled in and tilted so as to lift up and draw out the pot, and the latter, at a glowing white heat, is wheeled to the furnace, and there deposited in its proper place.

When the adjustment is properly made, the opening is immediately bricked up. The temperature to which the men are exposed in this operation (which sometimes takes several hours) may be imperfectly imagined when we remember that the other pots in the furnace may at that time be at a perfectly white heat.' (p. 84)

They who assist [setting the pot] are exposed for a considerable time to the whole force of the furnace heat, and it is frightful to witness the sufferings of the workmen exposed to the radiation of the flames . . . the whole breast of the fire must be exposed. (*Exhibitor*, p. 55)

We find ourselves on a sort of platform, in front of six furnace mouths, which disclose such a fire within as throws us into a secret despair, despair for ourselves, lest we should lose our senses, and for the men, because it seems impossible to live through the day in such a heat. (Martineau, p. 34)

This diction of suffering, however, is attended by strategies of speechlessness that complicate its avowed and genuine empathy. First, the account of the furnace moment is split and deflected, often by intervals for fact-heavy instruction, so that the furnace moment returns as a deferred repetition. The *Penny Magazine* pauses twice in its account of the furnace to offer facts (on one occasion it explains the engineering principles of the double dome, fuel consumption, 21 tons of coal for 15 tons of coke, on another, the week-long cycle of preparation and working of the pot), and the *Exhibitor* separates three references to the anguish of the furnace with the familiar statistics—21 tons of coal feed an 18 ft high 15 ft diameter furnace. Dickens and Wills approach the furnace with parodic linguistic flourish that becomes a rhetorical delaying tactic: “Let us therefore witness the actual liquefaction.” In obedience to this grandiloquent wish, we were shown into the hall of furnaces’ (p. 435). An effort of distancing produces the displacements of gigantesque, surreal comedy as ‘diabolical cookery’ takes place. The *Leisure Hour*, with consummate capacity for circumventing the furnace crisis, places all its references to the furnace well apart from its factual account of the glassmaker’s skills, in a preface to the visit series that creates a disjunction between the environment and the work. It separates protest and accounts of labour, fact and value. It prefaces its sequence of factory visits by an impassioned account of the Birmingham skyline, raging with fire: a ‘monster factory’ ‘whose pyramidal towers shoot forth tongues of flame’ (p. 25); the ‘volumes of flame flashing and flourishing and darting snaky tongues of flame into the lurid air . . . seem to convert the arena of man’s manful mastery over the stubborn elements into a pandemonium, whose inhabitants, tortured in fire, work retributive vengeance upon each other’ (p. 27) Writers negotiate a conflict between confrontation and avoidance, recognition and disavowal. The fiery furnace becomes a figure for the industrial unconscious. The unexpressed

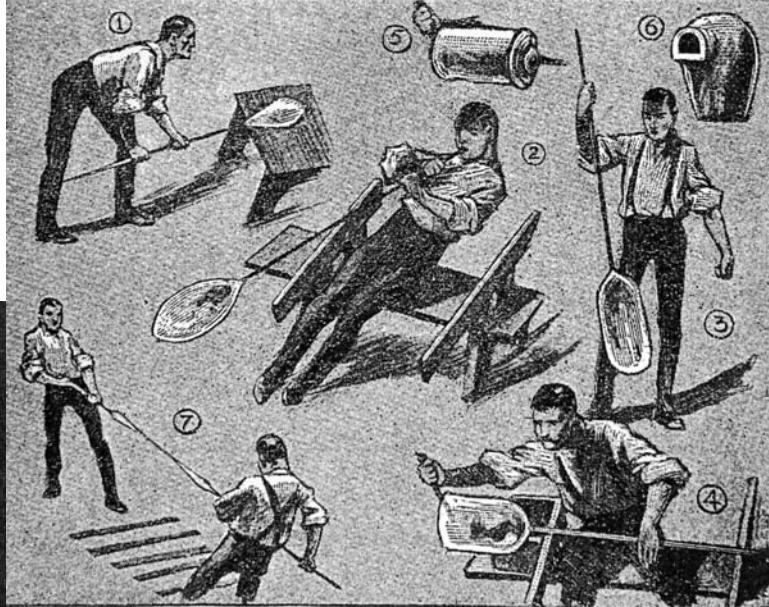


Figure 7
Glassmaking. Powell's Glass Works, London. The processes of glass manufacture: 1-5, Making Flint glass for windows; 6. Melting-pot for Flint glass; 7. Making glass tubing

Figure 6 Glass blower in the shades

analogy—*is this hell?*—is the unasked question. It is never spoken, perhaps because such blasphemy would be too easy and too difficult, genuinely exposing the problem that these furnaces are man-made.

In a second move to speechlessness, heat gags and blocks respiration. We have seen the *Leisure Hour* response to the black country: ‘the air we breathe is hot and stifling, as though every inspiration we draw had first gone through the process of singeing for our particular benefit.’ Three other accounts react with panic to stifling heat. ‘We were aroused by a sensation like the sudden application of a hot mask to the countenance. As we instinctively placed a hand over our face to ascertain how much of the skin was peeling off’ (Dickens and Wills, p. 435). Heat scorches and splinters ‘the very breath’ (p. 435). ‘He feels, as he looks upon the vivid light from the opening furnace, as if a hot mask were placed upon his face, and he unconsciously puts a hand up to his brow. A warm perspiration envelopes him, and it is some minutes ere he can recover from his first emotions on witnessing the strange unearthly scene before him. Dark figures flit past him, each bearing a mass of living fire, and he almost regrets his temerity in venturing into the horrid place’ (*Exhibitor*, p. 58). ‘Turning to the men, we observe that they work over a row of troughs of water. We would like to plunge our head in, if the water were not so dirty’ (Martineau, p. 34).

Such respiratory deficits bear witness to the artisan’s own loss of breath in the process of making glass. These obstructions to voice also testify to a moment when speech fails and empathy reaches its limit. One cannot breathe for someone else, one cannot speak for someone else. How can the worker’s experience be spoken of? Should he be spoken *for*? The mask of heat paralyses the tongue and throat of the observer. The tongue and throat of the anthropomorphized furnace (its vents are customarily described as ‘mouths’) are transposed to the onlooker, who, as if gagged, is unable to speak industrial pathos. The ‘mask’ of representation itself, heat, prevents articulation. It turns the onlooker back from the Promethean encounter with fire and language. ‘Emotions’, ‘temerity’ (*Exhibitor*), ‘despair’ (Martineau), flood the spectator, but something is left unsaid, silenced in confrontation with the mouth of the furnace. The decision not to speak is expressed as involuntary suffocation.

Pre-furnace Rhetoric, Phases Two and Three: The Journey through Factory Space, a Short History of Glass and its Constituents

The early segments of tourist narrative are carefully structured as a preface to the furnace crisis. Once the tourist is inside it, the actant becomes the

factory space itself, its divisions and parts organized by function and the abstract logic of a sequence of tasks, and the *objects* in it. It is less the geometry of the division of labour that matters than the imperatives of successive tasks. Another narrative segment hallows glass with history and religious association. Both have internal strains.

The factory tourist's progress is a journey through statistics and affect as the factory cartography unfolds. Measurements—size, number, quantity, weight, tons of sand, hundredweights of white-hot molten glass—are the other side of the affect which fills four of the five descriptions (the *Penny Magazine* is the exception), as if factual observation and feeling are dialectically linked. The *Penny Magazine* presents an exhaustive scholarly inventory of successive factory spaces and their functions, from the washing and drying of sand to mixing room, from the furnace to glass-engraving shops: 'the whole occupying an area of about three-fourths of an acre. The routine of operations will come successively under our notice' (p. 82). It appears to neutralize the human experience of manufacture because it is absorbed in describing technology. Neither owner nor operatives have first claim to existence here, nor even machines: only process counts. Dickens and Wills likewise incorporate statistics into their tour: "'In order to understand our process thoroughly,'" said the obliging director of the seven acres of factory and four hundred operatives we had come to see, "we must begin with the beginning. This", picking up from a heap a handful of the finest of fine sand' (p. 434). Martineau also computes: 'Messrs. Chance's works are not in the town . . . they would take up too much room in any town. The buildings occupy many acres . . . The number of men, women, and children employed are twelve hundred or upwards. The schools on the estate contain from four hundred to five hundred children' (p. 33). Many a market town, says the *Leisure Hour*, stands upon a smaller area than Chancetown, as it designates the Smethwick factory (p. 59).

There are attempts to redress this fact-loaded narrative in two ways: by investing the factory space with social and human meaning, and by anthropomorphizing the massive Stourbridge clay pots on which the founding of molten glass depends. Martineau's humanizing project is most emphatic. She documents women 'picking' or gleaning glass waste, and a carter—'The poor fellow is not quite sane'—who attempts to block their way 'but for the help of concerned workmen' (p. 33). The compassionate paternalism of the Chance enterprise demonstrates for her the industrial estate as community. The employment of the mentally retarded, the consideration of both men and employers for the retarded man, the presence of schools, are of a piece with the later account of a deaf and dumb worker (p. 37), and the provision of libraries for employees (p. 36). The capitalist as paternalist or even friend is the model.

These were the days before the Siemens tank, introduced in the 1870s, enabled the temperature of glass to be regulated systematically and the length of the work time to be correspondingly ordered.⁹ Up to this point, vast clay containers, stocked in three stages, made by hand, built up manually with rolled clay in the factory and transported to the furnace, brought glass to a white-hot temperature in the furnace. Crucial to the whole process, it was their unpredictability (glass could reach the point of readiness for working at night, for example) that not only made the process of glassmaking so full of risk (as seen, they could break in the furnace) but also dictated the uneven work pattern of the blower. These pots, containing 16 cwt of glass and using 1,000 lb of clay, the bottom and sides of the pot 5 inches thick, attract intense attention. Even the *Exhibitor* visitor, whose account is sparsest, comments, ‘Great care is necessary in the making, drying, and baking of these pots’ (p. 55). Their drying and hardening is described in detail by the *Penny Magazine*. Its account of the elaborate preparation of the pots is the most detailed and almost ritualistic—the ‘pot-arch’, the small furnace that test-heats the domed pots, the theatre of the main furnace, also domed.

But one process disrupts the narrative with real disgust: ‘The mixed ingredients [of clay] then undergo a process so primitive, that one almost regrets to see it in this age of machinery. The powdered clay, being mixed with warm water in large square leaden troughs, is trampled on with naked feet until thoroughly kneaded into a stiff adhesive clay. . . a machine . . . failed to produce the desired effect, and the old method was again resumed’ (*Penny Magazine*, pp. 82–3). Martineau also notes the ‘squashing tread’ of clay by foot with intense distaste (p. 33), and remarks on the gendered division of labour. The pot maker is assisted by a girl who rolls the clay for pot construction. The pots’ journey to white heat in the furnace becomes the hidden analogy for the experience of labour, and substitutes for the workman’s body. On them is transferred the powers of endurance. Dickens and Wills describe the pot that has withstood seventy days lying ‘burst into a hundred pieces’, ‘out in the rain’ (p. 436). As the tourists depart the workmen sit on a log calmly drinking beer ‘out in the cold and wet’ (p. 437) metonymically related to the pot, for all their composure. At the start the authors describe the seven pints of beer a day consumed by every man, and explicitly make the association—‘necessary to moisten human clay’ in a temperature 1,300°F above boiling point (p. 434). The clearly non-mechanized nature of Stourbridge pot construction throws them back to an atavistic craft culture that can be understood as pre-industrial. The use of hands and feet, the birth of glass out of clay and the immediate pressure of the body, confirms a primal ordeal, which is transferred to the pot itself. The primitive process frankly shocks; the

shock can be voiced precisely because the process is primitive, whereas the processes of industrial labour in the glass factory cannot be voiced and do not call out overt disquiet. At the same time the pot is exoticized and displaced into fairy-tale economics, as two orientalizing references to Ali Baba suggest. The dark drying room was ‘studded with nearly a hundred of these dome-shaped vessels. A little stretch of imagination would have transformed the assemblage into Cassim Baba’s oil jars, and have peopled them with forty (or twice forty) thieves; but the damp odour of clay kept the thoughts from wandering from Blackfriars to Bagdad’ (*Penny Magazine*, p. 83); ‘we mounted to an upper storey that reminded us of the yard in which the cunning Captain of the Forty Thieves, when he was disguised as an Oil Merchant, stored his pretended merchandise. It was filled with rows and rows of great clay jars.’ Dickens likewise orientalizes the scene. Despite the playful exoticizing, the sinister undertones of Ali Baba are present however distantly: there is the incipient collision between orientalized ‘craft’ and the modern factory, the forty thieves (duplicitous interlopers and murderers) and the modern industrial capitalist.

A dignified genealogy that takes glass back into prehistory is one way of assuaging modern process. The third narrative segment attempts this. Referencing Sir J. G. Wilkinson’s *Manners and Customs of the Ancient Egyptians*, the *Penny Magazine* explains that glass was worked ‘before the exodus of the children of Israel . . . three thousand five hundred years ago’ (p. 81).¹⁰ Theban paintings represent glass blowers relating to this period, and a glass bead at Thebes contains the name of a monarch reigning in 1500 BC. This glass bead of 1500 BC reappears in Dickens and Wills (who also reference Gardiner Wilkinson), this time, though, with a specific gravity identical to that of modern English Crown glass (p. 433). Such reference universalizes the science of glassmaking, embedding glass in a narrative of continuity (the ancient bead’s specific gravity), hallowing it with Old Testament and religious associations. The *Exhibitor*’s history, for example, moves from Egypt, to Venice, to the Phoenicians, and to the Crusades.

And yet the modernity of glass, pressed by these writers, is not easy to reconcile with such history. An ultimate purity has been reached by modern methods, *Leisure Hour* boasts (p. 59). Four out of the five discussions attend to the composition of modern glass in detail (Dickens and Wills (p. 434); *Exhibitor*, p. 55; *Leisure Hour*, p. 59). ‘[Lead oxide] gives the glass greater density, greater power of refracting light, greater lustre, greater resistance to fracture from sudden heat and cold, and greater ductility during the working.’ The *Penny Magazine*’s scholarly exposition of vitrifiable sand, and salt or alkali as flux, is completed by the modern addition of metallic oxides (pp. 81, 82). Flints, disintegrated by being thrown red-hot into water, and once thought to be the most valuable siliceous matter, are

obsolete. But glass straddles awkwardly between modernity and history. Glass in these texts is a cross between industrial and alchemical product, claiming aura from a past mode of production, at the same time as technologies of mass production of glass offer the rival aura of modern technological progress. It is hallowed as if to disguise the disjunction of new forms of production and the pain exacted by modern purity.

Post-furnace Rhetoric, Phases Five and Six: Infernal Choreography and Feats of Magic

Between them these factory tours describe most of the current genres of glassmaking in decorative and heavy glass. All are object lessons in task description. They are also balletic accounts of the choreography of work: the silent workers do not communicate with their audience. The tours convey an aesthetic—the prowess of the worker, his skill and autonomy, the intensely interactive collaborative necessities of labour, work as ritual and ceremony, work as performative spectacle (a glass dance), and finally the worker as shade or semi-human entity (this last prefigures the sixth phase of the tourist narrative, work as magic or even dementia). Enormous deference and deep respect for the men attend these expositions. But post-furnace phases of the factory narrative simultaneously interrogate *work and species being*. Accounts of work pull in different directions. How can the worker be human?

In the *Penny Magazine* and *Exhibitor* work is seen as prowess, interactive teamwork, spectacle, and dance, in the making of a claret jug or a wine glass respectively. The *Penny Magazine* presents teams of men as a disciplined collaborative mechanism: ‘one man whirled it... another man received it... a boy blew through the tube’. The *Exhibitor’s* technical terms seem intended to convey a privileged technical language of private expertise.

He next rolls it [red-hot glass on the blowing iron] on the marver, or cast-iron slab, and, slightly swinging it round, blows through the pipe, so as to expand the metal sufficiently for the bowl of the glass. Another workman, seated at the Chair, then receives the mass, and further shapes it by means of the pucellas and battledore, by which latter instrument the end is flattened. A second workman then brings a smaller gathering of fused glass, and places it to the end of the bowl, to which it immediately adheres. This is the stem. A few turns on the chair-handles, and a few slight touches with the pucellas, and the glass is ready to receive the foot. Another workman, called the ‘footer’, brings a third gathering on the end of a blowing-iron. This is shaped like a small globe, and is instantly attached to the stem and opened out, and flattened by the workman at the chair till, in a moment almost, the glass is

formed . . . the glass is, lastly, knocked off the pontil by a smart blow, and is taken away by a boy to the annealing oven. (p. 70)

Dickens and Wills present the glassmakers as coequal participants in primitive ritual, and virtually Masonic companions bonded in a collaborative ceremony. 'Such figures there must have been, once upon a time, in some such scene, ministering to the worship of fire, and feeding the altars of the cruel god with victims' (p. 435). The heat of the furnace increased by 'the tiseur or stoker', a man, with 'the assistance of two companions', ladles metal from one pot to another, and, when the furnace has maintained heat for another eight hours 'in the language of the men', 'the ceremony is performed' (p. 435). A gong summons the men to cast who 'hastened to a focus', 'like giants in a Christmas pantomime about to perform some wonderful conjuration; and not a whisper was heard' (p. 436). The 'enormous cuisine' is performed: the 'red hot gruel' is to be poured on a 'stupendous iron table' on which lies a massive rolling pin.

The exception here, Martineau does not express respect for collaboration but presents the work of cylinder blowing as an aesthetic of power, the men like actors taking possession of their stages or 'bridges' as independent virtuoso performers.

Between the range of blocks and the furnace, there are bridges across a deep chasm; a bridge to each furnace mouth. The workman runs along his particular bridge, holds his metal into the furnace, withdraws it for another toss, heats it again, with another puff through the pipe, and at last has blown a hole through the further end. The whole expands, the edges retreat, and we now see the cylinder form arranging itself. There he stands on his bridge—as half-a-dozen more men are standing on their respective bridges, swinging the cylinder at arm's length, even swinging it completely round in the maddest way; the scarlet colour at the further end shading off beautifully into soberer reds up to the point of the pipe, where the central knot is still scarlet. When it is of the right length (that is, for the Crystal Palace panes, somewhat above forty-nine inches) the cylinder must be detached from the pipe. (p. 34)

The valorization either of prowess or collaboration bypasses the politics of the workplace. The structure of the 'Chair' or group of three workmen attended by a boy apprentice, for instance, is only there by implication in accounts of Flint glass processes. Similarly, Martineau does not register the eight-man set required by Cylinder blowing. Industrial injury, except for a brief reference by Dickens and Wills, does not feature: 'one poor fellow got the large shoes he wore, filled with white-hot glass.' (p. 436).

These writers forgo a direct politics for different questions and something deeper. The 'other' of the heroic worker, and dialectically related to him, is the workman presented in semi-human terms or dematerialized.

For the *Exhibitor*, the factory tourist is in an ‘unearthly scene’, ‘dusky figures close beside him swinging about what appears to be great masses of red-hot iron . . . Dark figures flit past him, each bearing a mass of living fire’ (p. 58). For Dickens and Wills,

In dark corners, where the furnaces redly glimmered on them, from time to time, knots of swarthy muscular men, with nets drawn over their faces, or hanging from their hats: confusedly grouped, wildly dressed . . . mysteriously coming and going like picturesque shadows, cast by the terrific glare. (p. 434)

A ‘salamander, in human form’ (p. 436) plays demonic see-saw with a container of white hot glass. Martineau’s workers, though performing the most imposing tasks of cylinder blowing, are barbaric and sexually dangerous: they

have bare feet and legs; some have no clothing but drawers and a blue shirt; one or two, indeed, add the article of gold earrings, being Frenchmen. All have glistening faces; and all swing their glowing cylinders as if they were desperate or demented; a condition which we suspect we are approaching, under the pressure of the heat, and the strangeness and the hurry of incessantly getting out of the way of red-hot globes, long pipes and whirling cylinders. (p. 34)

Can these men, subjected to such physical pressure, be human? Can they be, in some senses, alive? In what sense do they claim species being and thus affinity with the narrator? These are ‘unearthly’ creatures, reduced to shades and shadows, the dematerializing term ‘figure’ constantly associated with them. Have they agency? Reduced to ‘figures’, they fall out of the category of the fully human. As such they spare us analysis, but on the other hand, a group of further questions arises; if these figures are inhuman, how have they come to be like this? Shades haunt.

A corollary of haunting is the attribution of magical power to the workman, the next phase of post-furnace narrative. All factory tourists repeatedly celebrate the dexterity, speed and skill of the glass worker. This defies description. Here is the *Penny Magazine*: ‘with a dexterity altogether beyond the scope of description . . . The rapidity with which these operations are effected almost baffles the eye of a spectator’ (p. 85); ‘Great, indeed, is the surprise excited at seeing such an elegantly-formed vessel manufactured in such a way in the space of ten or twelve minutes’ (p. 86). Dickens and Wills likewise mark speed: ‘So rapidly are all these casting operations performed, that, from the moment when Mr Bossle thought his spectacles were melting off his nose, to the moment when the sheet of glass is shut up in the oven, about five minutes have elapsed’ (p. 436).

Such velocity is a manual achievement, not a mechanized one. Two points follow from it which frankly disadvantage the narrator. First, work

becomes a magical conjuring trick, a cheating of the eye. '[A]ny number of glasses may be made of a particular pattern, with little or no tool-work, without the slightest apparent difference or variation of one from another. . . The extreme rapidity with which these operations are formed is most astonishing. You watch the workman as you would a conjuror, and the results are quite as surprising. . . Without close attention, the minutiae of this operation eludes the eye, so quickly is it performed. . . and so quickly is the whole process carried forward, that one workman can form the necks of bottles while three others are employed in moulding' (*Exhibitor*, pp. 70–1).

Second, the manual execution of the task and its description in writing are incommensurate. The *Exhibitor* continues: 'This operation, so long in telling, and apparently so complex, is the work of about three minutes! . . . a dexterity only acquired after years of practice.' The 'marvellous rapidity and certainty' of Crown glassmaking, so that 'a spectator had need to make good use of his eyes to understand what is going on' is also stressed by the *Leisure Hour*. 'The description we have attempted to give would probably take as much time to read' as the process itself. It may have been this magical execution, using centrifugal force, and requiring the integrated skills of many men, which prompted him to describe the archaic Crown glass process and its astonishing feats (for this was not the progressive form of manufacture and was being superseded by Cylinder glass). The worker's rapidly turning rod forces the glass to change its form. The orifice opened in the globe of glass becomes a 'deep vessel—now it is a large vase—now a huge saucer—now a shallow dish—and now it is the flat circular table' (p. 60). Tension builds as the glass expands.

Laden with respect and sympathy, imaging the workman as hero *and* conjuror, these accounts also make the workman and his work invisible. His very skill, baffling the eye, makes him disappear (Martineau's image of work as dementia at least has the merit of making workers visible). How are we to calibrate this 'invisible' work? Furthermore, not to speak of their respective status, what is the relation between manual work and the work of writing, and the capacity of one to represent the other?

Phases Seven and Eight: The Artefact at Last, the Safe Return from the Shades

These two final phases are often conflated. The end of manufacture is the successful proliferation of glass commodities that increase almost by organic reproduction. The final stages of the glass artefact are here allegorized as a form of socialization, in which rough material is transformed

for use, tended by women and boys, ready for the market. The scintillating glamour of cut, engraved, painted, smoothed, and polished objects, glistening and brilliant, supersedes all other description. We return to the market through a decrescendo via the great grinding machines grotesquely elided with the human, comically full of ‘affectations’ for Martineau (p. 36), ‘creatures struggling to get free’ for the *Leisure Hour* (p. 61), and polishing machines, whose deficits are smoothed by women in erotic motion and tended by boys red with rouge like Red Indians (Dickens and Wills, p. 437). Here, and in painting and decorating glass, women’s work is freely acknowledged. It is an increasingly feminized space. Most accounts end with decorative glass and the ‘elegant show-rooms or galleries’ (*Penny Magazine*, p. 88) where innumerable glass artefacts are on display in a transparent crystal environment.

Butter dishes, wineglasses, decanters, plates, door handles now accessible to the poor (*Exhibitor*), decanters, goblets, wineglasses, girandoles, chimney ornaments, plates, door handles, ground glass stoppers, optical glass (*Penny Magazine*), mirrors, transparent flooring, door panels, windows (Dickens and Wills), ‘charming’ groups of statuary, shades (glass domes for covering objects), ‘vistas’ of domestic glass, candelabras (Martineau), coloured glass windows (*Leisure Hour*), the lists abound. But it is almost as if these articles are at the same time unfinished, and the possibilities of further work are endless. Glass panels, says the *Leisure Hour*, can be stained, stencilled, engraved (p. 62). Glass can be painted, enamelled, crystal polished (Martineau, pp. 37–8). Glass can be further worked—cut, engraved, layered, ‘two-coloured’ and cut (so that the outer surface exposes the second colour of the inner surface), encrusted, painted, ground. All optical glass requires further moulding, grinding, and annealing (*Penny Magazine*). It is as if the erotics of commodity can only be justified by labour. But the final glass object is where aesthetics and technology meet. Technological process through ornamentation is also a guarantee of beauty. Martineau terminates her tour at Osler’s, producers of decorative glass and creators of the fountain, to make this point.

For the *Penny Magazine* and the *Exhibitor*, the journey ‘home’ ends in the show room. For the *Leisure Hour*, the journey ‘home’ is back to the idealized factory. It ends by celebrating (a deserved reputation) the ‘humane and truly philanthropic spirit’ of the Chance enterprise (p. 62). Dickens and Wills meditate on Defoe’s account of Colonel Jack sleeping in the ashes of a glass house, as contemporary boys do, and meditate on Defoe’s island throughout the train journey home, displacing the arena of glass to the exotic (p. 437). It is Martineau who affirms another popular myth of Victorian globalism. Osler exported ‘by order of the Viceroy’, two 10-ft-high candelabra to Egypt to be beside the tomb of the ‘Prophet’ at

Medina: 'It is a symbolic incident, indicating the spread of British arts among the remotest regions, and the strangest races and faiths on earth' (p. 38). The journey home is the journey of exported commodities and their symbolic meanings, including the force of empire.



There is plenty of triumphalism and simplification in the documentary poetics of the glass factory. Dickens and Wills, for instance, rejoice that we now torture and 'stretch upon the rack' 'the ores and metals of the earth' rather than, in the name of Christ, people. 'Burn fires and welcome!' (p. 435). But it would be unwise to dismiss these as naïve writings. They are attempts to imagine, and ask their readers to imagine, what it means to make glass and its consequences. They are fraught and complex. There is an industrial imaginary at work in these texts that comes up with awkward contradictions and questions, structural questions that go to the heart of the glassmaking process. I do not read these questions as occlusions, evasions, and aporia that are simply left as they stand. The texts actively *produce* these questions. They are a positing of difficulty. The intellectual and psychic irritant of these difficulties cannot be dormant in the text. They are the contraries that produce movement. Marx insisted, in his account of bottle glassmaking in *Capital*, that the social relations of the collective labourer had been turned into a machine, and quotes a manager: 'when once they begin, they must go on; they are just the same as parts of a machine.'¹¹ Visit texts for the most part ignore such a model. Tim Barringer writes of the instrumental and expressive accounts of work current at this time.¹² These accounts opt for the expressive mode. They prefer the mythos of glassmaking as a heroic, even agonistic, transformation through the agency of a collaborative act. Yet the subtext is that glass, mediated through work, but also a mediating substance in itself, responds to readings that accept its antithetical nature equally alive to beauty and pain.

Robert Lucas Chance, Modern Glass Manufacturer

Fractures in the Glass Factory

Revolution in Glassmaking: A Modern Material

I turn from factory tourism to one of the glassmakers who created the material foundations of glass culture. To attribute the creation of mass transparency in the nineteenth century to the energies of one man, Robert Lucas Chance, to one place, the Chance factory at Spon Lane, Smethwick, and one time, 1832, would have seemed hyperbolic even to Chance, an obsessively ambitious but nevertheless modest man. Even so, the Chance factory was the first by several years to introduce Cylinder glass blown by the human breath with workmen imported from France and Belgium. Known as ‘Sheet’, and by a variety of names,¹ this glass, superseding the wasteful disks of earlier Crown glass, enabled Chance to maintain hegemony in heavy and window glass production for the next thirty years—‘The name of CHANCE occurs so frequently in the preceding observations, and is so honourably connected with every branch of the manufacture’, the Great Exhibition jury wrote in 1851.² We ‘recognise’ the ‘colour and brilliancy’ of the Chance glass, *The Leisure Hour* wrote, in ‘the new villas and suburban villas everywhere rising in the neighbourhood of London’.³ This man, an intellectual and dissenter, in his youth a friend of Coleridge, went into the family glass factory at the age of 12, became a manager at 14—he was known as ‘the little master in the jacket’—married into a glass dynasty, and set up one of his own.⁴ Deaf, rightly praised for his public munificence and private benevolence—‘he acted rather as the steward than as the owner of his well-earned wealth’, the obituary in the *Birmingham Daily Post* (9 March 1865) affirmed—he was also a risk-taker, fanatically driven, dictatorial, peremptory, and explosive. He speaks of his ‘blow-up in November’ over quality as if this is a common occurrence. He reputedly travelled to Dumbarton in search of a skilled manager, John Hartley (who

later became a partner), roused him from bed 'and brought him straight away' (Chance, p. 2).

His achievements were extraordinary. '[I]n spite . . . of strongest opposition by his partners' (Chance, p. 6), the experiment with Cylinder glass brought him commissions for the Chatsworth conservatory glass, for the windows of the new Houses of Parliament in 1848, and for the 300,000 panels, 956,000 square feet, for the Crystal Palace of 1851. By 1866, Chance shared 75 per cent of the heavy glass market with two rival firms, and was only finally taken over in 1945, when Pilkington became the dominant shareholder.⁵ Robert Lucas Chance had national and global ambitions. He sought trade in the Middle East, the Americas, and Russia (though he was foiled by Protection there). He intended to be pre-eminent for the quality of his glass, comparable with the name of Wedgwood in the pottery industry. Moreover, he had two further liberal ambitions, to create and define a truly modern glass manufactory as a civic achievement, and, as a corollary, to create new technologies of the highest scientific order. This was the modern idea played out in the making of glass.

Whereas the factory tourist created a modern myth of transformation, Chance created an ideal of the perfectly functional factory benignly ordered. But the inherently unstable nature of glass production joined with Chance's own volatile temperament to thwart this perfectionism. It acted like the check of a reality principle. The intractable conditions of glassmaking meant that he alternated between two poles: on the one hand he attempted to see labour as purely instrumental (one might chiasmically say 'pure' alienated labour), regulated by abstract, standardized formulas that made the labourers' mediation invisible; on the other he recognized the specific particularity of his workers as unique individuals, men with bodies and minds, locked in relations of reciprocal need with master and manager. Work for Chance alternated between the neutral and the social. Two consequences followed. The Chance glass factory matched none of the models of industrial organization generated in the nineteenth century, or rather, it veered between several. Neither paternalism and deference, nor Owenite egalitarianism, nor the impersonal functionalism advocated by Andrew Ure and Charles Babbage, but deeply repugnant to Marx, who deliberately took the glass factory as an exemplary moment in the division of labour in *Capital* (1867), are paradigms that fit, though glimpses of all can be seen. Marx took the manufacture of glass bottles as the epitome of the 'one-sidedness' in which workers become multiples whose work is organized to a 'fixed mathematical relation or ratio', and which thus converted them into a 'never-failing instrument'.⁶ But at Chance this was only part of the story. Secondly, the glass factory, excruciatingly hot and dense with fumes, was a place of passional extremes, panic and peripeteia, industrial hysteria, sound and fury.⁷

This swing between the instrumental and the interpersonal, near despotism and human recognition, appears in two documents in particular. One is J. F. Chance's record of letters—an epistolary drama—from Robert Lucas Chance to his son, Robert Lucas Chance the younger, and nephew, James Timmins Chance, who had been summarily dispatched to France and Belgium in the highly competitive search for glass blowers during the glass famine of 1845. The other is a thirty-nine-point memo to another son, John Homer, in July 1850, on the management of sheet glass manufacture. We can think of work and constructions of work as socially produced (as Patrick Joyce has argued), and the documents endorse this. There was something inherently unstable in glass manufacture that led glasswork to be constructed in unstable ways. These unstable conditions preface an account of the two documents.

'Chance' is a peculiarly apposite name. Glass production was structurally irregular. The unpredictability of the temperature at which glass was ready to work meant unpredictable shifts of varying length, sometimes at night. Before 'mechanical methods of production' (machinery was only an adjunct of glassmaking till late in the century) and the introduction of tank furnaces, Sir Hugh Chance wrote in 1974,

glassmakers worked irregular shifts called 'journeys,' lasting perhaps eight hours until the pots were 'worked out.' 'Founding,' i.e. filling the pots, melting and refining the metal, and reducing the temperature to suit working conditions, took up to 24 hours, and the glassmakers were not called in until the metal was ready for working. So shifts or 'journeys' took place at irregular times, sometimes in the day or sometimes at night. The blowers worked usually five journeys per week, but if melting time was unduly prolonged—coal firing was not easily controlled—only four journeys could be completed in a week.⁸

Though it solved some problems, ultimately displacing Crown (glass blown and spun as circular 'tables'), Cylinder glass created others. Huge pieces of 12 foot square glass, without the wastage of trimming and cutting at the edge and centre, could be created, but the workplace patterns of Crown and Cylinder were fundamentally different, creating different genres of the division of labour. Crown depended on an intricate team choreography: in Cylinder the glass blower was a solo performer. This is how the *Penny Magazine*, returning to glass production in 1844, on a visit to Cookson's, in South Shields, described the making of the two types and the artisanal virtuosity they demanded. In Crown manufacture 'the men go flitting past' in the chiaroscuro of shadow and heat.

If each man stood in one spot, and made a piece of glass by his own work, the picture would approach nearer to one of 'still-life;' but they are continually passing to and fro. A piece of glass goes from hand to hand, probably a

dozen times in the process of making, travelling along from one furnace [hole] to another.⁹

To the ‘bystander at once beautiful and inexplicable’,

The glass changes hands more frequently than we have here noted; each man having by practice acquired the skill for one particular operation. It passes also round the central furnace from one opening to another, in order that each man may have a working-spot without interfering with the others . . . It will readily be understood that although a dozen men are thus engaged in making one piece of glass, there are many pieces under operation at the same time, each man taking up a new one as soon as he has handed over the previous one to the man standing next to him. There is thus a kind of endless chain in which all the links are being made at once.¹⁰

The process of Crown production is so complex that the writer, George Dodd, takes two and a half columns to describe it. The gatherer initiates the process by gathering molten glass with a rod that is held perpendicularly upwards, shapes it on the marver, passes it to an assistant who initiates the blowing process, who passes it to the blower proper who rotates it and flattens it, who then works with another workman to exchange the blowing tube for an iron rod (punty) on which the glass is rotated. The final rotating or ‘flashing’ process then takes place, seen here as a miraculous ritual:

As the substance of the glass becomes hotter and softer, it yields more readily to the centrifugal force engendered by the rotation: it becomes every moment broader and flatter, deviating more and more from the shape of a globe. The hole which the tube had before formed, and which was at first only about two inches in diameter, gradually enlarges by the same force, until it becomes three inches—six—twelve inches in diameter; and finally, the whirling action so completely masters the previous condition of the glass, that the flattened and misshapen globe suddenly ‘flashes’ (to use a technical term) out into a circular sheet four or five feet in diameter, nearly equable in thickness in every part, and being still attached to the rod exactly at the centre.¹¹

Virtuoso workmanship is required by both processes, but by contrast, far from being part of an ‘endless chain’ of interdependent men, the Cylinder blower ‘made a piece of glass by his own work’. Dodd believed his virtuosity and ‘quickness’ surpassed the Crown maker. While Joan Wallach Scott described the bottle glassmaker in France in the 1860s as part of a team, Dodd saw individual prowess.

The blower raises the other end of the tube to his mouth, and blows the mass of glass into a hollow form . . . and this is made the nucleus of a cylinder three or four feet in length, by a most remarkable train of processes. The workman holds the glass at the mouth of a furnace, to heat it to a certain degree of softness, at the same time keeping it rotating to prevent it from falling off the

tube. He then lets the glassy mass hang downwards, and swings it to and fro in a recess or cleft in the floor of the shop. By this movement the globe, yielding to its own weight by the softness and ductility of its substance, elongates into a cylinder with hemispherical ends. Again is the mass rotated and rotated, and again is it swung like a pendulum at the end of the tube; until, at length, the workman fairly swings it round in a vertical circle, at the imminent risk (as it seems to the looker-on) of shattering the cylinder in fragments. . . . that it should become almost a perfectly true cylinder from end to end, that the thickness should be the same in every part . . . are results which few persons could anticipate.¹²

It is easy to see why Crown became 'extinct' (Chance, p. 5). J. F. Chance reckoned that Crown took the skills of seventeen men—four blowers, four gatherers, two or three pontystickers, a piece opener, a carrier off, a piler, a kiln assistant 'and several boys' (Chance, p. 43). Cylinder, on the other hand, required a team of four pairs, in which three pairs worked the pots while one rested. In the early days of the French souffleurs in the 1830s 'each blower worked out his pot by himself, helped only by a boy, his *gamin*. Gatherers and separate blowing holes were yet of the future' (Chance, p. 7). Gatherers (who began the Cylinder process) and separate blowing holes, which came into operation in the 1840s, systematized and simplified the Cylinder process. It is immediately clear that in Cylinder-making fewer men can undertake more at each stage of the working and that, moreover, each phase of the working is a *discrete* stage, so that, not only can the work be segmented, but the workmen are substitutable as they are not in the continuous ongoing chain of movement that brings about a Table of Crown. In other words, the genre of an atavistic craft can be fused with a segmented division of labour in Cylinder-making as it cannot in the production of Crown. Just as the importance of Sheet is not simply lack of wastage but its suitability for standardization and prefabrication, qualities less relevant to glass production in the eighteenth century, but which were positive requirements in the nineteenth, so the structure of production was amenable to the serialization of factory production and the *abstraction* of labour that it required. Such a process endorses the distinction between skilled and unskilled labour that could not be made so readily with Crown. In the *Penny Magazine's* meticulous description, Cylinder blowing falls into two distinct stages, resolving itself into the independent activities of the blower and flattener. The blower alone brings the entire cylinder into being. Each skill is discrete and independent. The process of flattening is separate, and can theoretically take place at a quite different time if necessary. The cylinder is reheated and split (at Chance with a diamond), falling open by its own weight in the heat, and flattened with a block of wood at the end of a handle. It is then ready for annealing.

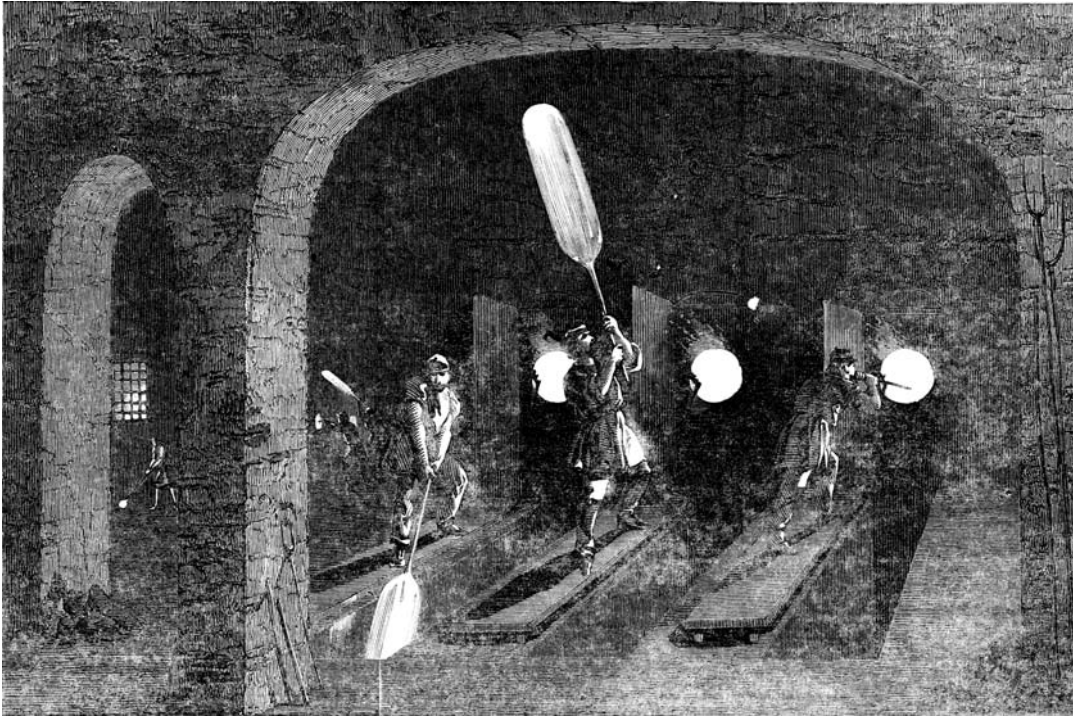


Figure 8
 Cylinder glass:
 'Manufacture of Glass
 for "The Crystal
 Palace" at Messrs
 Chance's Works, Spon
 Lane Near
 Birmingham',
*Illustrated London
 News*, 1850

Suitable as these processes are for assimilation into the discipline of a factory system, there is a contradiction at their heart. The very process that releases the workman from interdependence also makes him uniquely responsible for the quality of the product. Everything depends on him and his body as virtuoso performer, and thus he cannot be seen wholly instrumentally. Henry Chance's account of glassmaking, in a lecture for the Society of Arts explaining how the Crystal Palace panels were manufactured, implicitly recognizes the double nature of Cylinder production. It is both an art and a systematic industrial process that cannot recognize an aesthetic of labour. He emphasizes the serial as opposed to chainlike nature of Cylinder production by demonstrating that before the blower takes glass onto his pipe it has gone through the hands of ten separate workmen in one form or another, from founding to gathering, but these stages do not coexist as in Crown making. The blower is the final solo performer. True to the theatre of labour he works on 'a stage or frame of wood, erected over a large pit or well about ten feet deep, and these parallel stages are sufficiently apart to enable each blower to swing his pipe to and fro in a vertical plane, that the glass may run freely out, as the phrase is, to the required length.'¹³

Cylinder glass changes the relations between men and employers and men and men. A dialectic between the impersonal functionalism of labour

required by the factory and the art and skill of an individual producing an artefact with the irreducible being of his body produces two sets of power relations. The will to instrumentalism is countered by the unique prowess that demands recognition and independence—not to speak of money—Crown workers were paid under half as much as Cylinder blowers.¹⁴ In Crown the task makes men interdependent even when they are instrumentalized. In Cylinder the set of men unites through economic individualism as they work to production targets.¹⁵

Two Documents of Conflict

Hunt the Glassblower

When Excise tax on glass was abolished in 1845, the complex entanglement of Excise and window tax ceased.¹⁶ The price of glass was cut by half after 1845 and fell from 1s. 2d. to 2d. per foot between 1844 and 1865.¹⁷ A huge surge in demand meant intense competition for blowers. Barker calculates that there were only about fifty skilled blowers in England. Nothing demonstrates the stresses of Chance's reliance on the unique prowess of individual men, than the vicissitudes he underwent, moving from exhilaration to exhortation, from triumph to rage and blame—once on the same day—in the frenzy of letters written to Belgium over 15 to 27 July 1845. His son and nephew—the latter forced to interrupt his honeymoon—were sent to scour the continent for sets of men. He had always been exasperated by dependence on 'foreign workmen', as they were termed. A curt memo of 1860 notes that 'even now we have not been able to teach a sufficient body of workmen to enable us to dispense with foreign workmen' (Chance, p. 57). The French and Belgian blowers were from the beginning, as he saw it, recalcitrant, blowing short weight, instigating fights, a 'battle royal' in the factory (Chance, p. 37), demanding exorbitant wages, and putting up a 'shew of resistance' to organized work patterns (Chance, p. 8), particularly when the Crystal Palace glass demanded them.¹⁸ One, Zeller, was dismissed as an example in 1836 (Chance, p. 14). Now, in 1845, Chance was in competition for foreign blowers with Pilkington and Hartley, sons of his former manager. Calculus and competition run edgily through the letters. They need fifty skilled men, as many as were working in England at this time.¹⁹ If they get only forty-five 'who shall we have to make the plate glass' and heavy weights—'what a predicament we shall be in' (18 July). 'We are approximately eight sheet [sets]' if English apprentices were used, he calculated finally on 31 July. Joseph André (galling, as he had defected from Chance) was seeking blowers for Hartleys.

Yet he was repeatedly forced from figures to personalities, and not simply the egregious Hartleys. As the letters unfold, complex relations of passion, power, and dependency emerge. People, managers and workmen, money, skill, logistics, pull in opposite directions. He begins with high optimism, writing to his nephew James Timmins on 15 July that his eldest son ‘takes up the journey *con amore*, and having read the *volumes* I have written on that subject has his mind impressed with the importance of his mission’. In addition to these *volumes* he wrote another excited letter to his son on the same day. Two Belgian souffleurs had arrived that day, sent from Dorlodot (the continental agent responsible for hiring labour). It seemed not improbable that they could engage the number of men required as eight or nine men were following. He mentions ‘The report at our works that Joseph André has only succeeded in obtaining two men for Hartley’. But there are ominous elements. He gives mixed messages to his son which expose the dependency on prime workers and its financial stress. J. F. Chance notes financial largesse combined with anxiety—‘A few hundred pounds expense to get a complete set of workmen’ was of little importance: ‘the only fear is lest they should not be all of the right stamp’. (But he was writing to James Timmins at exactly the same time ‘to impress on your mind’ that Belgians make more glass and are paid far less ‘*per foot*’ than the French, and, by implication, his own workers (Chance, p. 33).) And logistics subtract from the largesse: the readiness of furnaces and arrival of men should be correlated to avoid paying them when idle. Moreover, James Timmins had fallen down badly by not liaising with Dorlodot. He must ‘put everything on a solid footing’, at Namur.

On 18 July James Timmins, his honeymoon interruptus disregarded, was the recipient of disappointment, anger, and blame. The tone becomes frantic: ‘J.W[ithers?, a manager at Spon Lane] has reported that the two Belgians blow worse than the youngest English workmen and would ‘never be worth anything’. ‘I cannot but fear that Dorlodot is little better than a charlatan.’ He ‘Much regrets’ James Timmins’s omissions. There is panic: ‘what a predicament we shall be in’ if four possible end-of-contract departures occur at Spon Lane. ‘The grand deficiency of men to make 21 oz. glass is not supplied, and you propose to leave to Dorlodot to secure the good men’; ‘I can assure you I am utterly discouraged and cast down.’ Dorlodot is demonized.

On 19 July his son wrote a journal letter completed on 27 July, described by J. F. Chance as ‘An immense letter of 8 large pages’. It was a reassuring report of many engagements and hopeful conversations with Dorlodot, who advised that the men should practise at the unfamiliar Chance furnace on half pay. He has ‘Fetched Clement Echenbreuer out of bed [evidently a family practice] and employed him for three years’. The

formerly disgraced Zeller was visited, who said that he had been offered 550 francs for 36 hours work per week and declared that he would not work 40 hours for less than 550 francs. Robert engaged him for 500 francs for 30 hours. He had done so because he was a first-rate workman 'and the very man wanted to blow heavy glass'. Pilkington, Bontemps, and others (a tactful way of referring to Hartley?) had made efforts to get him so Chance would cause 'surprise to the generality'. Dorlodot said that the two Belgians were the worst of the lot. But the letter ended in disappointment. He had been manipulated. Zeller and other promised workmen had signed local engagements as soon as he left, declaring that they had been forced to give in. Ten days earlier he could have 'got' them. They were sorry not to come. 'Much disappointed.'

Meanwhile his father was writing on 20 July in despair and anger to his nephew, James Timmins. 'Nothing has made me so uneasy since 1831 as the finding the 7 men sent by Dorlodot to be such poor operatives, rely upon it they are of a different grade to the men we previously had'; 'the disaster of these 7 men . . .'. J. F. Chance's notes add that Chance intended to reverse his policy: 'Acting contrary' to James Timmins's 'expressed opinion and plan' he intended to send some of the best foreign blowers to recruit their fellow men. There is a fascinating ideological shift here. He is treating the workmen non-hierarchically as autonomous, independent agents, repudiating James Timmins's assumption of managerial authority, which, indeed, his first instructions to his nephew bade him to exert.

Yet, quixotically, he wrote on the same day in high spirits to his brother and partner in the firm, William (and father of James Timmins). J. F. Chance's notes run: 'Saw a fine-looking fellow at the gate this morning—Everard's brother.' A friend of Gaspard André had offered his services, 'a first rate man'. Why couldn't Dorlodot supply such men? On 24 July he reported that Withers admitted that the first of the two Belgians had improved and could now blow the standard 40 × 30 16 oz. Admiration mixed with objectification ('a fine-looking fellow') and exasperation ('the two Belgians') coexist. Things ended cordially, however, with the 'charlatan' Dorlodot on 29 July, and, as agreements on wages, weights of glass, and weekly hours were made, he asked, 'How many men had Joseph André secured for Hartleys?'

Desperate Surveillance: A 'Want of Rigid Discipline'

The same mood swings and tensions occurred in the factory. 'You must have before you at all times . . . be especially watchful . . . take especial care . . . Go there constantly'.²⁰ The 'rigid discipline' John Homer was exhorted to maintain suggests glassmaking required an almost febrile surveillance. But the mood of crisis indicates that the will to impersonal

systematization was constantly thwarted by contingency and incipient disruption, checked by the individuality of workers, the economic intricacy of the wage structure, by unreliable devolvement to managers, and the perilous chances of glassmaking itself.

John Homer is enjoined to check the quantities made by each Sheet glass blower at the end of every 'journey' or shift, to interrogate him about short work, to send him for reprimand to Robert Lucas or J.T.C. (James Timmins) 'if it proceeds from idleness or neglect', to visit the 'defendant' at his house in cases of absence and to give no heed to 'pleas of sickness without strictest enquiry' (point 5), to heed the 'non-attention' or absenteeism of workers responsible for wastage (point 8), and to guard against infuriating absenteeism on Mondays (point 33).²¹ He must 'visit the warehouse daily and examine every man's work for yourself, and report to each manager the defects of each man's workmanship' (point 22). 'Above all, let no man absent himself, or neglect his work, from the highest to the lowest, without reporting it in your journal' (point 34). He must correlate manpower and logistics and avoid the mismatch of 'blowers lacking gatherers, and gatherers lacking blowers, from a want of rigid discipline' (point 8).

In the end, it came down to individuals: 'Leguay. See him constantly and report how he gets on, he and his son' (point 38).²² Zellar [*sic*], the highly paid shade maker (of glass domes) must not work at other tasks (point 17). Thompson, Oakes, and Parish must be directed to gathering if they do not blow (point 16). Workers were as dispensable—he must get rid of bad flatteners as 'we have plenty of flatteners' (point 28)—as they were essential. In a factory employing over a thousand workers in 1850 the intimacy with which workers are known is striking. Names and nicknames appear frequently in the Chance history—'Le grand' Meyer replaced the disgraced Zeller in 1836, but Zeller was evidently back in 1850 despite his rejection of Robert Chance in 1845, and stayed. In 1860 'Zeller's pub' is the scene of drunken abuse of 'JW' [John Withers?], a manager, by Joseph Neale. It was 'JW' who supplied this information to the writer of a letter to James Timmins Chance. Neale was accused of running a common shop system, blackmailing workers to buy from his brother-in-law's grocery store. 'George Neale was larking about . . . with some girls. He also drinks.' Another employee, Lawton, was there with someone else's wife.²³ Gaspard and Joseph André, Desguines, Stengre, and Felix Bournique were among the first imported blowers in 1832. Gaspard André exasperated the board by blowing short weights (Chance, p. 7). In a census of workers in December 1842, 'Workpeople employed by Chance Brothers', he and his 14-year-old son are both marked as being able to read and write.²⁴ The Neale family appears there. Stengre went with Robert Chance to Lyons in 1850 to secure more blowers for the Crystal Palace (Chance, p. 52).

Point 4 of the memo notes that the ‘different tariffs’ at which each man worked had to be calibrated with types of glass made, so that each could be made for the lowest wages. Workmen must be forced to work standard 16 oz glass, resisted ‘because they get more wages for 21 and 26oz’ (point 9). Men on guaranteed monthly payments must be kept working to justify this expenditure (they were paid by the piece, so these payments must equal the monthly guarantee). Arguably, economics drove the inward knowledge of men’s skills and natures, but these also drove wages. There was an unsystematic wage hierarchy. A document of 6 April 1852, ‘Guaranteed Foreign and English Glass Blowers’, shows that the range and type of payment varied greatly.²⁵ The highest paid foreign blower (nineteen were listed) was guaranteed £20 a month (the average was between £14 and £16). The highest paid English blowers, Joseph Parish and Thomas Thompson, were guaranteed £3 a week (£12 per month), but as gatherers they were guaranteed 30s. a week. (Barker’s wage list for Pilkington’s sheet houses in 1849 is roughly comparable, but the highest Chance wage is higher than Pilkington’s blowers were guaranteed (see above, note 14). Yet payment was by the piece—what Chance meant by tariff—and thus variable. These were among the highest artisanal wage of any trade, but the differentials were intricate, particularly if one includes Byzantine ‘Perquisites’ of variable rates of ‘House and coal’ payments, per annum or quarterly. And overtime rules added to the variations. An elaborate letter from Chance of 8 August 1849 stipulates a new quota of 360 and 375 cylinders of 16 oz glass over five to six journeys before ‘overwork’ is paid (basic payments were based on a norm of 60–75 cylinders per journey), provided the men work all the journeys—to prevent the men ‘from playing one journey, and making up for their deficiency by working over’. As ‘a compensation for burning their fingers’, gatherers were to be paid on the same principles.²⁶ It adds up to a combination of ruthlessness and flexibility.

‘Treat the managers great with respect . . . and support their authority’ (point 30), but John Homer was also enjoined to check their journals (point 7), and their arrangements (point 33). He must not even trust George Bontemps’s management of the shade blowing and coloured glass department (point 6). This suspicion of the highly distinguished Bontemps, the great scholar-technician of glassmaking, who had, as trusted colleague, collaborated with Robert Lucas in the introduction of Cylinder glass in 1832, and who had fled the continent in the revolution of 1848 to join the Chance firm, is quite extraordinary.²⁷ It is indicative of Chance’s tendency to fall out with managers, frustrating intermediaries whom he positioned as those links in the production chain always likely to let him down. The Hartley brothers, James and John, left amid recriminations in 1836 (Chance, pp. 19–21). Withers (teacher of the Belgians?) was reviled in Manichean

language for failing to organize supplies of furnace coal: ‘One of the great evils of our manufactory is the great influence of Mr. Withers.’ His ‘system of favouritism’ (Chance, p. 41), his ‘timid mind’ and ‘want of resolution’ (Chance, p. 42) would bring about the very strikes the manager feared. (He remained but Chance formulated plans for ‘getting rid’ of him (Chance, p. 46)).²⁸ Chance never did find the ‘master’s man’ he wanted, ‘one of the old set of managers, one who can gather, blow, flash and carry off’ as well as organize (Chance p. 41): when he thought he had discovered such a man, he found that he had been mistaken and hastily revoked on the day following the contract he had drawn up the previous night (Chance p. 42).

The memo points to the extreme tensions and anxieties of glassmaking, always in crisis: Chance’s document demonstrates the enormous difficulty of producing metal of the correct quality and colour (points 13, 21): ‘Broken pots [the huge Stourbridge clay founding pots] are the worst of all evils, and a report of every case should be instantly laid before me or J.T.C., and don’t rely on that, but tell me also’ (point 14). Breakage at five vulnerable points in production must be avoided at all costs—in blowing, cylinder splitting, carrying, cutting, and packing (point 23). The defects of unequal thickness (point 24), blisters (point 25), seediness (point 26), and poor flattening (points 27, 28), make glass unsaleable. Good glass is wasted. Henry Chance noted that sixteen kinds of human flaw had to be excluded from the process: on the cylinder nine kinds of blemish could be produced by the founder, gatherer, and skimmer, and the blower himself—‘on this abortion the flattener chances to have exerted his most exquisite skill’. A flattener can mark a perfectly blown piece of glass with seven kinds of defect.²⁹ All this was exacerbated by the anarchic potential of the factory, thwarting the drive to efficiency. There were episodes of drunkenness, fraud, stealing—‘we must have about us a set of scoundrels’ (Chance, p. 39). Men defected to other firms: ‘This losing of men annoys me beyond anything.’ Nevertheless, the systemic and structural instabilities of glassmaking were frequently displaced onto workmen, whose labour, at one and the same time, was conceived instrumentally and in terms of *personal* responsibility. Correspondingly the master’s (to him) appalling burden of surveillance was further intensified. The Chance dynasty was sustained by a high level of emotion. ‘[H]e had a way of expressing his opinions which impressed them, with singular force upon the memories of his auditors,’ the euphemisms of the obituary explained.

Breakdown of the Modern Ideal: Benevolence and ‘Paternalism’

‘[W]e injure both the men and ourselves . . . [who are] not mere machines, but have sensitive feelings like ourselves’ (Chance, p. 42). So the son of

William, James Timmins, the thoughtful seventh wrangler and brilliant technician from Cambridge who had joined the firm in 1838, wrote of the glassworkers when Robert Lucas Chance wanted to enforce a speedier rotation of work on the Crown workers in 1847. They threatened a strike (the defensive strategy associated with skill that was becoming obsolete), and James Timmins took their part against his uncle, though he did not refuse to work the 'impolitic' scheme. Chance seems not to have heeded a letter signed by forty-nine Crown workers in July 1847 claiming that they 'cannot with justice to ourselves and our families' sustain themselves on present wages.³⁰ And, indeed, wages were reduced in 1848 (Chance, p. 43). Yet, as one of the 'Black country elites' the Chances sustained a liberal reputation for ethical and progressive management.³¹ The 1851 jury praised their 'liberality, intelligence and spirit of enterprise' (Chance, p. 53): the obituary of Robert Lucas noted the largesse of his private 'beneficence... he never failed to relieve any authenticated case of distress... many a struggling family had to thank Robert Lucas Chance for the assistance that came secretly'.

The Centenary pamphlet of 1924 notes the 'close and friendly relations which have existed between employers and employed'³² (it printed a photograph of employees who had been with the firm for more than fifty years), and lists benevolent schemes: a Provident Society in 1841, a school for boys and girls in 1845 (10,000 pupils passed through it before the state took over), a Reading Room and Library in 1852, a Pensions Scheme in 1866, a dividend scheme in 1899. James Timmins Chance (by then Sir James), purchased 50 acres of land that became West Smethwick public park in 1895, seven years before he died in 1902. He gave the same sum, £50,000, to set up the Chance School of Engineering at Birmingham University. James Timmins, an Anglican, had wanted to go into the Church before he was precipitated into the glass industry.³³ His uncle was a dissenter, a Separatist, a group that aimed to return to the 'principles of Christian fellowship' as it 'subsisted among the first disciples of the Apostolic Churches'. He defrayed the cost of the Separatist Meeting Hall and a pamphlet addressed to an 'ardent admirer' of the Church of England is attributed to him.³⁴ His son, John Homer, assisted with the restoration of two churches and continued the philanthropic, religious, municipal, and civic responsibilities of his family, a 'key figure', as Trainor calls him, in West Bromwich charities. Education and 'intellect', John Homer believed, would ultimately lead to class 'levelling'.³⁵

There is no doubt that the Chances attempted to assimilate Owenite ideas to a capitalist framework in good faith—and with deep religious conviction. They appear to accord with paradigms of the culture of the factory that argue for the reciprocal bonds of an ethical paternalism and a

Women and Boys: ‘We all caught it sometimes’—some literal fractures

Women and boys did not leave the residues of their breath in the glass artefacts they produced, an intimate connection of the body with labour that endorsed the claim for uniqueness and specificity. But though they were essential to the final processes of production they barely figure in the ideal of the modern factory that the Chances attempted to put into practice. We know from factory tourists that women worked at the Chance factory in the smoothing and polishing departments. (Such women had caused a moment of erotic excitement in the lookers-on at their labour in Dickens’s account of a glass factory visit.) We can guess at the proportion of women in the factory from Pilkington statistics.³⁹ Maxine Berg reminds us that particularly in the later stages of industrialization cheap women’s and children’s labour played a major part.⁴⁰ We know that in Birmingham at large during the 1830s and 1840s women and children were increasingly substituted for male labour on the grounds of falling prices.⁴¹ Belgian window glassworkers from Charleroi area emigrating to America were accustomed to see women workers doing skilled work—flattening, cutting, moving glass cylinders—though women were subsequently excluded. Perhaps a parallel workforce pattern occurred in England.⁴² We certainly know that at the time of Martineau’s visit to Chance and Osler in 1852 she was particularly asked ‘*not to notice* the circumstances of women being employed instead of men’ in a cutting process. ‘In London it may perhaps create some unpleasantness and there may be those who might suppose that women not being so strong as men might not do their work so well though this is really not the case,’ Follett Osler wrote.⁴³ This is in many ways an astonishing letter. It implies that women worked cut crystal glass, grinding patterns with sand-and-water-sharpened cast-iron cutting wheels, a skilled process, and the one Ruskin singled out as the abuse of the glassworker’s body.

Women occasionally flicker into visibility. The Board Minutes of Chance for June 1843, actually simply lists of statistics on weekly production, contain, evidently for someone’s amusement, the following minutes, included among the statistics concerning types and amount of glass made that week.

10 June 1843

976 That there were *not any* slabs broken by Mrs Bray during the week.

17 June 1843

985 That there were not any slabs broken by Mrs Bray.⁴⁴

It looks as if Mrs Bray, evidently a polisher (glass was polished on glass), was quite as ‘strong as men’ when it came to breaking slabs. The object of

amusement, or else of charity, women get into the records as special cases. This letter from the wife of a deceased glassworker, who may once have worked at the factory herself, is included in a gathering of miscellaneous papers that someone (possibly J. F. Chance) seems to have selected to indicate the variety of calls upon the time and resources of the masters.

22 Oct 1847
Mrs George Jackson
Stating her needy circumstances

I respectfully take the liberty of addressing you and to [request?] any donation you may be pleased to make so as to assist in enabling me as much as possible to get through the coming winter—When my Daughter married Mr Jackson raised upon his policy of Insurance £50 to give her at parting and departure to America he also raised another £50 in the same way upon the departure of our son to New South Wales therefore I had no interest in this policy upon his demise.

I find my little furniture is of no value and nothing but severe distress presents itself before me—In this position if you will condescend to take my case into consideration I shall be most grateful for any donation that you may think proper to give me—At present I am confined to my bed through illness but when I recover will wait upon you at any time you may appoint to explain my situation if not unpleasant to yourself.⁴⁵

Boys, minimally paid, were often badly treated. A boy could cover thirty-two miles a day in a glass factory. He might sing to keep himself awake in the intense heat, at 80 to 196°F.⁴⁶ (Matsumura, p. 40). He had to run out for the men's beer, or if the factory was teetotal, he would undertake other errands. (Pilkington stopped factory drinking, but Barker does not say when (p. 94).) A workman stated that mature men would find the work of the taker-in too exacting: 'it would kill him'.⁴⁷ Violence was common.

Men used to knock the boys about and the boys would run away. I have seen men knock boys down and hit them with the iron or tools, &c. . . . I have some nasty cuts on the top of my head now that I got when I was little, but I did not get knocked about much because I worked with my own relations, and they took care of me.

Once I was taking in a glass and fell down and broke it, and when I came back and told the master [workman], he jumped up and ran at me and knocked me down and kicked me. There was a great bruise on my thigh from it. I saw a man hit a boy of about twelve on the back of his head with the blowing iron, which had some glass on the end of it . . . We all caught it sometimes . . . They leathered us sometimes.⁴⁸

There is an extraordinary acceptance of conditions: 'we like to play', 12-year-old Gaskell of Pilkington said to the Children's Employment Commissioners in 1865:

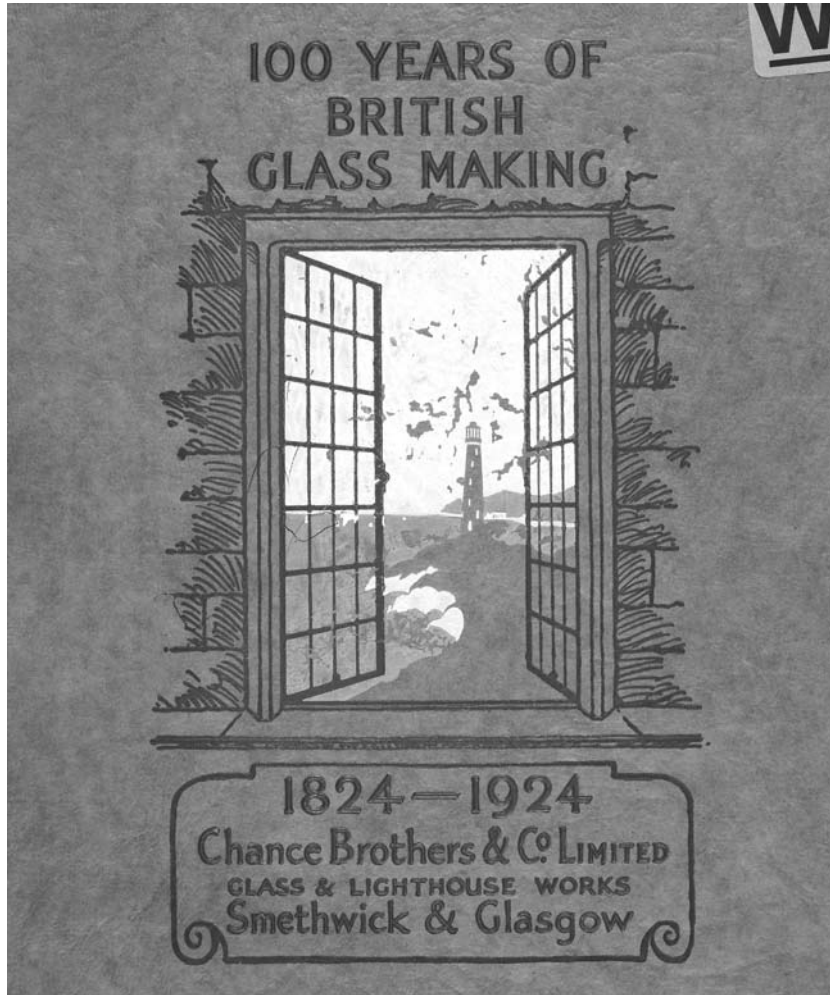
We are about ten hours on and twenty-four hours off, that is the journey; but we boys always get called about three hours before we start with the men, for we have to sweep up and get ready for them before they come. We could do it all in an hour if we liked but we like to play in that time. We are called at all times night and day. The 'teazer' or furnace man goes round the town and calls every boy in the house when the furnace in that house has heated the metal in the pots enough to start working in about three hours. He comes to the door at home and knocks and calls 'Gaskell', and then, if it's night, my father looks out of the window and the teazer says, 'Number—called'; that is the number of the [furnace] house. So I get out of bed and go off.⁴⁹

Decline and the Breaking of Chance: the Modern Idea and High Research

It is not part of my project to write a history of the Chance enterprise, but the reasons for its decline are bound up with the high ideal of modern industrial research. 'First member of his family to enter the works', Sir Hugh Chance recorded bitterly in his private diary, when Sir Austen Pilkington visited the firm in 1923, a year before the Centenary (Barker, p. 374). By 1854, Pilkington had levelled with Chance, and they became the two major heavy glass producers in the country: Chance's employees rose from 1,200 to 1,700 between 1852 and 1868;⁵⁰ Pilkington's St Helen's factory jumped from 450 to 1,350 between 1849 and 1854; they achieved parity with Chance with nine furnaces in 1854 by constructing a fifth sheet furnace in that year (Barker, p. 111). Chance made overall losses between 1892–5, and though it pulled back it did not expand (Barker, p. 161). There were three interacting causes of decline, over-investment in scientific research, strangely accompanied by failure to take technological opportunities, and the general background of industrial stagnation after the depression of the 1870s.

The first reason for the collapse of the Chance hegemony is perhaps ironically to be seen in the Centenary pamphlet: its cover shows an open window through which is seen a lighthouse on a promontory; 'Glass and Lighthouse Works' is the designation of the firm. An ambition for high scientific research, an intellectual rather than a commercial ambition, driven by the technological genius and noble aims of James Timmins (who is remembered as 'the late' twenty-two years after his death), marks the firm off from its competitors. The pamphlet positions the firm as arbiter of quality, just as Robert Lucas Chance had hoped and insisted upon (its sheet glass is a 'standard for quality' throughout the world (p. 9)), and the intellectual aristocrat of scientific innovation. Its thin glass for

Figure 10
Front cover of
centenary pamphlet,
*100 Years of British
Glass Making*
1824–1924, Chance
Brothers & Co., Glass
and Lighthouse Works



microscopic glass revolutionized microscopic work in the 1840s (David Brewster, indeed, relied on consultations with the firm (Chance, p. 48)). George Bontemps initiated the manufacture of telescopic glass (a 29-inch disc was exhibited in 1851) as well as possessing superb skill in coloured glass manufacture which continued to 1924. Between 1848 and 1914 the firm were the sole manufacturers of optical glass and supplied the armed forces in the First World War. It was pre-eminent in tinted and figured rolled glass (p. 16)⁵¹ and in 1923 had manufactured the first heat-resistant glass. But it is the establishment of the Lighthouse works in 1851 that elicits most (justified) self-congratulation. Chance ‘supplied and erected lighthouses for every maritime power in the world . . . beams from their apparatus flash over every sea in the inhabited globe’ (p. 11).

The lighthouse was James Timmins's passion. Not content with inventing grinding and smoothing machines that put Chance ahead of competitors in the production of polished plate even before he left Cambridge, he adapted the lenticular lighthouse technology of Fresnel and discovered a way of adjusting the beam to the horizon and eliminating dip, an achievement comparable with Thomas Stevenson's concentration of light into parallel beams.⁵² The firm was visited by the Royal Commission on lights and buoys in 1858, consulted by Sir George Airy, the astronomer royal, and Michael Faraday, in 1860. Chance was virtually a government agent and national and international provider of lighthouses. But the investment was huge—an acre and a half of factory, a 50-horse-power steam engine and specialist grinding equipment. James Kenward, writing on these achievements in Samuel Timmins's survey of midland industries in 1866, notes that the firm had lost £20,000 on lighthouse construction and, astonishingly for a *laissez-faire* document, argues that a government subsidy is the only way to make lighthouse manufacture possible.⁵³ Arguably, high research on behalf of the nation drained Chance Brothers.

This technological passion was accompanied by a curious lack of opportunism when it came to changing methods of heavy glass production, significantly after the retirement of James Timmins. In 1875 Chance attempted to move into the cast plate trade, imitating a move successfully made by Pilkington, a 'disastrous venture' (Chance, pp. 106, 108–10), and the factory was closed after a loss of £20,000 in 1876. In the 1870s also the company dragged its feet on the full introduction of the new gas-fired Siemens tank furnaces that enabled continuous production, night and day (it consumed too much fuel), whereas Pilkington adopted the new furnaces. 'It was a major error of judgment—and it was not rectified until 1892' (Barker, p. 139). Chance did not explore mechanically blown 'drawn' Cylinder glass, using compressed air, invented in America, either. This was largely as an alternative to drawn sheet glass produced in continuous bands, also made by machine, but it was not further developed until 1914. Pilkington obtained the right to work the drawn cylinder process in 1909 (Barker, p. 216), but adopted machine-drawn sheet in the 1920s. The displacement of skilled blowers occurred in the 1920s, though hand blowers were used until 1926 (Barker, p. 302). Chance were dependent on archaic blown sheet in 1926 and up to the 1940s.

As for the general decline of the glass industry, D. C. Allen, writing as a near contemporary, can speak: by 1914, 'The industry was recognized to be slowly sinking. The conservatism of masters and men in the face of improved methods of manufacture, and the lower cost of production in Germany, Belgium and America, were slowly bringing ruin to the industry.'⁵⁴

The internal conflicts that produced both glass and the glass culture of Victorian modernism were themselves part of that modernity. The era of glass blown by the human breath lasted over a hundred years. After that air from the artisan's lungs was never again the source of mass transparency.

Riot and the Grammar of Window-Breaking

The Chances, Wellington, Chartism

the dangerous propensity of the poorer classes for throwing stones...¹

The facets of glass culture I have looked at so far expose the complexities that went to the making of mass transparency. Factory tourism transcendentalized glass at the same time as understanding its darker meanings. Glass production at Chance occasioned incompatible readings of master, men, and labour. I now turn from the making to the breaking of glass. Glass was a crucial site of political conflict nationally, a visible target for violent demonstrations of fury and protest. Window-breaking was endemic to what a historian has called the ‘spectacular’ riot of the nineteenth century.² It defined the ‘mob’.³ Robert Lucas Chance’s brother William was involved in two of the following case studies of glass-breaking. In the chapter after this I look at the glassmakers’ written and spoken words, their forensic and compositional skill, and their sophisticated understanding of symbol. On the face of it this articulacy contrasts strongly with the violently non-verbal aggressive acts of the urban glass breaker, who committed one of the most powerful forms of urban violence in the century. Rather than contrasting this anarchic and inarticulate destructiveness with working-class self-recognition and the maturity of the educated artisan, however, I claim that there is a language of glass-breaking, and a continuum of concerns between the two plebeian groups (in any case we have no means of knowing how the groups overlapped). A ‘common self-understanding’ runs through the political language of popular rhetorics, historians agree, however variable, changing, differentially gendered, and constantly resignified this language is. This common understanding extends from the deliberate techniques of artisanal self-representation to the non-verbal language of the glass breaker. There is a grammar of window-breaking.⁴

William Chance twice listened to the sound of breaking glass and twice helped to precipitate a virtual festival of glass-breaking. The first episode

was in the pre-reform days of violent agitation in 1830 when, as High Bailiff (or Mayor) of Birmingham, in the early days of the Birmingham Political Union, he instigated a visit to the city by the Duke of Wellington and Sir Robert Peel at the height of their unpopularity and of Birmingham's extreme suffering under economic recession. The pair were ostentatiously shipped up the canal to view the Chance works at Smethwick to the sounds of a hostile crowd. The Duke declared himself 'astonished' by the process (did he see the earliest experiments with Cylinder?). 'The Duke of Wellington has paid a visit to Birmingham, and we question if he will soon forget it,' the satirical *Argus* wrote.⁵ He saw glass being made during the day and heard it being broken at night. In September 1830, the month of the Duke's visit, Birmingham papers described the sound of glass breaking all over Europe, reporting revolutionary action in Belgium, Saxony, Brunswick, and parts of Austria. '[N]umerous groups formed themselves, and proceeded to the offices of *La Nationale*. In a moment the windows were smashed, and it was attempted to burst open the door' (*Aris's Birmingham Gazette*, 13 September 1830, on insurrection in Belgium.) The second glass-breaking occasion was in 1839 when, as a magistrate of the newly incorporated borough, William Chance helped to precipitate a Chartist riot, attempting to put down a mass meeting in the Bull Ring. (As an Anglican, unlike his retiring brother, who took no part in public life, he could take public office.) With the Mayor, William Scholefield, he was responsible for a reprise of Peterloo on 4 July, turning sixty specially imported London police on a peaceful crowd and provoking nearly two weeks of riots which required the presence of the army to suppress. Analogues with Peterloo were explicit, and one working man was certain that the intention was to 'murder' the people.⁶

Of the first episode the Birmingham *Argus*, which described itself as a 'chef d'oeuvre of Satire and Politics', said:

On leaving the Society of Arts, the party were loudly hissed, hooted, and groaned . . . *ditto* at Thomason's, in Church-Street, *ditto, ditto* on their return to the Royal Hotel! During the dinner the mob outside became very violent: the Duke was called for: the lamps of the Hotel were smashed: and everything was done to show 'His Highness' that he was decidedly unpopular.⁷

The second occasion was far uglier, the result of high tension generated by Chartist mass meetings. Contemporaries registered the intensity of the Bull Ring riots in terms of the amount of glass broken. On 4 July 'the whole of the windows of the hotel [where troops sheltered from the crowd] being smashed in and some costly mirrors . . . completely destroyed'. In the culminating riot of 15 July 'From Moor Street to about a hundred yards beyond New Street there was scarcely a pane of glass left entire!' The crowd

attacked the Public Office, ‘demolishing in a few seconds every window in the front of the building’.⁸ There were eighty-seven panes of glass.⁹ A grocer’s shop was attacked (men broke through the protective wooden shutters ‘smashing a thick pane of glass inside’) and shop weights and sugar loaves were used as missiles in addition to iron railings. The riots peaked on 15 July, the day Chartists had designated as a workers’ ‘holiday’ or strike. The composition of the crowd was varied.¹⁰ But both the men and women in it were bound by shared interests.¹¹

‘We have mobs, we have riots, we have broken windows . . . and broken heads, and much injury done to, and destruction of, property. But we never fail to find the Justice of the Peace faithful to his trust . . . to put an end to the mischief,’ the Duke of Wellington wrote in August 1830 (the month before the Birmingham visit), with patrician contempt for the mob, then confident that revolution in England was impossible.¹² The visit was a fiasco. It must be assumed that William Chance’s activities as the major glass producer in the city would be a horizon for artisans well beyond the glassworker, as would the bitter economic depression of this period, the deeply radical though conflicted politics of Birmingham, and violent political agitation prior to reform.¹³ The ‘Chance Dinner’ (at Dee’s Royal Hotel), as it became known, was not only pilloried in the *Argus* but reported in detail by the *Birmingham Journal* and *Aris’s Birmingham Gazette*.¹⁴

The pair were invited by William, it seems, as a deliberate act of hegemonic aggrandizement, an attempt to move Chance from local to national prominence. Earlier William had refused to give his official support to the founding of the Political Union, the organization set up by Thomas Attwood to campaign for reform.¹⁵ Crucially, he refused to call a Town Meeting, a pre-reform ‘constitutional’ form of municipal sanction, to inaugurate the Union. Thus he put it outside the town’s political structures, ensuring its exile from procedures that could be sanctioned by the Bailiff. Not only this, he pursued his own liberal politics unilaterally, circumventing the Political Union and holding a private dinner for Wellington and Peel from which its members were excluded, but at which he nevertheless ineptly transgressed the agreed non-political protocol in a speech which praised Wellington and Peel for Catholic Emancipation at the same time as arguing for reform. In this way he simultaneously enraged different constituencies at the dinner, provoking violent outrage from different factions inside the room—*Applause and murmurs* is a constant aside in reports. The crowd assaulted the hotel outside while the hundred or so diners inside were in a state of uproar. Significantly, the radical *Birmingham Journal* of 25 September 1830, reporting ‘the Chance Dinner’, carried an advertisement for another dinner, that

of the Political Union, 'In Honour of the French Revolution'. It was almost as if William courted analogies with the church and king supporters who had destroyed Joseph Priestley's laboratory in 1791. The Chance Dinner was an occasion of conspicuous consumption. Wines of 'the choicest and rarest description' and every 'delicacy which the most varied and fastidious taste could desire, or the season afford, absolutely loaded the tables' (*Birmingham Journal*, 25 September 1830). The Wellington party entered to the strains of 'See the Conquering Hero Comes', and there were glees and music throughout the evening. Yet to see the dinner as the focus of purely radical protest would not be to put the emphasis where contemporaries did: the Tory *Argus* was as violent as any of the print media in its protest. At this stage the Political Union (which the paper supported) was aiming for cross-class accord in its reform programme.¹⁶ William had divisively flouted the discourse of *mutuality* that drove the language of the Union in its early phase. Hence the *Argus* accused him of illegality.

That whipper-skipper little saintly gudgeon, W. Chance *Esquire*, has again declined to call a Town's Meeting. In January he refused to preside at the formation of the Union, on the squeamish plea of his *loyalty*: since then he has avowed himself a Reformer, and *legally* declines to sanction a Meeting to address the King! Admirable chicanery: shall this wooden-headed puppet be again allowed to insult the King, and degrade the Town? Let the High Bailiff be regarded with the contempt his *illegal* office demands, and we shall soon have this Gog of the Court Leet as low in the dust as any Dagon of the same party.¹⁷

The paper burlesqued his fawning sycophancy to the patrician Wellington, symbol of all that refused to countenance cross-class accord, the 'monopoly' of aristocratic 'Old Corruption'. (It associated Wellington's aristocratic disregard of sociality with sexual flouting of norms, dubbing him a 'military sexagenarian Romeo', adulterously accompanied as he was by Mrs Arbuthnot; 'This pretty pair stopped at Drayton. Is Lady Peel blind?') It reserved the fiercest ridicule for William Chance—a 'toad-eater, hat-holder, and Court-Leet slave'.

The party above-named first visited the Society of Arts. 'The High Bailiff, and other gentlemen', joined them there. The rooms were full. The High Bailiff—whose perpetual 'booing' reminded us of the advice of a certain *Sir Pertinax Maesycophant*, seemed to feel the influence of the great man's presence, for he bowed 'as if by instinct'. His conversation *to* (not *with*) the Duke ran thus:—'Ladies and Gentlemen! don't crush his Grace. Your Graceship (!) must be annoyed by the crush? They are so very anxious to see your Grace. Allow me to carry your Grace's hat: it must tire your hand. Pray, don't crush his Grace! Mr Low Bailiff, keep the people off; they incommode

his Grace. Is your Grace incommoded? Let me carry your hat, your Grace. Look at that picture, your Grace. 'Tis as natural as life. I wish, your Grace, you'd let me carry your hat. Pray don't be pressing on his Grace. *Do* let me carry your hat, your Grace'. Every 'your Grace', was accompanied by half a dozen bows, and, finally, at the fourth 'time of asking,' the hat was given to Mr Chance, by the desire of Mrs Arbuthnot, and he carried it (as a flunkey would) while the Duke was in the Exhibition room.¹⁸

The Chance dinner ran out of control despite William's attempts to bring it to order—'I think we had better stick to the toasts', he parried, when in the 'confusion' an anti-Catholic attempt was made to reply to his support of Catholic emancipation. But he could not control a prolix and meandering speech in support of reform made by Mr Charles Tennyson, MP, of Ripley Castle, castigating the Duke, that 'illustrious warrior', for resisting reform and excluding the great manufacturing cities from representation. This speech, according to the *Birmingham Journal*, provoked 'conflicting demonstrations of the opinions of the room . . . and it was evident that certain portions of it were unpalatable to some persons present in the mixed company assembled'. The Tory *Aris's Birmingham Gazette* (27 September 1830) refused to report it. Tennyson attempted to adapt a rhetoric of unity paralleling the discourse of mutuality then uppermost in the Political Union for a flagrantly middle-class agenda. He argued for reform as patriotism and the sign of Britain's national greatness through a rhetoric of 'the People' whose ambiguous semantics sometimes included and sometimes excluded the working classes, sliding between popular, plebeian discontent and rightful middle-class grievance. But reform was clearly seen as the prerogative of the middle classes. For the purposes of this speech they *were* the People. He warns against working-class revolution, as if this could be prevented by middle-class enfranchisement.

A noble Lord, present at a dinner given to the noble Duke at Manchester, had been reported to have propounded as an enigma, the alienation of men's minds in the present day, from the laws of the country, and the diminished respect of the people for the aristocracy. 'This', said Mr Tennyson, 'is the noble Lord's enigma. He leaves the solution to others. *Daras sum non Oedipus*—but I may venture to pronounce that the phenomenon arises from the increased intelligence, wealth, extent, and power of the middle classes of the people, especially in the manufacturing towns and districts. A conviction has burst upon them that there exists no due and sufficient connections between them and the legislature by which they are taxed and governed; and that the aristocracy have, to a considerable extent, appropriated the elective rights of the people.' (*Applause and murmurs*) . . . Some change in the representation of the country was indispensable (*Murmurs*) . . . [The Duke must have been] apprized of what was really passing in the minds of the masses of the people by whom he had been surrounded. [An oblique reminder of the hissing crowds.] (*Birmingham Journal*, 25 September 1830)

It was so easy so conflate Tennyson's rhetoric with that of the Political Union that *Aris's* was asked to carry a disclaimer repudiating a claim that he was a member.

The same uneasy logic is at work in the early days of the Union. In the act of asserting unity the identity of class interests was problematized. A note in the radical *Birmingham Journal* for 1 January 1831 is an indicator of the anxiety of inclusion: it attacked the *Aris Gazette*, the Tory paper, for misreporting the presence of 10,000 working-class participants at a Town's Meeting called by the Council of the Political Union. It attempted to assert joint working- and middle-class solidarity and its democratic status. 'The assembly comprehended a very numerous portion of the middle classes.' The meeting was also attended by 'gentlemen belonging to almost all ranks and all parties of the town'.¹⁹

The problematization of unity was itself a new *political* experience. The hissing groaning crowds that dogged the Duke's party literally and symbolically deconstructed false unity by smashing glass, asserting their own agency and separateness. Attacking property, not people, uninterested in theft, purposefully pursuing the man who personified exclusion (forms of protest George Rudé has associated with protest at this historical moment),²⁰ the crowd in 1830 performatively demonstrated its alienation from process in an expressive act. They *affirmed* something about the specificity of their own experience as well as, or through, shattering glass.

By 1839 the discourse of inclusion was permanently fractured. Historians argue for an ultimate schism between the middle- and working-class members of the Political Union.²¹ By 1839 Birmingham had become a centre for Chartism, which had evolved sophisticated, nationwide organizational structures and a programme that endowed working men in particular with a new self-consciousness. It hosted the Chartist Convention in May 1839, and tension grew. Crowds met twice a day in the Bull Ring to listen to speeches by local male and female speakers and leading Chartists, including Feargus O'Connor. The Bull Ring crowds of 4 July reacted to the surprise attack of the London police, according to Clive Behagg, with stunned silence and then with a demonstration of physical force, on this occasion answering violence with violence. The same signifiers of fury, glass-breaking, took on more extreme meanings in comparison with 1830. Nevertheless there is a recognizable grammar of glass-breaking in the century. It is a counter code. It can be deduced or read *through* patrician or upper-class readings of glass-breaking. The Duke of Wellington, whose Birmingham experience may have been his first encounter with breaking glass directed specifically against him, exemplifies these readings.

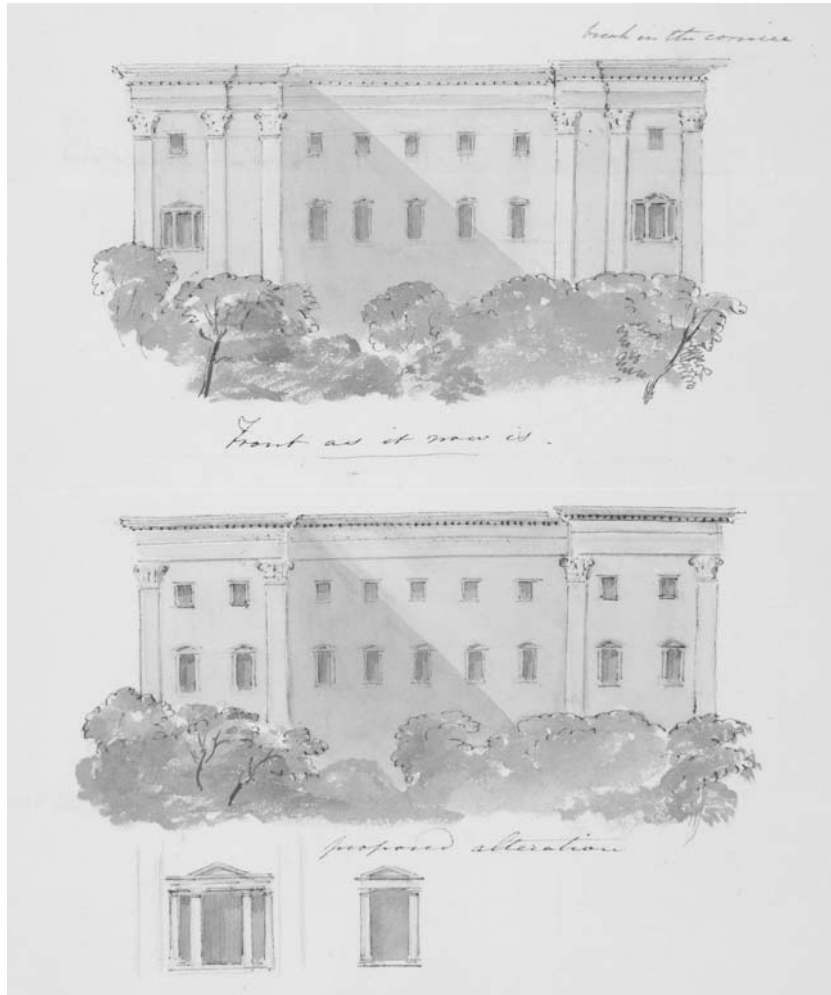


Figure 11
 The redesigned
 windows of Apsley
 House, 1829, later
 attacked by the ‘mob’

Wellington’s Windows

Wellington cared about his windows. He had cared enough about the windows of the north front of Apsley House to have had them redesigned by Thomas Liddell in 1829.²² Yet his windows were broken three times in 1831, on 27 April, in early October, and again on 12 October. The previous year in November, two months after the Chance visit, they were also broken. The following responses to window-breaking reveal a patrician code of understanding. For him window-breaking was a praxis, a *style*. I have chosen five episodes that chart Wellington’s readings of window-breaking.

Episode One. Complacency, noted earlier. Of the 1830 revolutions: ‘Yet who ever heard of a mob in possession for three days of a town in England? We have mobs, we have riots, we have broken windows . . . and broken heads,

Figure 12
Riot and the cultural imaginary. Hablot K. Browne's portrayal of 'spectacular riot' for *Barnaby Rudge*



and much injury done to, and destruction of, property', but Justices of the Peace never fail in their duty. August 1830²³

Episode Two. Blaming the parish underclass: 'Letter from Messrs. Farrers and Company to Arthur Wellesley, First Duke of Wellington [30 April 1831], advising against claiming compensation from the parish for the windows of Apsley House broken by the 'mob' . . . This is impossible.' An earlier ruling would have allowed claims.

'This has been repealed. The new clause employs the word feloniously. The windows were not broken with a felonious intent.'

John Mugford, Butler, Public Office, Bow Street, London: on 27 April [1831] 'a crowd gathered outside Apsley House. The crowd threw stones at the windows; twenty four panes were broken. Mugford cannot identify the offenders.'

James Cadwallader Parker, glazier, Spurr Street, Leicester Square, London: 'the repair of twenty four panes of glass will cost fifty nine pounds twelve shillings.'²⁴

Episode Three. Unilateral Reprisals: 'A mob came to break the windows of my house . . . They continued to break them till my servants fired some powder from a blunderbuss from the roof of the house. There were no constables there to remonstrate with the mobs.' 6 October 1831.²⁵

Episode Four. Exasperation: A 'mob' of three thousand or so, harangued in Regent's Park on Monday [11 October 1831], 'marched to St James' yesterday [Tuesday 12 October 1831] as in the previous November riots: ' On their return from the Palace my windows and those of others were broken. Lord

Londonderry was assaulted on his way to Parliament, all this by daylight.’
13 October 1831.²⁶

Episode Five. Complacency again, on the rejection of the second reading of the Reform Bill by the House of Lords: ‘A few windows were broken and other outrages committed but we have gained six months of time.’ 18 February 1832.²⁷

The Patrician window-breaking code

(1) That window breaking is endemic to the lower classes and because of this *means nothing* and can be disregarded. I have already quoted Wellington’s patrician insouciance towards broken windows and broken heads; in 1832 the six months gained for regrouping after the failure of the second reading of the Reform Bill outweighed the costs of riot—‘A few windows were broken’. Window-breaking is a non-formal act of violence, a certain *style* of crime without a content, and Wellington’s early public response to it is good-natured contempt, almost *noblesse oblige*. Later he reacted more violently—indeed with increasing panic and paranoia—when he believed the Birmingham Political Union to be arming for revolution. But the assumption of the crowd’s endemic irrationality is still fundamental.

(2) The ‘mob’ is a designation appearing four times above in contemporary collocation with window-breaking—a contraction of *mobile vulgus*. It signified a disorderly, lawless rabble, composed of elements of the population of no account as individuals. It was a heterogeneous aggregation of illiterate members of the underclass, who were precisely a mob because they were incapable of being organized or submitting to organization. It is significant that the Butler, nearer to the perpetrators in standing, uses the term ‘crowd’ rather than the patrician ‘mob’ to describe the stoning of the windows. *By definition* the mob were *mobile*, incapable of rationality. The definition of the mob became a self-fulfilling prophecy and carried its own explanation of violence within it: one had to look no further than the signification of the word for an explanation of violence. The astonishing lack of introspection as to the causes of the revolutionary situation of the 1830s in Wellington’s correspondence comes in part from the ideological limits of his language, which made him literally incapable of analysis. Informers offered him essentially consoling language of mob rule about his ‘reception in the north’. ‘The Birmingham Political Union caused some difficulties; a mob can always be found for ale’;²⁸ ‘half of the crowd were women’; ‘a third of those attending were women’.²⁹ We know, however that women were active and articulate in such meetings. According to Helen Rogers they were ‘spectacularly’ mobilized by 1838, when 12,000 women attended a town hall meeting. Before the founding of the Female Union in 1838, and the extraordinary activism of Mrs Lapworth, its President, earlier campaigns for an unstamped press and for trade

unionism had involved women, so the women reported to Wellington would not have been passive.³⁰ To feminize the crowd by seeing it as non-rational was, however, a consequence of the ideological closure of the Duke's language.

(3) The mob strikes at the heart of the *legal* foundations of civil society, property. Hence Wellington's lawyers' zealous but unsuccessful attempt to claim compensation from the parish for the broken windows (£59 12s. was about six months wages for the very highest paid artisanal glass worker—over a year's wages for a Crown glassmaker). For him the Reform Bill, like the activities of the mob, was simply illegal, destroying the constitutional legality of the existing order by voiding the charters of the ancient boroughs. For this reason, at the Chance dinner, in reply to the toasts, the Duke 'made no allusion whatever to the speeches of the preceding speakers'. There is something wonderful in Wellington's imperviousness to political argument, while the crowd called for him outside. He simply praised 'your enlightened protection and encouragement of the arts' (*Aris's Birmingham Gazette*), as did Peel. Not the vote, but art, was to legitimate manufacturing enterprise.

(4) Given the primacy of private property, private individuals could defend it by violence against the mob: 'my servants fired some powder from a blunderbus from the roof of the house.' Window-breaking was thus defined as a series of discrete, sporadic, unconnected acts against the private citizen. The Birmingham Political Union represented a new kind of criminality altogether—Wellington became convinced that the Union intended insurrection with a private army, usurping the king's prerogative to levy troops. Thus he undervalued the strength of crowd protest on the one hand and exaggerated the terrors of the Political Union on the other, persuading King William IV to proclaim the illegality of armed bodies.³¹ (Thirty-six letters alluded, many at length, to the Birmingham Political Union between March and November 1831.)

The logic of this patrician window-breaking code was so strong that it prevented Wellington from seeing the symbolic importance of the window and its strategic use as a political statement—he had been informed of the ritual of 'illumination', the mass lighting of candles in windows, in Dublin in 1828 prior to Catholic emancipation, a silent and peaceful practice impossible to prevent.³² He did not connect window-breaking with European revolutionary feeling and political demands, though as early as 1827 he was informed of window-breaking in Portugal.³³ Nor did he recognize the substantive violence committed by the authorities in riots—in June 1831 in Merthyr Tydfil troops fired from windows of the town's main inn, killing twenty-one men, and in November 1831, during the Bristol riots, constables deterred 'the most determined of the throwers of stones at the

windows' and some 100 to 150 persons were killed over a period of three days of rioting.³⁴

The Plebeian Counter-code

(1) The window breaker affirms his action as part of a *collective* action. Window breakers acted in groups, rarely alone, to increase the difficulty of being caught, but also as a demonstration of solidarity. George Rudé has pointed out that crowds are constituted by diverse factions and groups of different status and with different agendas, but they could nevertheless create a *performative* unity displayed by the spontaneous capacity to organize.³⁵ 'none of the Belgravia window breakers have been caught . . . The mob seems to have dispersed. The streets were still full, but of well dressed people seeing what was going on, and attracted by the broken plate glass windows,' a memo to Lord Palmerston in 1855 affirmed.³⁶ There was an element of spectacle, an aesthetic, intrinsic to window-breaking.

(2) The shock of window-breaking asserts a violent shattering of barriers that has both symbolic and literal meaning. The *jouissance* of window-breaking is associated with violent, traumatic sound and the insistence on being *heard*. To be heard in turn is to be redeemed from anonymity. This refusal of anonymity is of a piece with the corresponding move of the crowd to attack concrete and specific signifiers of oppression—an employer's house, an exploitative trader.³⁷ That is, attack is not motiveless or arbitrary. A kind of primitive phenomenology is in force, in which the irreducible physical body of the stone thrower and its sheer power comes to demonstrate individual prowess and thus uniqueness.

(3) Window-breaking is an end in itself. As Wellington discovered, a *lack* of criminal activity cost him dear: no felony or looting was associated with his broken windows. During the Bull Ring riots of 1839, Clive Behagg records, the crowd displayed disapproval of those who looted; a boy 'with his pockets stuffed out' was upbraided: 'what have you got there, that is not what we want, we are too brave for that'.³⁸ Private property, usually of those who were directly connected with oppression or exploitation, was attacked and destroyed, but not stolen.³⁹ This affirms a reading of property at odds with the Wellingtonian primacy of ownership. In his classic essay on the language of Chartism Gareth Stedman Jones argues that a conceptual alliance between the middle and labouring classes occurred, because they shared a notion of the primacy of property.⁴⁰ (This argument is a corollary of his understanding that Chartism articulated a rational and *abstract* political language of representation and non-representation rather than a discourse of suffering.)⁴¹ Nevertheless, the similarity is purely symbolic. The property owner owned things, whether buildings or capital,

which could be exploited for profit in the market at a remove from his body, and which indeed allowed him to exploit the labour of other bodies. The worker owned his body, and only immediate physical labour could provide him with livelihood. His labour was always a form of use value forced into a system of exchange. The attacks on property dramatize this difference, affirming the independence and agency of the body—again a primitive phenomenology comes into play.⁴²

(4) Window-breaking constitutes a symbolic and ideological challenge in several ways. In breaking a window you were destroying the product of artisanal labour conspicuously exploited for profit. In breaking a window you were demonstrating that the very area of greatest vulnerability in a building was one of its most luxurious commodities. The building must in some sort have become a body, whose vulnerable orifices could be attacked. Indeed, in breaking a window you were claiming that the *ownership* of the window was not to be identified with the domination of the gazer from inside over the space beyond the window. That is to say, you were fundamentally challenging his or her perceived right to his *perspective*, and insisting that there are other perspectives, from the other side of the window. This is an ideological challenge because it is about claiming a different interpretation of yourself than that of the property owner's, wresting a different perspective from him and demonstrating that his are literally constructed categories, bound up as they are in his very buildings. Moreover, though one would expect a consciousness of the metonymic work of exchange to be the prerogative of the property owner, accustomed as he would be to dealing with the variable equivalences of the market, and thus possessed of a heightened awareness of abstract or symbolic equivalences, such a perception would not be solely in the ownership of the property owner. A working populace relatively newly educated to wage labour—we must remember that payment in 'truck' or kind, was still a residual practice and that several well-known cases were brought by workers against employers⁴³—would also be sensitive to being caught up in a network of equivalence and substitution. Gareth Stedman Jones, arguing for the possession of a complex language of politics on the part of Chartists, writes that Chartism 'was constructed and inscribed within a complex rhetoric of metaphorical association, causal inference and imaginative construction', and others have expanded on the metaphorical possibilities open to plebeian subjects.⁴⁴ A worker would know experientially if not theoretically that accounts of wage labour are caught up in equivalents, and would be aware of the abstraction of labour that follows upon substitutions that equate labour and money. The window breaker asserts through action and *practice* the literal materiality of his body. But this resistance to abstraction entails an understanding of

symbolic meaning. Certainly this resistance can only explain the stubborn refusal of substitutive accounts of labour in later debates by glassworkers to which I will shortly turn.

The visceral pleasure of breaking a window and its energizing arousal, understood as ritual and symbol, is a form of aesthetic experience—Ruskin believed, a typically pessimistic insight, that physical *gesture* was a form of expression taken by oppressed labour. However the grammar of glass-breaking worked in opposite directions. At one level it was tied to the literal, to the simple somatic immediacy of violence which proposes there is nothing between you and the other, and sustains the illusion of an unmediated subject/object world where abstractions dissolve. The penetration of the brittle membrane of glass becomes an act of destruction in which there is no escape in thought from its sheer literalness: the act is incapable of generating further meaning. It is an act of social despair. At another level it displayed symbolic understanding, an understanding born of an engagement with the experience of abstraction and substitution as lived experience in the commodification of labour.⁴⁵ It destroys and affirms in a complex way.

The historical meaning of glass-breaking changes. The suffragettes who broke plate glass shop windows in the late century gendered the practice.⁴⁶ In the case of the systematic destruction of Jewish windows in the Fascist Kristallnacht of 9–10 November 1938, this brutalizing assault racialized the window. Because it always relies on shock, window-breaking must always be brutal. The practice of glass-breaking had no hold on the glassworkers and their disciplined strike, to which I now turn. Their writings and speech, nevertheless, hold things in common with the grammar of glass-breaking.



4

The Glassmakers' Eloquence

A Trade Union Journal, the Royal
Commission, 1868

Seeing, then, that we labour at a beautiful art, is it not our duty and privilege to excel in the same—to spur on each other to surpass our forefathers—to be ambitious for our own credit and attainments, and to study taste, richness, and beauty.

Anonymous writer in *The Flint Glass Makers' Magazine*

'The changes of form seem almost miraculous, rather deserving of the term 'creation' than that of 'manipulation' . . . Perhaps there is no employment so dependent upon steadiness of nerve, self-possession, and skilful manipulation, as Glass-making. It requires adroit adaptations of the simplest tools, for the rapid production of manifold forms and designs, upon the most pliant material, while it retains its heat; and perfection depends not altogether upon long-continued practice, but upon a certain innate tact, without which no workman can ever rise to eminence.'¹

'This wine glass that I have in my hand . . .' (Joseph Leicester); 'the foot is the most important part of the glass (*holding up a wine glass*)' (T. J. Wilkinson). Giving evidence to the Royal Commission on Trades Unions in 1868 each man, in a performative act, brought a wineglass into the hearings as emblem of the trade—'*holding up a wine glass*'—manipulating symbol and spectacle as well as rhetoric.² The wineglass is a point of reference throughout: comparing the production of eight-man sets in Paris with a four-man set in England, Wilkinson showed that only thirty more glasses per shift are produced—'a commoner article than this glass in my hand' (18787). It is over the wineglass, too, that the desperately contentious apprentice question and the problem of surplus untrained labour is addressed by Joseph Leicester. A novice boy spoils the bowl and the stem of the glass if he spoils the foot—'and the master says to the man, 'You should have seen it', docking up to half the man's wages (18798).

The semiotics of the wineglass go to the heart of the making of decorative flint or 'white glass'. They point to the rigorous traditional working pattern maintained through the organization of 'Chairs' or stratified groups of three men plus a boy whose names derive from the processes of making a

wineglass: the ‘Workman’ (sometimes termed gaffer), who performed the skilled work sitting on a special chair before the furnace, the servitor, who was a secondary partner in the process, the footmaker, who fashioned the feet and stands of the wineglass, and the taker-in, or boy, who carried finished work to be annealed. Chairs worked in relays for a six-hour ‘turn’ in split shifts, each Chair working a twelve-hour day. A six-hour turn or ‘move’ would produce 160 standard wineglasses and about eighty of the best.³

This chapter moves to the Flint glassmakers and their trade union magazine. Here, though in the context of waged labour, the meanings latent in the glass breakers’ practice come to the fore—a conflicted problematic of solidarity, the irreducible nature of the body as the worker’s property, a refusal of abstraction by asserting the non-substitutable place of the worker in the structure of the Chair. Fought out in the controversy over the use of apprentices, ten years earlier than the Commission, in *The Flint Glass Makers’ Magazine*, and a contributory cause of the great strike of 1858–9, the themes of the commission are anticipated, at times agonistically: the ethical problem of collective fairness, pride in the uniqueness of labour—‘we labour at a beautiful art’—and determination to perpetuate the structure of the Chair as guarantee of the irreplaceable body and its particular skills. Given the abbreviated lives of glassworkers—‘glassblowers and enamellers’, a medical historian reported in 1866, were ‘liable to special disturbances of their health’ in a city with a high proportion of lung disease and ‘pthisis’⁴—and their expenditure of life breath to maintain themselves, this stress on the irreducible body is unsurprising in a trade that depended on the unique moment of breathing. (Glass-cutting, finalized through a polishing process with putty powder composed of lead and tin oxides, ‘quickly poisoned’ the worker.)⁵ This stress on specificity also determined arguments about the freedom of labour and gave them a particular shape. It shaped the major dispute of the period—the use of ‘surplus’ apprentices.

The Writing Glassmaker

Over three issues, beginning with the last issue of 1857 and continuing into 1858, the year J. W. Woolley (who saw the Society through the great strike of 1858–9) was voted into the Central Secretaryship of the Society, *The Flint Glass Makers’ Magazine* carried seventeen letters written under pseudonyms, some of them several thousand words long, on ‘The Apprenticeship Question’, which is the context of the strike.⁶ The central issue, in an exhaustive and vehement debate, was ‘surplus’ labour: the supply of apprentices in the glass trade created a labour glut that exceeded

available places for them, lowering wages and displacing skilled workmen. The letters were eloquent, often rhetorically elaborate, displaying that delight in heteroglossia and hyperbole that has been associated with plebeian language as the sign of an assertion of agency, rather than the simple subversion of power.⁷ Here ‘Theon’, who initiated the debate, replies to an opponent, arguing that ‘surplus’ apprentices are not the cause but the effect of an ill-managed promotion and training system. His language is flamboyant and partly turns on linguistic critique, displaying, like many letters, extreme awareness of the management of metaphor. His opponent uses mere ‘figure’ that has the superficial appeal of magic lantern pictures without coherent intellectual power. His opponent naturalizes the fountain image, seeing the never-ending supply of apprentices as the source upon which unscrupulous employers fed. Thus his opponent offers a deterministic reading of the power of employers, Theon says, unaware that the fountain is *constructed*. The supply of apprentices, in other words, is not a fact of nature but can be managed. The understanding of metaphor intuitively grasped by the glass breaker appears here in an act of self-conscious political deconstruction.

Now I hope my opponent sees the cause of our surplus labour, emanating from that source which he has, without mature study, termed the cause. He says ‘Is not this the starting point, where men [the workman, the senior figure in the glass making team] are made?’ Yes, very true, boys become men, but his argument is based on false premises, we do not see boys or apprentices take workmen’s places, but we do see servitors take workmen’s places, thereby making vacancies for young servitors, footmakers and boys . . . Another question put ‘Is not this [the surplus apprentice] the fountain from which our employers draw to supply their wants?’ Yes, they do, and you ought to know that they are made thirsty before they do draw, that is, they cannot get their places filled up without putting young footmakers on . . . the promotion of boys cannot keep pace with the promotion of servitors: hence the great number of workmen continually on the funds, and, at the same time, so few footmakers. In the same sentence he is pleased to say ‘as such is it not the first cause and root of the evil?’ Mark his beautiful figure, which has no substance, and, like the figures produced by a magic lantern, they only please the eye. I have no doubt that many of your readers will agree with me, if my opponent does not, that a fountain is not self-caused, but caused to flow by some other agent independent of itself.⁸

The debate was intense, impassioned, and dialogic: the pseudonymous ‘Uncle Joseph’, for instance, used the analogy of a revolutionary polis, a king or ‘governor’ of a people in want, to describe indigent footmakers: instead of enjoining ‘*self denial*’: ‘would you not rather set yourself to work immediately to relieve their wants . . . Do you ask how this is to be done? *By assisting them to get their wages advanced*, which may easily be accomplished if we but act upon

the motto of “all for each and each for all.” Do you ask how? *By keeping back apprentices* until they (the footmakers) have obtained a better price for their labour. . . . But let the workmen first set the example, and help to raise the servitors and footmakers to a more equal position with themselves. . . . by so doing we may be united in our efforts of right against might.’⁹

‘F.P.’ set up a dialogue:

THOMAS. Do you consider it right for a young man to be kept back?

WILLIAM. No, I do not, but I should like to see a system formed that would be fair, alike to young and old.

THOMAS. How could such a system be formed?

WILLIAM. By getting the average life of a glassmaker, we should know how long he should be able to work at his trade; by dividing it we could tell how long he would have to make foot, and how long to serve before he be put to work.

THOMAS. Would not this be a difficult task?

WILLIAM. I believe it would; but if every district kept a list, and every one took his turn by the roll, every one then would take his turn properly. . . .

THOMAS. Do you think this could be done with fairness to all?

WILLIAM. I do. . . .¹⁰

The three cardinal principles of the grammar of glass-breaking—collective action, the body as property, and the refusal of abstraction—re-emerge here in these written testimonies. In the intractable problem of apprentices the central issues reappear, conflicted and problematized, to be sure, but in recognizable forms. The counter-code here revolves round three issues. First, the problem of organizing work and the workplace for collective fairness and on egalitarian principles when the structure of the Chair resists it. We have already seen the anxieties about collective fairness: ‘the promotion of boys cannot keep pace with the promotion of servitors: hence the great number of workmen continually on the funds’; ‘*By assisting them* . . . if we but act upon the motto of “all for each and each for all.”’ ‘Do you think this could be done with fairness to all? I do. . . .’ Fairness, though, in what ‘Uncle Joseph’ envisages as an egalitarian polis ruled by a democratic monarch, comes into conflict with principles of self-help, self-interest, and advancement: ‘Self preservation is the first law of nature’;¹¹ ‘And, besides this, it is the duty of every one to strive to reach the top of his profession . . . filling so respectable a position in society’.¹² Apprentices, ‘like so many torpid snakes, take their [the skilled workmen’s] places’.¹³ This is a contradiction that remains unresolved but it *surfaces* as a contradiction. Poems in the *Magazine* stress unity and brotherhood but even these show strains. ‘Long Live the Working Man’, for instance, its title also its refrain: ‘Of course for work we get and give, | As brothers should with brothers’. The alliteration on ‘get and give’, giving equal weight to opposite actions, underscores the problems of getting and giving according to a fair ‘social plan’.¹⁴

The second principle of the counter-code is the perception of labour as property, which is part of one's identity but constantly reduced to commodity: "Is not this [the surplus apprentice] the fountain from which our employers draw to supply their wants?" Yes, they do . . . ; 'our labour is just a commodity . . . the employing classes consider that their only duty towards labour is to get it as cheap as possible';¹⁵ 'masters are ever ready to get their work done at the lowest possible price . . . [apprentices will become] like a noxious weed, which the more you pluck, so long as the root remains, will only spring up afresh.'¹⁶ Opposing solutions, the restriction of apprentices as fodder for cheap labour, or the technical and actuarial regulation (see the dialogue between William and Thomas) of promotion within the Chair, are nevertheless made within the same conceptual framework that resists economic exploitation and refuses the model of labour as a quantifiable abstraction, even when the facts of exploitation are recognized—'labour is just a commodity'.

Finally, there is an understanding that saleable labour is caught up in a network of equivalences that open out a world of substitution. This abstraction of the worker brings forth a corresponding reaffirmation of the specificity of labour. Metaphor has its concrete and abstract moments. To be aware of substitution is to speculate on the *nature* of equivalence. A sharper sense of both the literal and the metaphorical work of exchange and *value*, a deeper understanding of what is owed to labour, are the emancipatory moments of saleable, exploitable labour.¹⁷ It is in the interests of the working man to sustain the concretion of metaphor rather than its abstraction. The form this takes is an insistence on the inviolable, non-expendable structure of the Chair. This is paradoxical, because it is both a 'conservative' and a radical move. In the Chair's unsubstitutable roles—Workman, Servitor and Footmaker—the task and the identity of the worker are one. The assault on its integrity by the substitution of untrained apprentices would change the social lifeworld. It was essential to mark off the Chair from the anarchic sweated labour of the exploitative London 'crib', which occasioned an eloquent attack from Joseph Leicester—masters are 'driving each other down to starvation prices'.¹⁸

As Pilkington's historian reminds us, these writers were privileged working men 'in the forefront of the artisan class', earning more than iron founders and skilled engineers. 'The glassmaker of a century ago, then, whose labour was highly skilled and physically exacting and whose hours were irregular and unsettled, had several advantages over his fellow artisans. He inherited a tradition of privilege.'¹⁹ Though now, as we have seen, superseded by more differentiated models, E. J. Hobsbawm's disputed tripartite taxonomy of industrial labour, headed by the skilled artisan, is relevant to these flint-glass writers.²⁰ However, a concern with

‘aristocracy’ deflects attention from other aspects of union culture disclosed by these letters. To praise the Flint Glass Makers’ Friendly Society as one of the ‘powerful’ new model unions, more concerned with welfare than with confrontation, displacing Chartist agitation by an intellectual grasp of surplus labour, or to critique its restrictive practices as ‘one of the most conservative and exclusive trades’ (the Webbs do both in their classic history of trades unions) is to miss the point of this correspondence.²¹ True, the *Magazine* is acutely concerned with benefits, superannuation, unemployment, and sick pay, but these letters strive to envisage a different world.²²

Money, wages, and advancement of course play their part in the apprentice correspondence but they were never the immediate cause of strikes. Clive Behagg, defending the ‘impenetrability’ of union practice, calls it a ‘participatory democracy’—Matsumura terms it ‘primitive’ democracy.²³ The Flint Glass Makers’ Friendly Society not only claimed the prerogative of organizing work methods and workplace territory, a hierarchy of subcontracting, and rule-bound provisions for maintaining unity (strike breakers were named as ‘traitors’, men working for lower than agreed wages were pilloried and sometimes expelled), but also the right of replacing workers when vacancies occurred in the trade, refusing the right of employers to choose men. It is easy to see why some commentators are at a loss to reconcile these intensely regulated structures with democratic processes. Yet they are of a piece with the counter-code that directed the apprentice debate. Participatory democracy refuses a *devolved* or delegated account of representation, in which a member can ‘stand for’ or represent a group, and proposes instead a democracy that recognizes a collective based on the equal weight and autonomy of the individuals comprising it.²⁴ Hence not only bonding rituals and deeply local loyalties emerge: it was a dialogic democracy. Every union member is responsible for policy; correspondence and debate was prolific. When, for instance, the Manchester branch tried to reclaim some of the strike fund in 1859, branches repudiated this non-communal act and the decision was voted on: the magazine printed strong condemnations from each of the twenty branches—‘selfish’, ‘contemptible’, ‘mean’ are common epithets; the trade ‘by a unanimous vote [should] knock the *yellow gloves* off them’.²⁵ The unpaid Central Secretary was elected every three years; the decision-making process was effected by a vote by all members—and the *Magazine* recorded all votes, just as it meticulously documented finances and branch membership.

The great strike and lockout of 1858–9 lasted seven months, from October to April. The *Magazine* reprinted Harriet Martineau’s hostile attack on the Flint Glass Maker’s Friendly Society strike and its

‘self-imposed despots’ in her anti-union article in the *Edinburgh Review*,²⁶ together with another debate from the *Glasgow Times* inspired by Sir Archibald Alison’s critique of strikes. The Central Committee replied immediately to Martineau the day after the *Birmingham Daily Post* reprinted her attack on 21 October 1859. The defence is eloquent: ‘every member has his vote and voice in the concern, and, as working men, we claim the knowledge to know and order our own affairs.’ The reply is succinct and mainly corrects factual errors; above all two of these are crucial: the men did not have the option of returning to work if they left the union; instead of being £2,000 in debt the union has current funds of £2,000. It is a thorough vindication and demonstrates the glassmakers’ ability to take on the ‘malignant’ language of ‘this great “Northern Light”’.²⁷

The issue of the *Magazine* for June 1859, headed ‘PEACE!’, began with a lyrical paean to peace. It testifies not only to the extraordinary range of linguistic register available to the glassworker, from poetry to economics, but also to intense relief at the strike’s conclusion. ‘Hail to thee, stranger! Where hast thou been? . . . have the frozen wilds of the north or the burning regions of the south been the blest abode of thy sacred presence? . . . Have thy snow-bright wings, oh! peaceful dove, borne thee away forever?’ Peace has returned, it affirmed, and a later address on the strike by J. W. Woolley warned against hubris—‘for we have had a terrible shaking, which, during some time or other, made the stoutest hearts fear and quake for the consequences’.²⁸ This ‘fierce and terrible contest’, proving that ‘unity is strength’, was, for Woolley and the central committee, a remarkable feat of national and international organization, financial skill, and moral power. Their ‘brittle’ trade, as it was called, was not broken. The glassworkers of Stourbridge, Birmingham, Dudley, Manchester, Warrington, and St Helen’s sustained the strike without renegeing, and the Society organized a system (with contributions from London and America) of unemployment pay and promissory notes (repaid with interest) that did not sink the union financially as the earlier devastating strike of 1848 had done.²⁹

There were two intertwined causes of the strike. In the later Trade Union hearings, the master, George Lloyd, gave a quantitative assessment. ‘It was chiefly concerning the number of apprentices employed by the Masters’ (18315). The firm of M. and W. Glazebrook refused to accept the union’s choice of a workman from Edinburgh for a vacancy and refused to pay footmakers a standard wage, threatening the integrity of the Chair. Another firm, Stevens and Williams, began the lockout in December when men objected to unlimited use of apprentices.³⁰ Eric Hopkins, in his ‘Anatomy of strikes in the Stourbridge Glass Industry’, confirms that

strikes were not about money, and foregrounds the threatened standing of the Chair, the union's prerogative of appointment, and above all the apprentice problem.³¹ True, the apprentice problem crucially dramatized the principle of the 'free' ownership of non-substitutable labour. But another episode gave concrete meaning to this principle. This was Glazebrook's prosecution of workers in a case brought seemingly under a vicious implementation of the Master and Servant Acts.

'The cases excited considerable interest, and there could not have been less than 300 glassmen, and others connected with the manufactures, present. The result was received out of doors with loud cheering.' M. and W. Glazebrook unsuccessfully prosecuted five workmen—'on the 25th of October last they deserted their service without the consent of their masters'. The hearing, which took place when the men were already on strike, was reported by the *Birmingham Daily Post* and other papers, and reprinted in the *Magazine* as a significant document of the strike after it was over.³² The firm circulated 10,000 'placards' affirming that five men had been discharged by them for forming a 'combination', almost immediately after the men gave in their legitimate notice. They warned local employers not to employ them. At the same time they pursued a case against the men for failure to work out legal notice. The men *had* worked out their notice, but it was a contradiction to discharge them *and* to act as if the men were still in their employ. This case challenged the remorseless and often vindictive use by employers of the Master and Servant Acts which were continually updated by Parliament throughout this period, and under which the Glazebrook case was apparently brought.³³ Such laws nakedly exposed the issues, and that is why the Glazebrook trial was so important to the glassworkers: the workman did not own his 'free' labour, and could not claim his entitlement to property, if the master made claim to his work under archaic laws of bonded labour. These acts belonged to an anachronistic, we might say, 'Wellingtonian' or feudal reading of the bonded worker. They were bitterly resented. They criminalized the worker for very broadly defined violations of employment agreements, but offered only civil remedies for breaches of contract by employers. They were regularly used in the Black Country to discipline workers in the glass trade, the colliery industry, and the Potteries, particularly in the 1840s, and had provoked riots.³⁴ (J. P. Roberts, a radical lawyer, was used by glass-makers and colliers to defend cases.)³⁵ Two Birmingham glass blowers were imprisoned for a month's hard labour in 1846, prosecuted by William Gammon: Rice Harris brought two cases in June and July 1848, losing the second but provoking a strike when he substituted French workers for the prosecuted men.³⁶ These laws were the other side, the black side, of benevolent paternalism and consensualism.

In the event the hierarchy of the Chair was preserved and Glazebrook went out of business. The union 'ended the struggle with almost complete victory', Matsumura affirms.³⁷ The three cardinal principles of the 'alternative code', collectivity, the refusal of a purely commodified understanding of work, and the unique social and non-substitutable nature of the Chair were maintained.³⁸ Footmakers received a living wage, and a ratio of apprentices was agreed. Although a ratio of one apprentice to two Chairs was agreed instead of one to three, the *principle* of a ratio was established, as well as the union's right to arrange replacement workmen with nominees or men picked by the Central Secretary. Though Hopkins believes that employers gained important concessions on the apprentice question, the glassworkers believed this long and bitter struggle to be of profound importance. It signified a new confidence. (One general context is the continuing politicization of Birmingham after Chartism. Dennis Smith, for instance, charts a new confidence in the formation of unions and societies forged along occupational lines, such as the Clerks Association in 1853.)³⁹ But above all it established a new balance of power.

The victory was a victory for the practices of the male worker. But women, who must have endured hardship during this strike, do appear indirectly in the *Magazine*, in its poetry. Many of these poems celebrate brotherhood and unity. But women also appear in their narratives. Most of the poems are highly conventionalized, relying on a rhetoric of simple moral and social statement and repetition of what we might call ethical affect, as with Ravenhill's 'Long Live the Working Man' and G.P.'s 'Let us be Friends', or J.E.T.'s 'That Man deserves your praise'.⁴⁰ Repetition of the basic moral need for brotherhood and unity becomes repetition *as* moral need for the repeated ethical act. The rhetorical iteration performs the moral act. The strike is a subtext. A genre of melodramatic tragedy, the penury of a loom worker suffering the death of his wife and haunted with his children's hunger, is taken up in another poem, 'A Tale of the Loom'.⁴¹ The mourning husband spots a costly garment with his tears, his wages are stopped and he (by inference) kills himself. This poem obliquely, in the stark, conventionalized terms that melodrama can achieve through simple outline and the foregrounding of essential facts, refers to the family suffering endured by workers and the necessary underpinning of the male worker's actions by women's and children's privation. The poem ends with a fierce attack on truck and wage stoppage. 'The means devised to end that power of *competition* grinding, | Is to give the million of the world the rightful law of toiling, | That universal Anti-Truck, and *Wages, without Stoppages, | May bless the Altar and the Throne and keep the poor in Cottages.*' It is in these poems that the missing female element in the

discussions of the *Magazine* surfaces. ‘Maryport’s’ ‘Stanzas for Music’ offer an idealized rural England and ‘The native charms of England’s girls’ in preference to other countries where ‘A ban is on the giant press | And *Freedom* quails with fear’.⁴² The violent generic changes, from melodrama to politics, from pastoral to campaign register, expose the strain of experienced disjunctions in lived experience, as suffering and politics, the ideal and the causes of repression, are put together. But they also demonstrate the leap from effect to cause. The polemical tailpieces give the narrative and pastoral elements of the poems the status of metaphor and allegory they would not have without this framing. One might think of this group of poems as an attempt to imagine the strength and limits of social ties and loyalty, both between men and men and women. The anomalous-seeming introduction of Byron’s farewell poem to his wife is not strange.⁴³

In July 1859, surely as a celebration of the conclusion of the strike, the glassmakers held a peaceful demonstration, an aesthetic double of the mass meeting. A fête attended by 15,000 people was held in Prestwood Park, and an account was reprinted from local newspapers in the *Magazine* of October 1859.⁴⁴ The glassmakers, led by Moore’s Worcestershire Sax Horn band, and accompanied by others, processed from Wordsley. They carried the ‘brittle material’ of their trade, a variety of ‘beautiful glass ornaments’—decanters, vases, and glasses. There was a display of glass at the fête supplied by manufacturers. ‘Flags and banners’ were carried. They wore glass hats, made by themselves, and the Ancient Order of Foresters wore ‘scarfs of hunting green’, representing Robin Hood and little John, and evoking ‘Merrie England’. Striking is the display of their own glass culture through aesthetic display, a visual language of unity. The presence of women (who made the scarfs and banners?) is explicit—the ‘blushing fair ones’ played kiss in the ring and Mrs Moody was one of the refreshment suppliers—and implicit, the invisible predicate on which the solidarity of the Friendly Society depended. The symbolic etymology of green, the colour of freedom, and the glass hats, reach back to 1819, when the Blackburn Female Reform Society, displaying green scarves, presented the cap of liberty (symbol of the French revolution) to John Knight, one month before Peterloo.⁴⁵ These symbols were also reworked in Chartist demonstrations. It is hard to know how far their use at the fête was conscious, and whether, like the reporter who associated them with the legendary ideal folk freedom of ‘Merrie England’, they were inflected in this way. Certainly there was a carnivalesque element to the procession—a long-tailed black rat was carried by the glassworkers.⁴⁶ These emblems are remote from the rituals of populist protest. But they have been transmuted into emancipatory symbols of pleasure, communality, and ancient bucolic democracy: they are gestures of independence.



Figure 13 Membership emblem of the Flint Glass Makers' Friendly Society. Key: *top L and R*: illustrations of Aesop's fable of the bundle of sticks, 'shewing that union is strength'. *2nd L*: Justice with sword and scales. *Top centre*: the Goddess of Fame crowning the designer and workman with a wreath of Laurel, 'shewing the Alliance of Art with Manufacture'. *2nd R*: truth with mirror and olive branch with 'Cornucopia or Horn of Plenty' at her feet. *Centre*: interior of glasshouse with furnace and men at work in the press, bottle, general blowing, and table glass departments. *R of centre*: finished work in showroom. *Bottom L*: Rose, Shamrock, and Thistle emblematic of England, Ireland, and Scotland. *L of centre*: Oak, Laurel, and Olive, 'representing Strength, Honour and Peace'



Figure 14 Membership emblem of the Union of Glass Cutters

Before he retired from the Secretaryship Woolley achieved another aim close to his heart. This was another visual symbol: an ‘Emblem Card of Membership’ intended for display in workers’ homes. ‘Our *design* is now finished and has only to be seen to be admired, and, we trust, accepted. It has, combined, all the elements of beauty, neatness, variety, expression, and adaptation, and will, beyond all question, be the best picture in existence referring to the glass trade.’⁴⁷

The Debating Glassmaker

‘This wine glass that I have in my hand . . .’; ‘*holding up a wine glass . . .*’. The Commission on Trades Unions of 1867–8 was set up after outrages, a bomb explosion in Sheffield and intimidation in Manchester, in 1866 and after public outcry against the unions—‘The unions must be stamped out as a public nuisance’.⁴⁸ Thomas Wilkinson, then Secretary of the Flint

Glass Makers' Friendly Society for the United Kingdom (he pointedly corrected a questioner who assumed he was Secretary of the Birmingham branch) and Joseph Leicester, famous glassmaker and radical, represented the workers, both in the Flint glass trade.⁴⁹ Representing the employers were Dr George Lloyd, Chairman of the Midland Association of Flint Glass Manufacturers since 1858, and at the time of the strike one of its most aggressive members, and William Robinson, member of the firm of William Gammon and Company, who had succeeded in prosecuting labourers for breach of contract in the 1840s. Lloyd was by far the most astute, thoughtful, informative, and sensitive of the two men.⁵⁰ The hearing was conducted by a disparate body including Lord Elcho, who had seen through the Master and Servant Amendment Act of 1867, and Frederic Harrison, a post-Chartist radical figure, positivist, and friend of George Eliot.⁵¹

Royal commissions were one of the ways nineteenth-century culture tried to arrive at an understanding of itself. Their exhaustive question and answer form, despite the forensic conventions that put an authorizing language and power in the hands of the collectors of evidence (it is significant that the employers were questioned first), made evidence collection transparent. Even in the highly controlled dialogism of the form, it is possible to see that some questions, unintentionally deconstructive, go beyond the ideological limits of the questioners, just as immanent positions are discoverable in the witnesses. Working-class speech was recorded verbatim. Here the proceedings opened up two opposing languages of freedom on the part of employers and men, a liberal, quantitative economics of *laissez-faire* freedom in opposition to an account of worth based on the identity of workman and task and collective skill. Both Wilkinson and Leicester were confident and articulate. But there were insurmountable hermeneutic differences that sometimes read almost like tragic drama, as employers misrecognize the men's statements, and the men redescribe and resignify the masters' words: 'There has been a misrepresentation by Dr Lloyd upon that matter' (18631): 'There you confuse two questions' (18734). Lloyd interrupted the proceedings at one point to insist that the union restricted production, while Leicester addressed the Chairman, who reiterated his denial in disbelief, that 'no rule of the society' set production limits (18812). Both Wilkinson and Leicester appear to prevaricate and are often evasive, reiterating 'the custom of the trade' (18730) in a way that probably exasperated their listeners. Yet irreconcilable accounts of glasswork are clearly and consciously stated. The task is the dominant term in one, abstract labour in the other, implying two different forms of life. In this debate glassmaking is the crucial site of opposing nineteenth-century readings of work and freedom.

Lloyd's computational understanding of glasswork in terms of 'levels' emerges at his most eloquent moments when he advances the classic ethical case for individual freedom and self-advancement.

I believe that the gifts of nature or God ought to be appropriated to enable the well-conducted and industrious man to have the opportunity of enriching himself rather than that he should be impeded as he is by carrying the additional weight of the burden of those who are of the opposite character. (18392).

Asked if local courts or arbitration procedures would be appropriate, he answered:

I can say nothing excepting that we hold that employment of labour ought to be perfectly free and unrestricted: how that is to be accomplished I am not able to say. I do not wish to trench unreasonably or unfairly upon the action of those men who have found, and I believe originally with perfect justice, that it was necessary to combine together in order to defend and assert their own rights. I think that the unions originally had very just grounds for adopting those measures, but I think that of late years they have been exercising them in a way which is injurious to themselves as well as to the employers. I think that they have perfect liberty to unite together to value the price of their labour, and that only, that is, as to what wages they will choose to work for, but not to interfere with others: that is to say, that all men should be at perfect liberty not only according to the recognized laws that the unions may think it right to adopt themselves and to make public, but that even those laws which are not written, the unwritten laws, should be such as that the men by no interference indirectly or secretly should influence others by force or otherwise, who are not members of the union, so that there should be freedom on both sides. (18521)

The use of an unlimited supply of apprentices chosen by the Master comes to represent the core of his case. He was questioned closely. 'That makes the union, taking the circumstances of the restriction of apprentices into account, entire masters of the situation?' (18445); 'And you have no control over the labour market?—No' (18446); 'But it is perfectly open to you to employ any other people that you think fit? . . . —I could not maintain my manufactory' (18527); 'Supposing that there were no restriction imposed by the union or anybody else upon the employment of apprentices . . . ' (18540); 'As a rule, you would consider an unlimited supply of labour the proper state of things . . . ' (18549).

Lloyd worked on the presumption that he and his men abstractly possessed unlimited freedom. The presumption throughout—and this is the basis of Lloyd's clear respect for labour—is that all men, masters and men, are alike because all exist with the *given* of being 'perfectly free'. That is why one man will do in place of another—the logic of substitution follows from this equality of freedoms—and why an 'unfettered' quantum

of labour must aggregate beneficially as each unit in the system exercises its freedom to work. 'Unfettered', a 'skilled hand is cheaper than an unskilled one, because he can produce the article cheaper' (18552). 'Unfettered' is regarded as a self-explanatory word requiring no definition. In a context of increasing labour costs, decreasing prices, and rising foreign competition, Lloyd admits, eloquently, to a constant feeling of 'apprehension' and 'anxiety' (18353), not simply because a new 'antagonistic' model of relations, wanting 'cordiality' and 'mutual interest', and the 'satisfaction in working together' (18352) has arisen, but because of the unpredictability of union intervention. Combination produces a 'shackled' industry (18428–59). Combination is so deeply alien to him that when asked if the powerful Masters could organize to ally Capital against Labour (18454–60) he is nonplussed and evasive.⁵² It is not in his conceptual framework to understand forms of regulation as anything other than reducing 'the skilled and industrious man down to the level of the less skilled and idle' (18390). Yet his logic breaks down. Once it is understood that even the minimal function of a union is that of establishing 'the price of their labour', employment is no longer 'perfectly free and unrestricted', as 'freedom' begins to conflict with 'liberty'. 'Perfectly free'; 'perfect liberty'. The reiteration of 'perfect' as an intensifier masks the conceptual faultline in this assertion. The computational logic of Lloyd's thought is in operation here. If there is individual self-improvement there must logically be hierarchical levels of status and reward, and so not everyone will be 'perfectly free' even when the notion of idleness is invoked to cover the differential between levels.

Wilkinson, on the other hand, not only sees the freedom of labour in terms of a particular set of skills and practices but insists that it is the complexity of the *product* that determines the labourer's status: there is a hierarchy of difficulty related to the *tasks* of the Chair, not a hierarchy of skill in itself.⁵³ For him the work process is the result of an interdependent group, a social reading incomprehensible to his listeners. Because the group creates the final product, they, not the master, require the autonomy and freedom of choosing their fellow labourers. His position emerges clearly on two occasions, when he discusses subscriptions to the union, and when he speaks of apprentices.

High and low subscriptions do not relate to high and low workmanship but only to a man's place in the structure of the Chair. What matters is 'the class of work the man makes', that is, the quality of the final *object*. The level of skill varies from Chair to Chair according to the quality of the final product it produces. Not only does this description reverse the priority of Lloyd, determining quality from the nature of the product and not from the intrinsic nature of the labourer: it also refuses the notion of a fixed hierarchy of levels; there are multiple varieties of skill determined by the



Figure 15
'Holding up a wine
glass'. The 'tendrill'
wineglass designed for
Henry Cole by
Richard Redgrave,
Richardson's, c.1849

class of the artefact produced. He gives no examples of quality work, but a frequent example offered by masters and men is the commodity luxury of the expensive wineglass or tumbler in comparison with standard glasses. The commissioners clearly did not understand his distinctions, which are disregarded in the following question as Wilkinson's 'first'-class man in terms of the task performed is redefined in terms of the superiority of the labourer: 'It is 1s. 3d. a week that is paid by the first-rate workman?' Wilkinson repeatedly attempts to resignify the descriptive language of hierarchy and to redirect it from class to task—'and is. for the third [the footmaker] let his abilities be what they may' (18632).

The most arresting hermeneutic differences emerge over the quota of apprentices. He was asked if three apprentices per Chair would lead to inferior work. Wilkinson replied that 'The work would most decidedly be inferior', a reply which led him to an outright disagreement with his questioner.

18725. (*Mr. Mathews.*) Should not that be a question for the master rather than the workman?—No.

18726. [*Wilkinson*] . . . The fact is that the apprentice earns almost half the amount of wages and frequently hampers the other two men he works with . . .

18728. If you were driving a pair of horses and one is an inferior horse, you can get the carriage drawn by putting more work on the willing horse? Yes.

Trapped by this quantitative analogy of 'horse power' when he answers 'yes', he opens the way for the employer's right to judge in the question that follows—whether the driver (the employer) would not discard the bad horse. His reply is weak, but his point is still the fallacy of the accounting method and the incorrect mathematical analogy: it is not in the employers' interest to 'discard' a low-paid apprentice however inadequate the work—that employers precisely work to the mathematical model of the lowest-cost horse power. His answer depends on a crucial exchange that had preceded this:

18718. Have you found that there had been or was growing up a tendency to employ apprentices unduly, or what was the evil against which you directed that movement? [i.e. the limit on apprentices]—Our idea is that we support our own poor: we spend a large sum of money in supporting both the superannuated and the unemployed belonging to our trade, consequently we consider that we have a right to regulate incoming labourers in accordance with what the demands of the trade may be. *You will observe that our trade is peculiarly situated by the men working in sets, and no man being strictly accountable for his own labour individually, everyone is either hampered or aided by those who work with him* [my italics]. And as regards the apprentices, there is no particular profit that accrues to the man for learning [teaching] the apprentice: the profit goes to the employer's interest, not the man's. Thus

it is that we believe we have a right, in fact I affirm that we have a right, to regulate the supply in the trade according to the demand.

Wilkinson's unfamiliar and subtle accounts of the individuation of labour are constantly collapsed by the commission's interrogations, into an account of work in terms of an individualist ethic of the self-made individual workman, a model that was indeed subscribed to by many workers themselves. Wilkinson shares an understanding of his labour as property with the new discourse of the self-respecting working man that developed over the mid-century, but his reading of the working man's autonomy is inflected in a radically different way from the employers' reading of it.⁵⁴

Perhaps these two accounts of work were not displaced until the postmodern world of float glass replaced the labour force with the computer. 'Float glass factories are quiet places remotely controlled from monitor screens,' T.C. Barker wrote in an update of Pilkington's history.⁵⁵

As a tailpiece we might remember that all ideological readings of work create exclusions. Neither master nor men regarded the factory boy, who could run up to thirty-two miles a day, as important. The pay, Lloyd said, for these 'little boys' was often 'nominal' (18324). Wilkinson excluded the workforce of boys from discussion. 'No, the boy is not recognised in any shape or form until he moves into the third position . . . The minor boys are continually coming into the trade and going out of it' (18722).

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Conclusion

The Culture of Glass: ‘Erase the traces!’

‘[W]e can surely talk about a “culture of glass”. The new glass milieu will transform humanity utterly.’ I recapitulate the statement with which this book began. It predicts a new culture of glass for the twentieth century while overlooking the existence of nineteenth-century glass culture. Walter Benjamin quoted Scheerbart’s optimistic prediction cautiously in 1933. Glass is a ‘cold and sober material’. ‘Objects made of glass have no “aura”. Glass is, in general, the enemy of secrets. It is also the enemy of possession . . . Do people like Scheerbart’s dream of glass buildings because they are the spokesmen of a new poverty?’ Glass signified the purism of modernist culture, an aesthetic modernism that he associated with the Bauhaus. But he was not sure about its ‘poverty’. It wipes the environment clean of all humanly made marks of individuation, obliterating the ‘traces’ of ownership and the passionate life inscribed there. ‘They have created rooms in which it is hard to leave traces.’ On the other hand he was not sure about these traces either. ‘If you enter a bourgeois room of the 1880s’, he continued, ‘for all the coziness it radiates, the strongest impression you receive may well be, “You’ve got no business here.” And in fact you have no business in that room, for there is no spot on which the owner has not left his mark—the ornaments on the mantelpiece, the antimacassars on the armchairs, the transparencies in the windows, the screen in front of the fire. A neat phrase by Brecht helps us out here: “Erase the traces!”’ Breaking an object in the bourgeois interior is an act that causes the owner to feel ‘that someone has obliterated—[he quotes from Goethe]—“the traces of his days on earth”’.¹

Polarizing the trace as the mark of a suspect nineteenth-century bourgeois identity-as-possession and the erasure of the trace as a dehumanizing modern purism, Benjamin too ‘helps us out here’ by focusing on the mediation of glass.

I have been reading the texts of glass culture—the texts of those who founded glass culture in the nineteenth century by their labour, whether as factory owner or factory worker, those who described that labour, and those who destroyed it. Read as historical documents these reveal something of the extraordinary lifeworld of glass manufacturers and glassmakers in the industrial era and its necessary engagement with political and economic issues. Read as texts they disclose through their structure immanent questions and reveal the languages of glass, a poetics that engages with problems of mediation. They disclose the dialectic of nineteenth-century modernism.

Both manufacturers and workers did believe that glass had ‘aura’. They believed they could leave their traces in it and through it. Chance saw their lighthouses as glass monuments to their scientific and ethical endeavour in the interest of international maritime safety as well as testimony to their global hegemony—‘beams from their apparatus flash over every sea in the inhabited globe’. The Stourbridge glassworkers understood that their ‘brittle’ art created works of beauty. They generally called themselves glassmakers, rarely using the word glass blower, though Chance sometimes used the French ‘souffleur’, the word that immediately connects the artefact and the artisan’s breath, as a term. An article on the history of glass in the *Magazine*, ‘this beautiful substance’, notes the aristocratic history of glassmaking in Italy and France: ‘Even in England, some few years since, the workmen [the most skilled men in the Chair] were commonly called “the gentlemen glass-blowers”.’² The prefix ‘gentlemen’ enables the brute somatic existence of breath in the artefact to be admitted.

There are traces, then, of the manufacturer’s identity and traces of the workman’s being in glass. To recapitulate the arguments of my Introduction: the transparency of glass becomes a third term—something between you and the world. It makes itself *known* as a constitutive element of experience that organizes work on the world as medium and barrier. The transparent medium relates self and other. It grants primacy to the self’s perception and to its freedom. The transparent barrier obstructs self and other. It opposes the self as object and reveals it as unfree or subject to limit. Transparency is a reminder of the question that Robert Pippin has termed ‘a new problem’ after Kant and Hegel: ‘How there could be such a being that was both *in* the world and the subject *of* a world?’³ Selfhood is double-sided, a free subject and a dependent object. To move from one position to

the other requires the mediation of a middle term, and such an obstacle puts the subject *in difficulties*. Glass culture in the nineteenth century exemplifies such difficulties. It is not the invisible, lucid, traceless world Benjamin attributes to high modernism's aesthetic purism. It is smeared with the prints of toil and thought.

Nineteenth-century modernism remains with the subject in difficulties, and glass culture plays out the 'new problem' of its modernity. The groups I have discussed as case studies work out the meaning of traces in glass in different ways. The factory spectator grasps the meaning of the transformation of dark and dirty elements into 'colour and brilliancy' through the sensoria—empathy with the crisis of the furnace and its deprivation of breath. It is the workman's prowess and suffering which mediates this change. The glass breaker *does* attribute secrets to glass, the secrets of power. To smash the barrier of glass, getting rid of its obstruction by force, is one way of demonstrating that dependency can reverse into freedom. The cost is both a desperate literalness and a purely symbolic gesture. Neither can perform a mediating act.

The 'new problem' of glass culture experienced by factory owner and worker intersects with major movements and moments in nineteenth-century history, and particularly with radical protest and the progressive liberalism of a managerial elite. Reform agitation, Chartism, trade union politics, cross the founding of glass culture. The languages of glass are bound up with the shifting and constantly resignified meanings of property, the people, deference, work. Pippin emphasizes that it would be a 'mistake' to assume that to think of modernism as a 'philosophical problem' *explains* all that is necessary to know about modernity. Technologies, forms of consumption and production, change experience. History does not depend on philosophy. Nevertheless, philosophy can reciprocally give shape to 'an ongoing historical form of life' and becomes an aspect of it.⁴ Certainly the free subject *in* the world and the bound subject *of* the world, the dialectic of glass culture, brings the dilemmas of masters and men into relation *as* dilemmas. These appear in James Timmins Chance's expostulation: 'We injure both the men and ourselves... [who are] not mere machines, but have sensitive feelings like ourselves'; and Dr George Lloyd's outburst: 'we hold that employment of labour ought to be perfectly free and unrestricted... all men should be at perfect liberty... there should be freedom on both sides.' These are as much languages of glass as they are expressions of felt paternalistic and laissez-faire capital. James Timmins challenges his uncle's freedom to see labour instrumentally, as the neutral or transparent mediation of a machine. He is ethically aware, as indeed was his uncle, not only that this is contradicted by paternalistic humanism but that the transparent account of labour is continually blocked by the

intrinsic need of glassmaking to recognize the individual being of the glassworker. Cylinder production, as we have seen, enhanced the glassworker's individuality. George Lloyd, again, presupposes a 'perfectly' transparent freedom that is contradicted from within because unregulated freedom leads to unevenly distributed privilege and from without by the structure of the Chair.

The glass culture of nineteenth-century modernism lives with contradiction and tension. Glass as barrier will always challenge glass as medium. The glassworker insists upon his own human and social traces in glasswork, his own mediation, 'the traces of his days on earth'. The obdurate refusal of abstraction and substitution of labour and the collective aesthetic of work that follows from it claims the freedom 'to know and order our affairs'. It is a phenomenological ethic, based on the irreducible individuality of the worker's body and breath. This group did produce exclusions, however, and its democratic individuation could collapse into individualism—self-help narratives and social bonding coexisted.

Marx is at pains to demonstrate, through the language of glass, that labour is 'crystalized' in the artefact, that objects represent 'congealed labour-time'.⁵ Challenging the traceless neutrality of models of labour as machine, perpetrated by Babbage and Ore, he was participating in glass culture as well as critiquing it. In Part II I move to another facet of glass culture, created by the glass panel. The physical environment, and the sensory and intellectual experience it made possible, for which the glassmaker provided the hidden infrastructure, is its theme. The 'crystalized' 'traces' in glass and the 'aura' of transparency reappear in a different form. The unique and enigmatic aura of the nineteenth-century glassworld came into being.



PART II

PERSPECTIVES OF THE GLASS PANEL

Windows, Mirrors, Walls

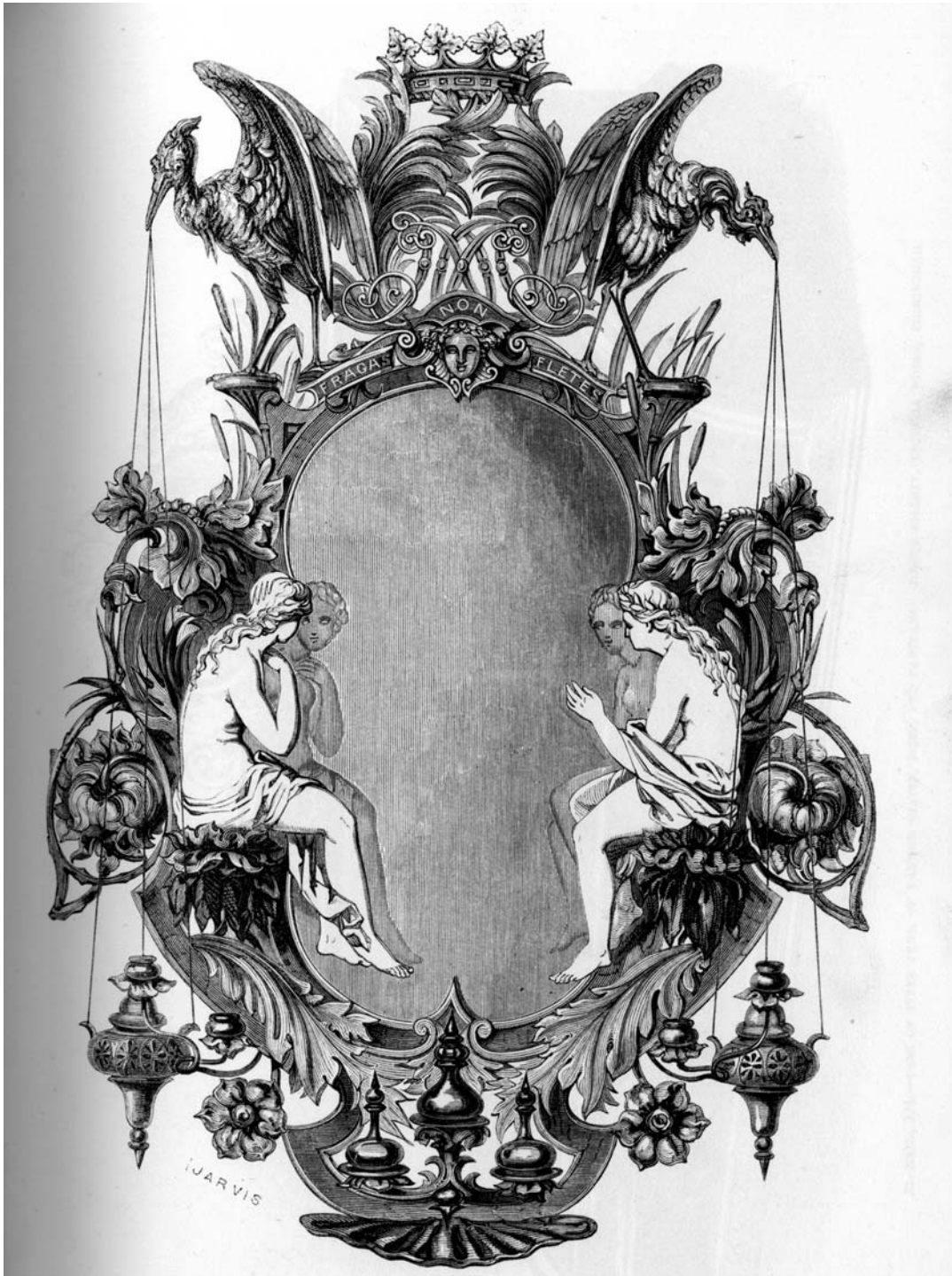


Figure 16 Pott's grand boudoir glass, from the *Official Catalogue*, vol. iv supplement

Reflections, Translucency, Aura, and Trace

5

The 'cold' being of glass resists traces, impervious to the world, Benjamin said. But the traces inescapable to nineteenth-century glass culture are reflections. Transient but ever renewed in the new glazed cityscape, they endowed glass with extreme perceptual intensity and peculiarly modern aura. Glass culture's material form was generated from the glass panel, vitreous squares larger than ever before, translucent, or silvered as public mirror. These surfaces, recording the random, dispersed, and evanescent images of the body in the world, gave a new publicity to the subject, who could exist outside itself in these traces. In a counter-movement, the glass surface intervening between self and world reinforced the subject's interiority. The reflection, and the transitive gaze through a translucent space, looking on, seeing through, these two activities, now, in the nineteenth century, possess an unprecedented scopic potency, remaking the aura of the trace and the trace of the aura. They set up a dialogue between reflection and translucency, the mirror and the window. Each addresses different questions to glass culture.

Phenomenologies of reflection and translucency may seem to travel far away from the brute physical facts of the making of glass. Glass and its transparency were quickly taken for granted. At a subliminal level, though, the artisan's invisible breath secretes itself in the traces of glass culture. The unconscious of glass, whether it is the ghosts in reflections or the exhalations drawn from the subject looking through a window, marks itself. It turns ethereality and materiality into enigmas.

This chapter is about the way reflection and translucency created a new order of perception in the everyday. The following chapter describes the material 'glassing' of the city, and the cultural meanings and tensions that emerged through the interaction of real and imagined glassworlds over the century. The politics of the conservatory, rival ideologies of the glasshouse

and the transposition of its taxonomies and space–time relations to the conditions of the Crystal Palace, are the subject of Chapter 7. Finally, preceded by a chapter on Cinderella and the glass slipper, glass under glass in the Exhibition of 1851 ends this exploration of the glass panel.

Reflective Glass Space: Looking On

Reflections are ideal images hosted by matter but not of it. Thus they are always in a sort missed encounters, yet, as images made by light, they are a kind of natural mimesis. But it is a mimesis constantly in deformation, unlike a painting. The angle of reflection is the same as the angle of incidence of light on a reflecting surface—nineteenth-century explanations of the physics of reflection invariably began with this assertion. The image will change, therefore, according to where the looker is placed: it will be different if she moves. The virtual image is projected back from the surface, seen in the mirror or glass panel as if it is the same distance away from it as the object or person standing before the mirror. However close you get the reflection is forever unreachable, always an ‘as if’. But the full-length image of the body in a mirror was a new experience, often remarked. The cheval glass was not democratized until the nineteenth century. The mirror wardrobe was an invention of the century’s first quarter.¹

In public glass, the externalized body repeatedly returns to the looker from the environment, often as a moving palimpsest in the cityscape, overwritten by other images. Reflections, those dim, secondary figments in transparent glass or silvered in mirrors, are neither doubles nor quite alien to the body. They are actually memories of light as it is deflected from a surface. For the first time in our culture, perhaps, self and world can be a mirage returned from the surfaces of the city landscape, great and small. The painter Manet, on a bus, looking ‘blankly’ at awnings, gas jets, shop windows, ‘a woman’s little pink slipper’, ‘a watch on top of a shelf of glasses’, watched the man opposite him reading a newspaper—‘Constantly there were reflections in his glasses’. (Dickens’s Paul Dombey is unnerved by the reflective spectacles of his new teacher—‘the glistening of the glasses, made her so mysterious, that he didn’t know where she was looking’.)²

The proliferation of glass surfaces creates a wholly new space, glass space. Of course, images in a mirror and in transparent glass are different. One loses form and substance, one seals a clear image within a gleaming patina. But they are all virtual images, and the dominance of mirrors in art and writing at this time discloses an acute awareness of a reflective world.

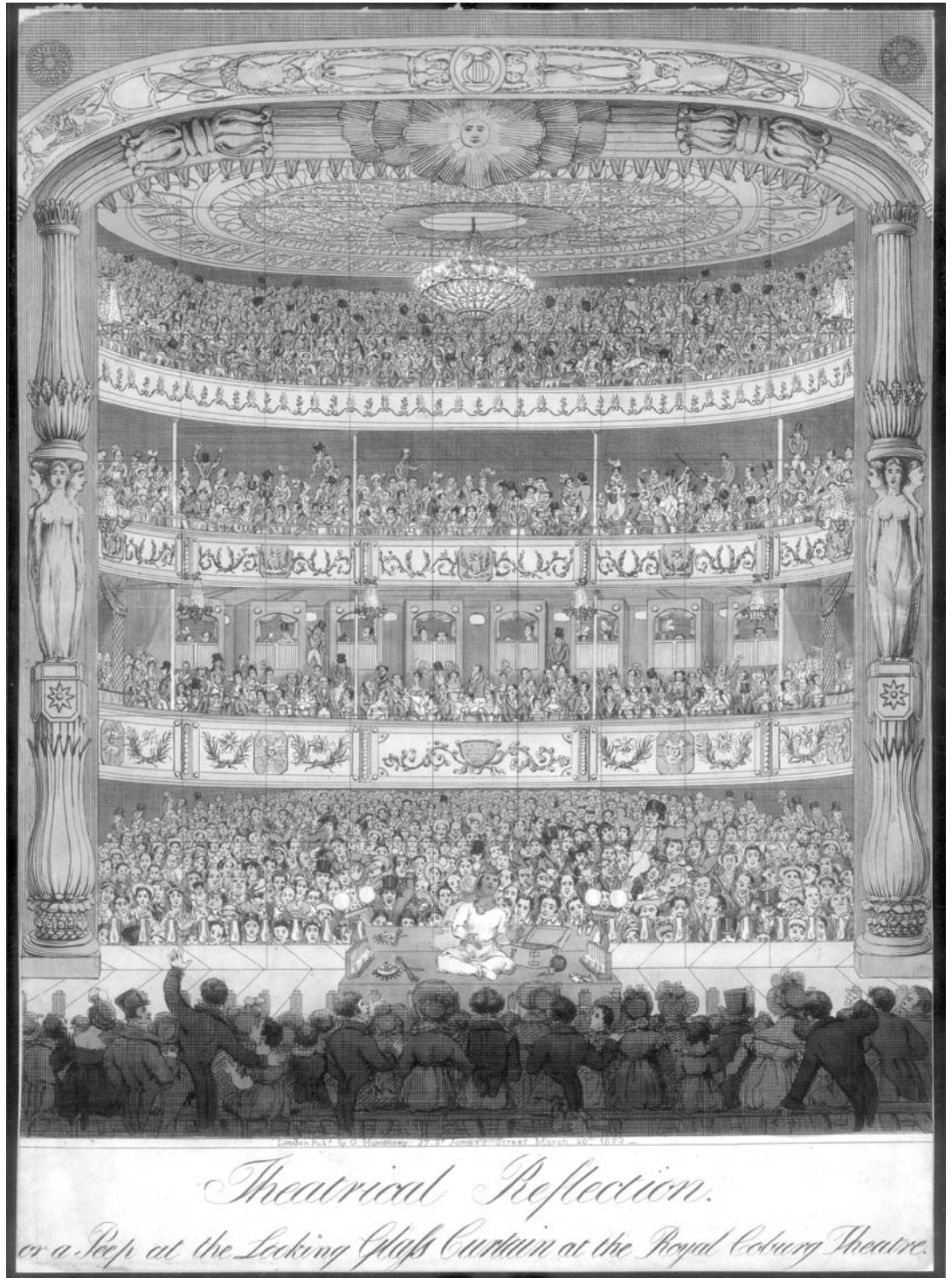


Figure 17 'Theatrical Reflections, or a Peep at the Looking Glass Curtain at the Royal Coburg Theatre', G. Humphrey, St James's Street, London, 1822

Virtual images belong not only to quotidian experience of reflections but also to the science of optics. The physics of virtual reflection in the nineteenth-century optics of the lens belongs to Part III of this study. Here, implicit in the kinds of question prompted by glass traces is an everyday phenomenology of reflections, moments in public glass. Translucency asks other questions which occupy the last part of this chapter. The image's accidental reflection, its incompleteness, and the enigma of the surface, prompt three questions. Who is looking? Is the image always fractured? What happens to bodies in glass?

Who is Looking?

I The 'looking-glass curtain' at the Coburg Theatre (now the Old Vic), known as the 'blood tub' for the excess of its melodramas, was a sensation of the early 1820s. It 'weighed five tons'.³ It delighted Edward Fitzball.

The Coburg, patronised by Her Royal Highness, the lamented Princess Charlotte, and Prince Leopold, decorated with one sunny glitter of gold-braided mirrors, with a superb looking-glass curtain, which drew up and let down in the sight of the audience, and reflected every Form and Face in the gorgeous house, from the topmost seat in the galleries, to the lowest bench in the pit.⁴

It displeased J. R. Planché.

the occasion of the first exhibition of an enormous looking-glass curtain or act drop, the advent of which had been announced in the largest type for many weeks, and had been confidently counted on as an immense attraction. The house was certainly crowded the first night... After an overture, to which no attention of course was paid by the excited and impatient audience, the promised novelty was duly displayed; not one entire plate of glass—that could not have been expected—but composed of a considerable number of moderately-sized plates—I have seen larger in some shop-windows—within an elaborately gilt frame. The effect was anything but agreeable. The glass was all over finger or other marks, and dimly reflected the two tiers of boxes and their occupants. It was no imposition, however, it was a large mass of plate-glass, and in those days must have cost a great deal of money. There was consequently considerable applause at its appearance. The moment it ceased, someone in the gallery, possessing a stentorian voice, called out, 'That's all werry well! Now show us summat else!' What more cutting commentary could the keenest wit have made upon this costly folly? Did the manager who was guilty of it deserve to succeed?⁵

This smeared looking-glass curtain consisted of sixty-three plates of glass.⁶ Horace Foote confirmed that this '*looking glass curtain*... consisted of a number of large plates of looking glass in a broad, rich gold frame'.⁷ Fitzball works happily with the mirror's mimesis. The ancient model of the mirror enables a unified image to emerge: for him the mirror includes

everyone in the theatre, ‘every Form and Face’, unproblematically reflecting social unity in the ‘gorgeous house’ despite being vertically structured in the hierarchy of audience seating. (The note of nostalgia betrays: this was a time when British society was highly stratified—and marked by division and conflict.) The audience is looking at a reassuring ideal image of itself, a virtual theatre. Planché, on the other hand, responds with suspicion to the new production of mass-produced reflections in which one’s body can be seen, glancingly, inadvertently, and in discontinuous fragments, reflected back from the environment in insubstantial replication.

Reflection is now outside one’s control. Since no one owns reflections, we do not know *what stranger* might see our own reflection, nor does the object of a gaze know that it has fallen on him or her. The ‘dimly reflected’, spectral tiers of boxes and their occupants will see themselves (Planché makes it clear he was one of them), however dimly: but other people, seated elsewhere, will see different groups of people from different angles in the theatre, depending on where they are. The illusion of collective seeing enabled by the proscenium arch is fractured, splintered into individual acts of seeing. In or on this shadowy screen: who sees whom? who sees you? at what angle? The engraving of the Coburg mirror foregrounds people in the pit, cheerfully waving at themselves in carnivalesque delight. Yet impartial reflections neither segregate classes nor unify them.⁸ (It is likely that the sixty-three plates of sutured glass would have reflected much more discontinuously than the illustration suggests.)

For Planché the mirror’s screen (smudged with the traces of workmen’s fingers) and proscenium arch combined are cognitively unsettling. Estranging simulacra and the interactive gesture of theatre do not mix. He would rather not see traces in glass. His act of demystification gets the genre of the glass surfaces confused. The elaborately gilt frame suggests the portrait and traditional ways of looking. The plate glass suggests a commercial window—‘I have seen larger in some shop windows’. Foote, on the other hand, likes spectacle: ‘crowded audiences testified their delight at seeing themselves in this immense mirror, and for the first time “on the stage”.’⁹ The audience is reversed to become performers. They are ‘the subject of their own spectacle’, as the mirror dissolves the boundary between self and the object of consumption, signalling visual pleasure as commodity.¹⁰ George McFarren’s poem to the mirror, claiming that the ‘illegitimate’ theatre, as the Coburg was, had discovered a ‘truth’ superior to the ‘giant’ legitimate theatres across the river, plays on the different ‘truths’ of art and reflection: ‘Our portraits must be true, for you’ll behold yourselves.’ But he actually suggests the way public glass gives and takes away.¹¹ It exposes an image and alienates it. You are anonymous and known at the same time.



Figure 18
 'The Looking-Glass
 Department of the
 Great Exhibition',
Punch, 1851

II In a Punch skit, the scintillating surface of the Exhibition of 1851 induces the erotics of multiple reflection. A young girl speaks: 'He met us yesterday, again, at the Exposition. Unluckily it was in that part of the gallery where the mirrors are exhibited, and which is always so crowded with ladies. We could not exchange many words, as one's blushes were reflected in every direction, and one saw oneself all round, and couldn't help thinking everyone else saw one.' The self is seen 'all round', not simply frontally, and 'everyone else saw one'; the spectator becomes a spectacle, but the mirrors' multiple images also publicly reproduce and compound desire. Desire as multiple blush is not only repeated 'all round' but it is there in the round, outside oneself, putting interiority at risk as the unconscious goes public, exposed to strangers. (The dominant red in the decoration of the Crystal Palace interior would take this up and work like a blush in the environment, the play of desire on the surface of the building.)¹²

III The glancingly deflected accidental gaze of a random reflection, or the longer gaze of a kind of virtual voyeurism, are two aspects of the same experience. Hardy is the consummate exponent of both. Here he registers a hypersensitive response to the glancing reflection. Reflected images occur with sensory immediacy: their virtuality seems to intensify their action upon the nerves. Car'line, newly married, goes straight from church to Exhibition (the Crystal Palace again) as a wedding treat, and sees a virtual

image (or is it?) of her ex-lover and father of her child transiently in the glazed patina of a mirror.

While standing near a large mirror in one of the courts devoted to furniture, Car'line started, for in the glass appeared the reflection of a form exactly resembling Mop Ollamoore's—so exactly, that it seemed impossible to believe anybody but that artist in person to be the original. In passing round the objects which hemmed in Ned, her, and the child from a direct view, no Mop was to be seen.¹³

For an optical flicker of a second in the syntax it is Mop who is 'passing round' the blocking objects, and, when the sentence gives over Mop for Car'line as the actant, for another flicker of visual possibility, she might be going round the back of the mirror as children do, to find the source of the image.

IV Jude sees the reflected back of Arabella in a pub mirror: 'The barmaid . . . was invisible to Jude's direct glance, though a reflection of her back in the glass behind her was occasionally caught by his eyes . . . when she turned her face for a moment to the glass . . . he was amazed.'¹⁴ Here the stranger you expect to view suddenly becomes someone you know. In this virtual voyeurism the reflection is seen twice over. A back, and then a face, first seen in a mirror, momentarily deflects Jude's gaze and brings the Medusa look into modernity. Here Hardy adapts the frequent trope of the reflected back of a woman. This is famously present in Manet's *Bar aux Folies Bergère*. The reflected crowd must see the barmaid frontally, while they also see her back in the same mirror that reflects them as spectators. The spectator can bypass the girl's frontal gaze and focus on the back. She in her turn is wholly exposed in the round, yet turns her back on the reflected viewers at the same time. Dreaming in public, the girl seals herself up in a state of reverie, as if not wanting to be porous to the gaze of strangers. It makes her absent. It is a visual surprise to see a slightly blurred image of a customer confronting her in virtual space—a wonderful touch, because this is probably just what he is to her.¹⁵ The complex disavowals of public reflection are here. At the same time the public reflection of the mirror asks just what is for sale. Not merely the substances in gleaming bottles portrayed both in the novel and the painting (Hardy tells us the names of these liquors are unknown to Jude), but optical pleasure. It is a vicarious narcissistic consumerism, as the looker is asked to fall in love with an image of someone or something else, the reflection, not the thing. Mirrors and the sale of optical pleasure come to be in constant conjunction. In Dickens's *Dombey and Son* (1848), Edith, 'sold' to Dombey stands in a boudoir scintillating with multiple images of herself. Casual would-be purchasers stroke Dombey's plate glass mirrors when his property is sold,



Figure 19 Edward Burne-Jones, *The Baleful Head*, c.1886

possessing by erotically running their fingers down the glass that has imaged his wealth.

V The same complex displacements occur in Burne-Jones's Perseus series. The final image is a tripartite act of reflected and deflected gazing. In the constricted surface of a small font-like artificial pool, an image of Medusa's head, suspended aloft by Perseus, joins the reflected heads of Perseus himself and his lover. The reflected heads are packed into a circular space, seeing each other by means of their mediated reflections, not face to face, communal, and solipsist simultaneously.¹⁶

VI Cityscape interiors are the preferred scenes of glass culture's reflections in texts of all kinds, perhaps residually preserving a connection with the private reflective subject gazing into a mirror, confirming identity. Elizabeth Barrett Browning's Arno river, a visually audacious representation of reflected buildings and the people viewing them inverted in the water, is exceptional: 'With doors and windows quaintly multiplied, | And terrace sweeps, and gazers upon all' (*Casa Guidi Windows*).¹⁷ Planes fractured and multiplied in the moving water, reflections are unstable, arbitrarily recording the urban scene. In twentieth-century modernism Benjamin takes the random reflection outside. The looker sees 'his own physiognomy flash by', as the eyes of passers-by become 'veiled mirrors', as glass partitions and 'doors and walls . . . made of mirrors' trick the sight, as 'A profusion of windowpanes and mirrors in cafés, so as to make the inside brighter', mean that 'there is no telling outside from in'. But there is an anticipation of this urban glass environment in Poe's 'The Man of the Crowd', where a daemonic narcissistic image disengages itself from the corporeal viewer and moves frenetically through London as an autonomous reflection, a shadow self constantly retracing its path, free and unfree. For Benjamin the man in the crowd is a damaged flâneur taking on the febrile life of the commodity. Imagined through the city reflection, he also represents an interiority split between image and body (maybe this is what commodity does to you?). The pursuing 'original', who, like Freud, encounters his alienated reflection as a stranger—'With my brow to the glass . . . there came into view . . . a decrepit old man'—is tied to the pursuit of this seemingly unseeing figure.¹⁸ Can a reflection see? Who sees you?

Is the Image Always Fractured?

I For John Claudius Loudon, giving advice on the bourgeois domestic interior, the pleasure principle of multiple reflection is thrilling.

a beautiful vase or two, with cut glass lustres, and a few other choice ornaments, may be placed on the chimney shelf . . . Silvered mirrors of

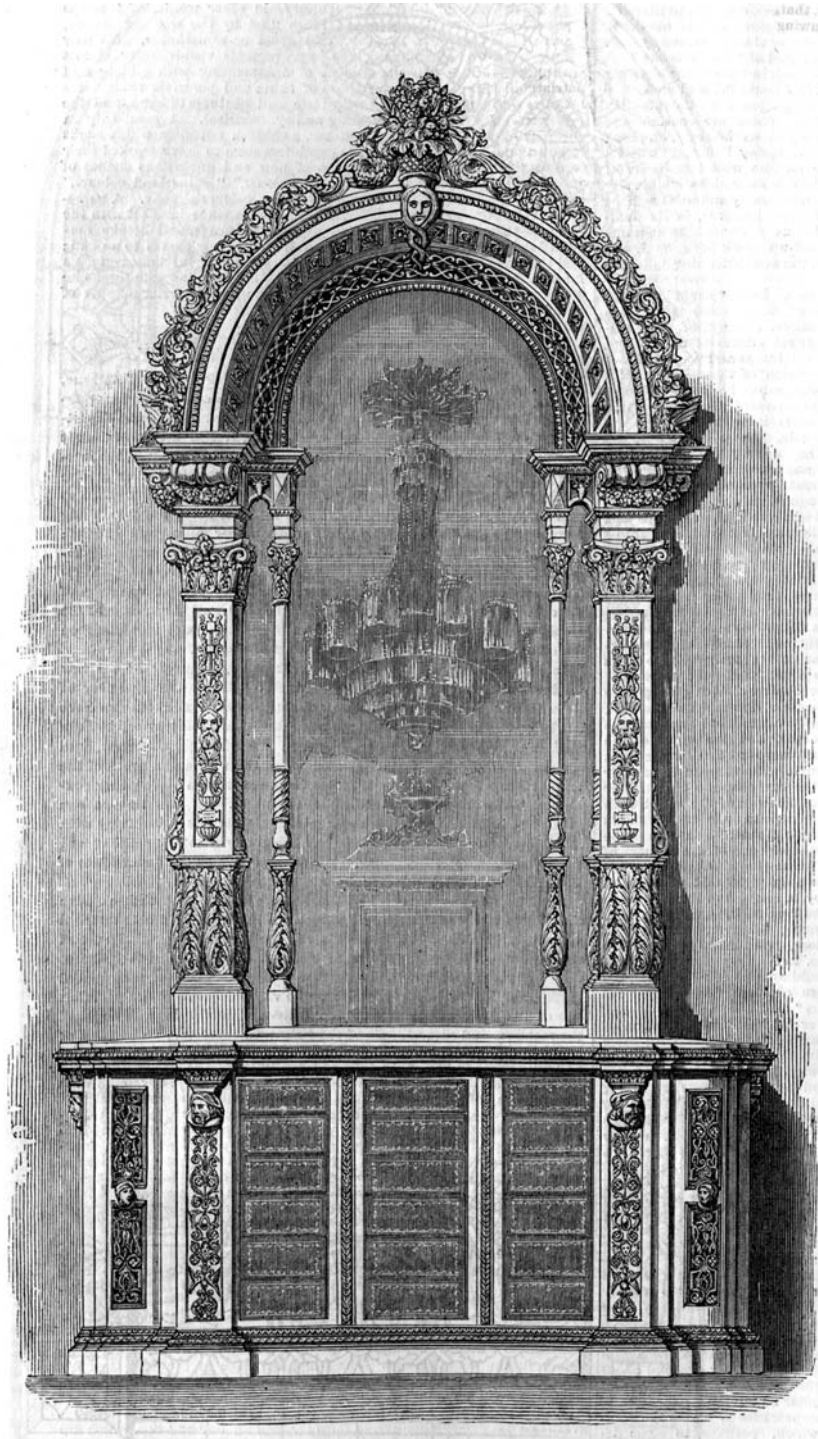


Figure 20 The trope of multiple reflection, 'Secrétaire—by Snell', a mirror reflecting a chandelier, *Illustrated London News*, 1851

polished plate glass, in gilded frames, cannot be too profusely employed in a drawing room; and, where it can be contrived, they should be placed exactly opposite one another, by which means the reflection of everything that comes within their focus is endlessly reproduced: and when the cut-glass chandeliers are lighted at night, and ladies in elegant dresses are moving within the scope of their operation, the scene becomes fairy-like and brilliant beyond description.¹⁹

II Yet this symmetrical repetition infinitely divides the reflected subject. Another kind of division occurs in Holman Hunt's *The Awakening Conscience*:²⁰ we look, deeply recessed to the left of the picture, at incandescent green leaves through an open glass door. A panel of the open glass door itself is reflecting this incandescence at an angle from another unseen angle of the garden. Its opposite door partially reflects at another angle. But the whole scene is a mirror *surface*, containing reflections of reflections of the room in front of the girl, who is starting from the man's knee at the piano. Her back and part of his head appear in dismembered parts in this mirror. This mirror also reflects another mirror on the wall in front of the girl, and another above the mantel to the girl's right. The space is segmented into mirror images reflecting angles or mirror images themselves. The reflected garden is also cut laterally by walls and paths. Our left is her right—to see what she sees we have to turn the image in the mirror image 180 degrees. It is a spatial act that reflects a massive psychic upheaval, and even then can be incompletely achieved, for the reflection is incomplete, cutting off unseen perspectives. It is a mirror trauma. Her dissociation, the viewer's failure to read her perspective. (The same dysfunctional 'bankrupt' mirror images of images occur in the Brogley junk shop in *Dombey and Son*—'and various looking-glasses accidentally placed at compound interest of reflection and refraction'.)²¹

III In James Tissot's late-century painting, *La Demoiselle de Magasin* (1883–5), a shop assistant looks frontally out towards the painting's viewer, her eyes mirroring an unseen shopper for whom the viewer is surrogate.²² She stands by an open glass door that is almost at right angles to the interior, a vertical cut dividing the door frame from the inside space and ushering the spectator's eye out of the shop to the street. But not before the eye has passed over the door's outer sheen of reflection that contains the mirage of two dark horses and a white caught from the street, and just entering the margin of the picture, the door crest superimposed on them (the reflected horses and the living ones are moving towards one another, of course, in the uncanny way of reflections); not before the stripes on the shop's own awning and on those opposite have been realigned through reflection to fall obliquely in counter-movement to those of the 'real' awnings seen



Figure 21 William Holman Hunt, *The Awakening Conscience*, 1853-4



Figure 22 James Tissot, *The Shopgirl*, 1883–5

through the glass, not on it. The regime of glass turns everything to discontinuous textures and surfaces. This is the shop's function—to enable the discrete sensory experience of each luxury item for sale. Further, it severs the environment by cutting it into discrete fragments of incomplete image superimposed on surfaces, images whose partial nature is derived from the random movement of the city, the accident of reflective planes, and the angle at which objects reflect.

A radically fissured visual world leads to two opposite possibilities—that of reconstituting the incomplete visual field, of putting together what never has been a totality, or that of working through its segmentation, attending to the knowledge offered by these partial and discontinuous mediations. 'I am that wretch comparable with mirrors | That can reflect but cannot see.'²³ Quoting Aragon's poem, Lacan moves from the mirror as a site that offers us the illusory completeness of the reflected image to the mirror as the moment of what he theorizes as phallic loss (the 'fracture' of castration): it brings to awareness the split between the eye and the gaze, as the eye is seen not to be in full possession or ownership of the seen. Yet this either/or of completeness and incompleteness is different from the fragmentary reflection registered as third term in these paintings. By its nature reflection is not totalizing. No reflection can represent the visual environment entire. Here this is understood at the level of quotidian experience. Half the room is reflected in *The Awakening Conscience*, the incomplete horses' heads just begin to enter the shop's images in Tissot's work.

IV In the nineteenth century the urge to reconstitute and unify pulls against the fractured world, to be sure, and yet fragments insist on existing. Something always escapes. The escape is not always negative: it leaves room for visual and intellectual negotiation and even optical pleasure. The duplicate world is sealed in glass and yet there is a 'beyond', an unknown visible almost but never quite within reach of the eye: the reflected passage seen through the open door may be a new space—'may be quite different on beyond', Lewis Carroll's Alice surmises.²⁴ The mirror's silvery completeness may make that 'beyond' inaccessible. But reflecting space enables one to think or see possibilities. The claustrophobic specular room tropes the room for speculation. There is Alice's carefree epistemophilia—does the mirror record what is the 'behind' of objects or something different? There is Bulstrode's agony in *Middlemarch*. '[H]e felt the scenes of his earlier life coming between him and everything else, as obstinately as when we look through the window from a lighted room, the objects we turn our backs on are still before us instead of the grass and trees. The successive events inward and outward were there in one view: though each might be dwelt on in turn, the rest still kept their hold on his consciousness.' In



Eliot's philosophical metaphor the reflection collapses time into space by making simultaneity of succession, and the two slit parts of Bulstrode's life, like the room and its reflection, appear together in their dissociation.²⁵

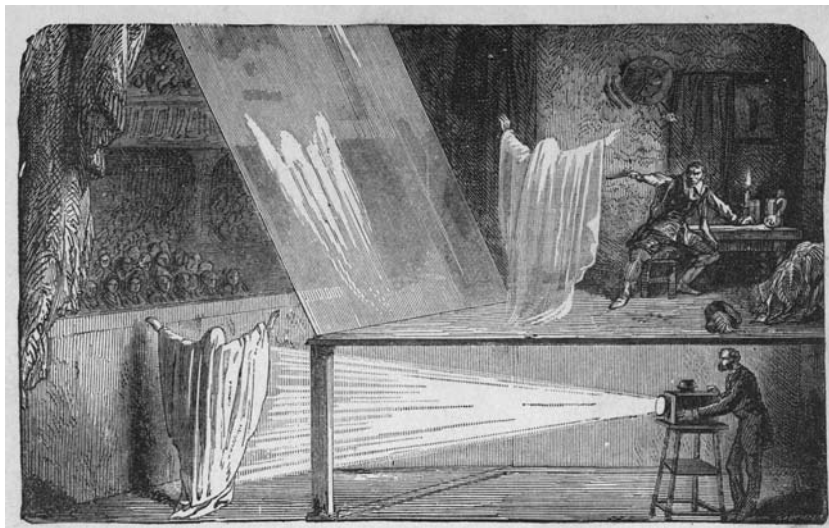
Figure 23
Edward Burne-Jones,
Venus' Mirror, 1870–6

What Happens to Bodies in Glass?

I Reflections confound surface and depth. Of painted reflections in water, Ruskin wrote, there can be no 'exact copy' between those objects above the water and the images in it: we discover 'a totally different arrangement of them, that which we should get if we were looking at them from beneath', 'under different lights, and in different positions'. Whenever we see reflections of distant objects in near water, 'we cannot possibly see the surface. And *vice versa*'. When a painting gives these images clearly 'we presuppose the effort of the eye to look under the surface, and, of course, destroy the surface'.²⁶ Such clearness seems 'preternatural' because the gaze is not in the habit of using a distant focus for near reflections. Such a 'preternatural' experience of reflection happens not only in Turner's work, Ruskin's exemplary painter, but in works such as Burne-Jones's *Venus' Mirror*.²⁷ The reflections of the cluster of intensely gazing women absorbed (but anxiously) in contemplating their images in a pool are so arranged that their inverted images are seen as if from below, their forms both elongated, as we take in depths, and foreshortened, as the clots of lily leaves through which the images discontinuously appear remind us of the surface which

Figure 24

Pepper's ghost, tricks with reflection, from F. Marion's *The Wonders of Optics*



we have had to ‘destroy’ in order to see reflection in depth. Behind an arm, foreshortened feet, a torso denied a head, comes the reflected sky—seen from beneath. The double focus makes of these water images another space, a heterotopia, as Foucault called it, where reflection is *not* a double but a displacement. ‘I see myself over there in the unreal space. A sort of shadow gives me the visibility to see myself where I am absent . . . From the mirror, I find the absence of where I am because I see myself over there.’²⁸ The enigma of the mirror is the depths of its surface, the surface of its depths. ‘Looking’ for this painting is to look deep into a depthless surface. Flatness and solidity are continuously negotiated. The eye questions solidities, haunted by the body’s illusory substantiality.

II The materiality of the image and its negation in glass (for it produces both these at once) prompt thoughts on the nature of what is spectral and what *is* bodily. ‘The production of living but impalpable spectres is’, F. Marion declared in *The Wonders of Optics*, ‘a completely modern achievement.’ He meant the production on stage (a feat that seems to have been achieved concurrently by French illusionists and by Pepper at the Adelphi for the performance of Dickens’s *Haunted Man*) of a virtual image reflected from a massive inclined panel of glass, unseen by the audience, that stretched across the front of the stage. The image of the corporeal actor beneath the stage was reflected onto the glass. For Marion this was truly modern, not only because of its virtuosity, but because before 1847 magic and optical illusion lacked the glass technology to produce such phantoms, ‘an imponderable ghost endowed with motion’;²⁹ the method of ‘manufacturing and polishing glass plates of sufficient size and clearness’

had not been developed.³⁰ The spectacle of theatre actually reproduced the living but impalpable, ‘modern’ everyday experience of bodies displaced onto public glass, no less an enigma for belonging to popular spectacle. When we are made phantom doubles in glass does this deny or affirm our own spectrality? The physics of reflection forms an image convergent with matter but not of it, we have seen. The ethereality of the image fused with glass returns us to the literally ethereal nature of glass, the product of breath. Here insubstantiality and solidity lose their antithetical values.

Mirror Lyric Collage

For phenomenologists there is a circularity to the visible that precludes spectrality. ‘The nearing of nearness is the true and sole dimension of the mirror-play of the world,’ Heidegger said.³¹ Merleau-Ponty asked to greet, not a phantom, but a ‘re-joinder’ in the mirror. He was unafraid of ‘the mirror’s ghost’ because it effected a metamorphosis of seeing, a mediation in which the carnal body was in dialectical continuity with the image by virtue of the reflexive, double nature of seeing in the world, where the looker was ‘seeing-visible’. The mirror is a type of ‘the labour of vision’. It figures ‘the metaphysical structure of our flesh’. The sensible image answers the body’s visibility—the sleek surface of a pipe, its smoke reflected in the mirror (breath again) is felt not only by the corporeal touch but also by the ‘ghostlike fingers’ in the mirror. Its mediation creates a series of exchanges, turns things to spectacle, spectacle to things, the self into another, the other into the self.³² (But, more pessimistically than he would like, smoke turns to spectre, spectre to smoke.) Merleau-Ponty here adapts the Hegelian ‘labour of the negative’, the act which brings self and things into a relationship that can be fully grasped as an interactive entity, to the purposes of the non-dualistic corporeal seeing-visible developed by later phenomenology. The mirror’s mediations, overdetermined at this time and almost always worked out through crises of sexuality, are less certain, however, for lyric poets.

I **Ghosts** in the mirror’s burnished patina. The language of phantoms haunts Victorian mirror poems. The image in the glass becomes ‘**The ghost of a distracted hour**’. ‘**Shade of a shadow in the glass**’: with ‘shade’ and ‘shadow’, the words match, but a reduced spectre of the shadow’s lexical form *precedes* it. Which is the ‘other side’ of the mirror, the reflection of a shadow, the shadow of a reflection? (Mary Coleridge, ‘**The other side of a Mirror**’). The ancestor of this poem is Tennyson’s ‘**I am half sick | Of shadows**’ (‘**The Lady of Shallot**’). ‘**Art thou the ghost, my sister, | White sister there, | Am I the ghost, who knows?**’ (Swinburne, ‘**Before the Mirror**’) ‘**Art thou . . . Am I?**’ The ‘I’ in the mirror, the ‘**thou**’ outside it,

or the 'thou', in the mirror, the 'I' outside it. The I/thou dyad is reversible depending on which 'white sister' is image or substance, reflecting subject or reflected other, and which takes on a blanched, ghostly status.

'She stops before the glass . . . steals shadow-like to where | I Stand'. The mirror's exposure of her abjection makes the unfaithful wife of Meredith's 'Modern Love' 'shadow-like', self-effacing—the husband literally has power over her image, power to spectralize her body, as if a reflection has stolen to his side.

The owner of Hardy's 'Cheval Glass' now lugs it over the world on his travels, half conscious of the comedy of desire. 'I . . . drag it about with me'. It was once owned by the woman he loved, now dead, bought at an auction of her possessions, and is now a cumbersome portable symbolic possession of her—the lyric is a play on possession, material and ideal, their interdependence and their irreconcilability. Her posthumous 'pale-faced form' emerges in the mirror brushing her hair at dawn or will 'Smile from the frame' at midnight 'at my call'. Vision or empty frame? Does the mirror 'materialize' the form?

II Fragments. John Tyndall explained, we have seen, that the virtual image is a form of 'as if', projected backwards from the surface of the mirror. The 'as if' is given back to the viewer, glazed in perfect replication but always in unreal space and simply obeying the impersonal and arbitrary dictates of light. I 'glass', 'I've imaged', caught 'within my rim', 'I flash back', 'I echo': Hardy's 'The Lament of the Looking-Glass' replicates the forms of doubling available to the mirror. But 'I never hold to sight' the desired image. There must always be something askance about the mirrorscape's image. A silver aloofness comes athwart the viewer because reflections are simply light's memory traced in matter. Mirror poems long for faces and visual coherence. There is always the possibility that the inhuman takes over as the human image is evacuated from the glass. Hardy's *Looking Glass* once 'pleasured' a girl's image. Now it glasses disjunct 'smileless things', segments of the inanimate world arbitrarily entering its frame as if severed from their associative field in human culture—'shadows of coursing cloud', the 'plying limb of a pensive pine' in the wind, 'phantoms of the night', 'roses red and white'. '[T]he pool in which light reflected itself': '[H]ow once the looking glass had held a face; had held a world hollowed out in which a figure turned, a hand flashed', Virginia Woolf wrote, learning from Hardy in *To the Lighthouse*. 'Only the shadows of the tress, flourishing in the wind, made obeisance on the wall, and for a moment darkened the pool in which light reflected itself'. Dante Gabriel Rossetti's 'Without Her', a poem formed from the sensory loss of reflection, posits a world without reflection. 'What of her glass without

her? **The blank grey | There where the pool is blind of the moon's face**'. The absence of reflection is as physical as the imprint of an absent form's pressure on a pillow, where the empty print doubles the face. The poem is hollowed out formally by the one-sided repetition of 'without her', which weights the beginning of the lines, leaving the latter parts of each line empty of corresponding repetition. The denial of human reflection empties out the universe. Rossetti sees shadow as a form of anti-light. **'Where the long cloud, the long wood's counterpart, | Sheds doubled darkness up the labouring hill'**. Cloud and wood—**long, long**—are dark counterparts, turning the principle of reflected light against itself as a kind of inverse reflection produced by dark matter. The Heideggerian circularity of mirroring would be denied by Rossetti: it is presented as a negative reflection of sky and earth here. The cloud shadow compounds the wood's darkness and its own by throwing the wood into shadow.

III Surfaces and Depths. Her **'beauty often in the glass | Sharp on its dazzling surface'** (Michael Field). **'Deep in the gleaming glass'** (Swinnburne). The **'effort of the eye to look under the surface, and, of course, destroy the surface'**. **'O set the crystal surface free!'** (Mary Coleridge). A raging, anguished, silent woman—**'she had no voice'**—is trapped in the mirror, suffering the hideous 'wound' of femininity. The glass could be freed from its image, the hardened surface might be actually uncongealed for a softer more plastic world. The *image* of the face might be freed also. The **'hard unsanctified distress'** of the image is *set* in the reflective surface, however. It is both distorted ideological image and imaginatively and somatically real to the speaker—a shadow is not an illusion.

In Dante Gabriel Rossetti's 'Willowwood' an imaged woman's face rises to the surface of water, superimposed on the reflected eyes of the gazing lover and personified figure of Love. Love and the Lover above the water do not look directly at one another—their mutual gaze is deflected and mediated by the reflections of their **'mirrored eyes'** below the surface. **'Only our mirrored eyes met silently | In the low wave.'** The disjunction of focus through the incompatibility of surface and depth is brought to its logical contradiction in the impossibility of the kiss. The **'brimming kisses at my mouth'** (one can only kiss one's own reflection) are a consummation and violation. The image of the woman's face, 'grey', as the fourth sonnet in the series has it, breaks through the surface of the reflection, yet the reflection is the very condition of its possibility. The rippling upheaval of hair and water compels the image from its reflection as living dead. The disturbance of the ripple effect is presaged in sound as multi-syllabled words rhyme with monosyllables—the ripple begins in the anamorphosis of sound. A second sonnet has the doubled and redoubled images of the

lovers as a ‘dumb throng’, ‘one form by every tree’, reflected to infinity, mirrors reflecting into one another.

IV A Stranger’s Look. ‘Once more, as I learn by heart every line | In the pitiless mirror, night by night, | Let me try to think it is not my own’: Augusta Webster’s rejected woman speaks in ‘By the Looking-Glass’. She suffers from reverse narcissism, attempting to disown an image that has been imposed on her by the gaze of the other, the culture’s remorseless reading of femininity. **She reads ‘every line’** of her face in the mirror as the text of alien representations: the ‘line’ might come from a text or a portrait, be one-dimensional or three-dimensional. Whether it is her own fleeting surface print or the culture’s authoritative in-depth picture of femininity scored into her face, the mirror image forces despair upon her. All she is left with is the image of a lined face. The mirror is simulacrum but it induces a collusive reading of the socially negated self.

Christina Rossetti: **All my walls are lost in mirrors, whereupon I trace | Self to the right hand, self to the left hand, self in every place, | Self-same solitary figure, self-same seeking face.** Here estranged images of the self multiply, no longer owned. But ‘**Who holds that mirror? . . . Who lifts that mirror?**’ Hardy asks, in the intransigent lyric that is the title poem of ‘**Moments of Vision**’, itself suggesting discontinuous sight. The determinant of the angle of vision and its effects is unknown to us, but it ‘**makes of men a transparency**’. He can be *seen through*, turned into an image (a ‘**transparency**’ is also a lantern slide). Each stanza begins with the anaphora of ‘**That mirror . . . That mirror**’, rigorously reminding the viewer of the concealed ideologies of looking. But this poem is also about ‘the meta-physical structure of our flesh’. The reflective truth of the mirror, the surveillance of the externalized image, **which ‘throws our mind back on us’** may simply result from its angle, but the mirror image also ‘**throws our mind back on us and our heart** [my emphasis], | **Until we start**’, shocks with passional and bodily recognition: ‘**start**’ and ‘**heart**’ register a cardiac shock, a psychic and somatic heartbeat of surprise. He sees himself ‘**start**’ in the mirror as he feels himself **start** internally. Bodies and reflections need each other, breathe with each other. Where finally is the reflection thrown in the last ontological moment of death? ‘**Glassing it—where?**’³³

Transitive Glass Space: Looking through

The traces in glass culture work differently for transitive glass. The paradox of reflection, visible but intangible, works the other way round for translucent glass. Here the trace is barely seen but material. Glass’s nature as

medium and barrier makes evident its materiality as a brittle film ‘in between’ the viewer and the world. Glass mists up in response to a breath on the window pane—‘Leaning their faces on the window pane | To sigh the glass dim with their own breath’s stain’ (Elizabeth Barrett Browning).³⁴ Frost flowers melt on it (Jane Eyre breathed on the window pane to see the stranger who changed her life approach).³⁵ Rain beats against it. Harriet Martineau reported a child’s question: ‘[W]hen there were no windows’, what did people do without the pleasure of tracing ‘the jerking, capricious drops on a window, which never seem to be able to make up their minds which way they shall run, in their inevitable general direction from top to bottom’?³⁶ Intended for the passage of sight, every window comes with a future history of seeing blent into it. It anticipates the gaze of innumerable eyes, from inside to out, outside to in, a relation that is always unsymmetrical. The window is the seam, or junction, of the body’s internal space. It turns inward and outward. Instigating both transitive vision and obstruction, it is a faultline, the point of tension. At its intersection, trauma, crisis, and epiphany occur. Opposites meet at the window. It is the place where contradictions are posed, where the boundary is unsafe. The window’s changing perspectives create an uneven relation between the gazing subject and the world—what matters is how the *window* makes you see, not only how you *see* through it—and ensure that there is never a wholly protected one-way movement of vision. When the window intervenes there are always *three* to any act of perception.

Despite its stubborn physical existence, the window’s boundary makes the scopic trajectory *theoretical* because the body can never follow the eye. At the same time the questions it asks begin with substantive, corporeal matters—power and blockage, restraint and desire. The violence of scopic control, a visceral desire for things and erotic desire all emerge at the window’s intersection. The consumer and the existential longing of the lyrical subject arrive together as the window’s physical obstruction intensifies the imagination. The person who looks from outside through an open window, Baudelaire wrote, never sees as much as one who looks at a closed window. There is nothing more profound, more mysterious, more generative, ‘than a window lit by a candle’. ‘In this black or radiant space life lives, dreams, suffers’; ‘the windows, I spoke to them | and they talked back’. Rilke’s ‘The Windows’ is a throwback to nineteenth-century glass culture.³⁷

Window, casement, lattice, pane. The semantic variables in play index innumerable ways of imagining a window in the nineteenth century. Yet a window is never simply an aperture in a wall to let in light. Ways of seeing were historically constrained by the technological necessities of the vertical window, the dominant domestic form for over a hundred years in Europe.

The lengthened window, sometimes reaching to the floor, was an architectural solution to the supply of light. 'The windows, in order to light a room cheerfully, should be brought down as low as the nature of the occupation of the room will allow, and be carried up as high nearly as the cornice,' John Claudius Loudon wrote.³⁸ The height of the window was necessitated by load-bearing problems which limited the width of the aperture: building technology had not developed ways of admitting light without high ceilings. Thus the oblong window, taking its stress at the centre, and crossed with horizontal supports, came into being.³⁹ This was the core building type, structuring the gaze from within and without, until the horizontal window (created by the load-bearing possibilities of concrete) of architectural modernism arrived.

Power—the Limits of the Gaze

I 'As the eyes of Lyncaeus were said to see through the earth, so the poet turns the world to glass, and shows us all things,' Emerson said of the poet.⁴⁰ Transparency and absolute knowledge are a habitual collocation. The aura of pellucid glass seemed to promise this absolute clarity. 'My prison is transparent: my management no less so,' Bentham wrote, and meant this literally as well as metaphorically. His prison was to be 'almost all window' and a glass skylight connected the Lodge and compartmentalized rotunda where the prisoners were placed in separate cells at the periphery. The now notorious Panopticon, a Russian inspiration designed by his engineer brother, and almost certainly influenced by the massive glasshouses on the Potemkin estate, afforded the 'invisible omnipresence' of the overseer in the central Observation Lodge a partial 'command' of the Second floor and a full view of 'the ground story [*sic*] of the cells'.⁴¹ Foucault has taught us that this intensely scopic model of power instigated a new psychic and political experience of surveillance, powerfully mobilized in actuality and in the cultural imaginary of the nineteenth century.⁴² But counter-models coexisted with hubristic panopticism. By Bentham's own admission, the overseer's view is partial and imperfect—his prison had four floors, and even to view two of them simultaneously required some contortion. The gaze is dependent on light transmitted through the prisoner's cell, for both prisoner and observer use the same light source, which has its point of entry through the prisoner's outer window. The prisoner is in silhouette at some points in the day, objectified but unknown. And the overseer may represent omniscient power but is trapped in an unalterable visual field, limited by the perspective of his own gaze from the interior. The unidirectional gaze of scopic power is the limit case of the unsymmetrical power relations of the window. But these are mostly more complex. The discomfort of being looked at is bound up with the

recognition on both sides that we are seen seeing. This is accomplished with beautiful subtlety in Trollope's *Barchester Towers* (1857) at the outdoor fête, when Signora Neroni takes up a panoptic station on her sofa at the drawing-room window in order to discomfit Eleanor, who, squashed uncomfortably between two unwanted suitors in a tent, sees her seeing—sees her, encouraging the man she cares about to view her as spectacle—and averts her gaze. And comedy: in *Dombey*, Toots's unpredictable appearance at different windows, into which he cannot see, disrupts a church congregation, who *can* see him.

II The Crystal Palace was a descendant of panoptical technology. It was a 'palace made of windows', as Douglas Jerrold's notorious satirical poem for *Punch* described it. It put the world's products under surveillance in one transparent space. *The Times* correspondent viewed it before it was opened in 1851. But glass disempowered his gaze by dematerializing like a 'phantasm'. The overview from the roof, the 'monster' window 18 acres wide, is uncanny, the sight of workmen crawling like insects below surreal and alienating.

an Arabian Nights structure, full of light, and with a certain airy unsubstantial character about it which belongs more to enchanted land than to this gross material world of ours. The eye, accustomed to the solid heavy details of stone and lime or brick and mortar architecture, wanders along those extensive and transparent aisles with their terraced outlines, almost distrusting its own conclusions on the reality of what it sees, for the whole looks like a splendid phantasm . . . looking downwards through the monster window frame, 18 acres wide, which is spread out at his feet, [he] may see the workpeople and other occupants of the basement and galleries crawling about like bees in a glass hive.⁴³

III *Punch* satirized the panoptical hubris of the Crystal Palace in a mock letter to Joseph Paxton, 'Glass Houses of Parliament'.

Glass Houses of Parliament! Do not all of us—all the represented—see all our members hard at work?—whilst it cannot be objected to permit the unrepresented, the unfortunate creatures without members, to look on too. How delightful to watch the senatorial hive!⁴⁴

Fully aware of the expenditure of human breath in glass building—'a huge glass globe blown by the concentrated breath of BRIAREUS'—the writer is alert to political meanings: Briareus was one of the three mythological giants who abetted Zeus against the archaic race of Titans (or in nineteenth-century terms an obsolete aristocracy), doomed to be superseded. But just looking will never give 'the unrepresented' power in an undemocratic state. 'Honey-bee and MP!' The MP is ironically aligned with the industrious working class excluded from the vote. Glass is never neutral.

IV The power relations of the window, Ruskin believed, constantly changed. The window only evolves as a peacetime structure. War's naked violence, and the requirements of range of shot and vision, attack and defence, determine other forms of inlet. Only in peacetime can 'the annihilation of the thickness of the wall' maximize seeing and power relations dissolve. The prime need of the window is 'approachability'. The nearer the viewer approaches the aperture the wider and deeper the visual field, the more he or she can see 'the earth and the doings upon it'. It is the prerogative of the peacetime subject 'to have it in their power to look out of a window'.⁴⁵ He speculates upon an aroused state, an everyday curiosity and awareness (despite his professed aversion to the city). The outward gaze for Ruskin rarely confers power on the viewer: sometimes the outside invades unbearably—'carriages, and dust-carts, and drays, and muffin-men, and postmen, and footmen, and little boys, and nursery maids and milkmaids, and all the other noisy living things of a city, are perpetually rumbling and rattling, and roaring and crying'.⁴⁶ Attempting to control the street's chaotic taxonomies through alliteration and internal rhyme and subsuming them under the rubric of noise, he actually individuates the experience, a 'crying' or weeping city differentiated from a roaring one.

This is something like the perception of the beat and rhythm of external life that, Henri Lefebvre says in his 'Seen from a Window', the looker perceives at the level of somatic perception, discerning the rhythms of power as well as able to individuate and make her own the diverse aural meanings that belong to the sound outside the window.⁴⁷ Ruskin's openness must be distinguished from the classic ownership of the vertical window (perhaps more coercive than Foucauldian readings of power) expressed by August Perret when he defended it against Corbusier's horizontal window, made possible by reinforced concrete that reduced the number of supporting elements. It was 'not a window at all'. 'A window, that is man himself!' 'The vertical window provides man with a frame, it accords with his outlines . . . the vertical is the line of the upright human being, it is the line of life itself.'⁴⁸ This window crossed the subject-object divide, creating 'mute dialogues' between the 'finite and the infinite'.⁴⁹ A 'window 11 metres long' dispensing with a sill so that it 'removes its own limits' is a depthless field, eliminating transitional space from foreground to distance—functional, pure, immediate. Lake and mountains are *there* without intermediary, 'sticking' to the retina. The horizontal window 'tears a hole in the protective covering of the private person'.⁵⁰ Perret deprecated the vertical window's disappearance as middle term, but he also claimed control over the visual field and over the space beyond.

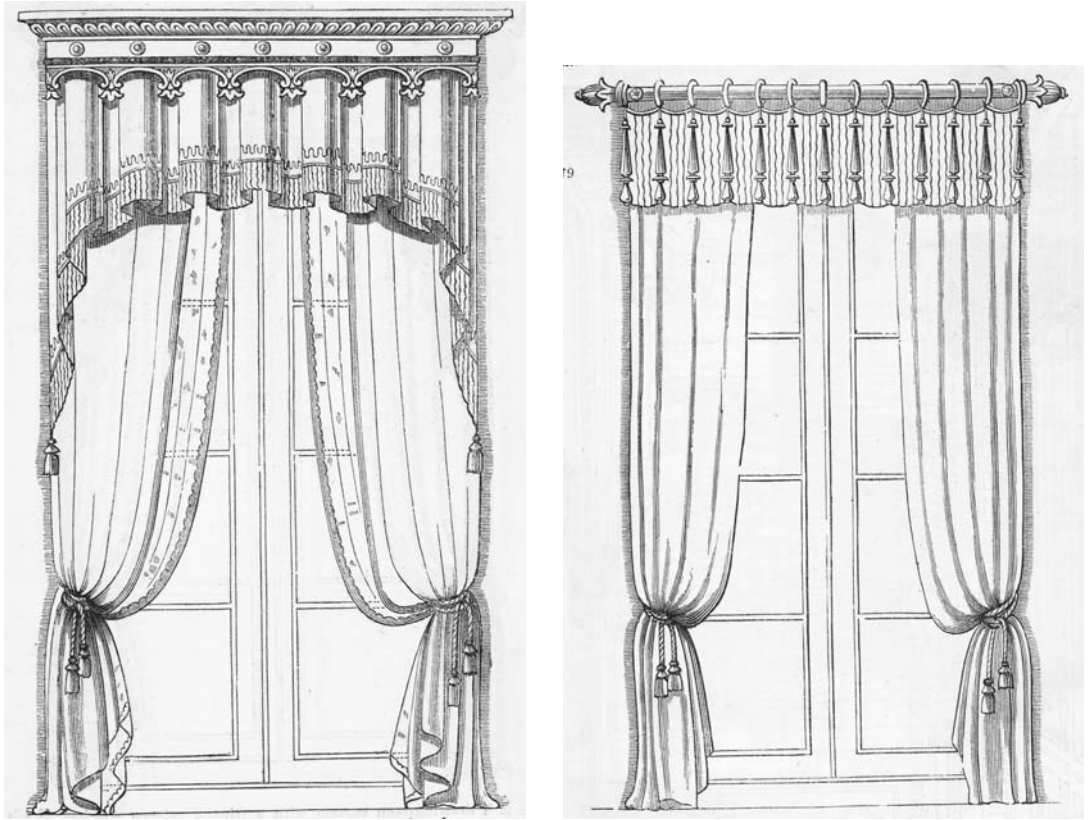


Figure 25 Two ways of 'dressing' a domestic window: John Claudius Loudon, *An Encyclopaedia of Cottage Farm and Villa Architecture*, 1842

Lefebvre also helps us here with this privileged reading of the private gaze. We might own a window and even land outside it, but not the visual field. The window, swagged, draped, tasselled, frilled, ruched, layered with curtaining, as magazines of taste directed, was a fraught reaction to the abrupt termination of possession that it marked.⁵¹ 'Dominated space'—railways, highways and machines, public glass, driven by the machinery of capital, commerce, or the state, a process accelerating in the nineteenth century, takes over the outside and makes the window permeable.⁵² The common public road was already a dominated space. It comes sharply up against the lyrical space of the window. It makes the aesthetic, staged arrangement of the window as a private proscenium arch all the more intense. But for Lefebvre this is not just a 'private' interior space: it is a more complex 'appropriated' space, bought from dominated agencies but capable, despite these constraints, of being an expressive

Figure 26 The exclusions of the vertical window. 'The young man who is alone in London on Christmas day', *Illustrated London News*, 21 December 1850



social space, and a zone of passionate individual culture and aesthetic creativity.⁵³ It is genuinely liberating, but is a response to the contingency of domination.

V It is an arts and crafts stained-glass artist who challenged the use of the window as mystified power, religious or otherwise, with an aesthetic reading of the fragile medium of glass as emblem.

[F]or you must always remember that a window is, after all, only a window, it is not the church, and nothing in it should stare out at you so that you cannot get away from it; windows should 'dream' and should be so treated as to look like what they are, the apertures to admit the light; subjects painted on a thin and brittle film, hung in mid-air between the dark and the light.

Stained glass, or glass painting, its earlier celebrant and scholar, Charles Winston, wrote, has a 'translucency' and the power of transmitting light unrivalled by other 'species of painting'. But to enable the collective seeing which is its purpose the glass-painted window had to negotiate the hazards of the very opacity conferred by colour itself. It can empower seeing and disempower it.

The greater the depths of the shadow, the greater no doubt will be the force given to the picture; but the brilliancy and general transparency of the picture are in proportion to the brilliancy of its lights, the transparency of its shadows, and the relative quantities of light and shade. The picture will be dull, if its lights be not kept clear and bright, whether its shadows be strong or weak; opaque if its shadows be not transparent, notwithstanding the brilliancy of its lights; and heavy if the aggregate volume of the shadows greatly exceeds that of the lights.⁵⁴

Consumption and 'Double Lustre'

I Commercial glass, with its sensuous optical allure, conferred what Trollope called a 'double lustre' on goods, giving aura to ordinary objects and multiplying the allure of luxury goods. The 'uncommon' windows created by plate are 'the most glorious product of the age'.⁵⁵ Glass and scopis desire are bound up with one another. In 1835 Dickens complained of an 'inordinate love of plate glass, and a passion for gaslights and gilding that had spread to haberdashers, hosiers and chemists'. 'Quiet dusty old shops' were demolished: 'spacious premises with stuccoed fronts and gold letters, were erected instead; floors were covered with Turkey carpets; roofs supported by massive pillars; doors knocked into windows, a dozen squares of glass into one.'⁵⁶

II This lustre artificially creates the limitlessness and the limits of wanting. In Knight's *Cyclopaedia of London* 'we find a shop which was one of the first

to adopt the expedient of giving brilliancy and apparent vastness by clothing wall and ceiling with looking-glass, and causing these to reflect the light from the rich cut-glass chandeliers’.

One indeed carries a story [*sic*] higher than the shop, and the lower half of the house is transparent. Here, too, we see of a winter’s evening a mode of lighting now become usual, by which the products of combustion are given off in the street, instead of being left to soil the goods in the window: the lamps are fixed outside the shop, with a reflector so placed as to throw down a strong light upon the commodities in the window.⁵⁷

Every object described is glazed in some way, its lustre intensified, a ‘dazzling array’ of wood, metal, the sheen of imitation waxen flesh, ransacked from every part of the world (easily ten countries of origin are represented here).

The furnishing ironmonger sets off his polished grates, fenders, candlesticks, &c., to the best advantage; the cabinetmaker, with his French-polished mahogany and his chintz furniture, does his best to tempt the passer-by; the tobacconist, abandoning the twisted clay-pipes and the pigtail tobacco of former days, displays his elegant snuff-boxes, cigar-cases, meerschaums, and hookahs; the perfumer decks his windows with waxen ladies looking ineffably sweet, and gentlemen whose luxuriant moustaches are only equalled by the rosy hue of their cheeks, and oils, creams, and cosmetics from Circassia, Macassar, &c.—nominally, at least; and so on throughout the list of those who supply the wants, real and imaginary, of purchasers.⁵⁸

‘[W]ants, real and imaginary’: these highly polished objects grant the longing gaze a kind of transcendental sensuousness. Provoked by the prohibitive aura of glass, the consumer encounters a deliberate barrier generating wants, and manipulating unfulfilled desire for possession. It is the *thwarted* gaze that seduces. When the writer proceeds to the substrata of London (Monmouth Street, the New Cut) no erotics of glass occur. Where commodities are ‘exposed to the view of a second, or perhaps a third’ purchaser, luxury arbitrarily becoming waste without transition: the gaze of need not desire is at work. Pawnshops, brokers, and old-iron dealers display goods—telescopes, gowns, Bibles, pistols—that tell a tale of ‘sorrow and poverty’, some goods ‘to all appearance useless, yet all for sale’.⁵⁹ Here display intensifies rather than concealing the relativization of value, the sudden shock of the uselessness of things that become exchange value’s detritus simply by being resold without the glamour of glass between us and them.

Desire—the Limits of the Gaze

Glass and sexuality come together. Not transcendental sensuousness here, mobilized by looking from the outside in, but a surplus of bodily and psychic longing that breaks against the boundary of the window. The

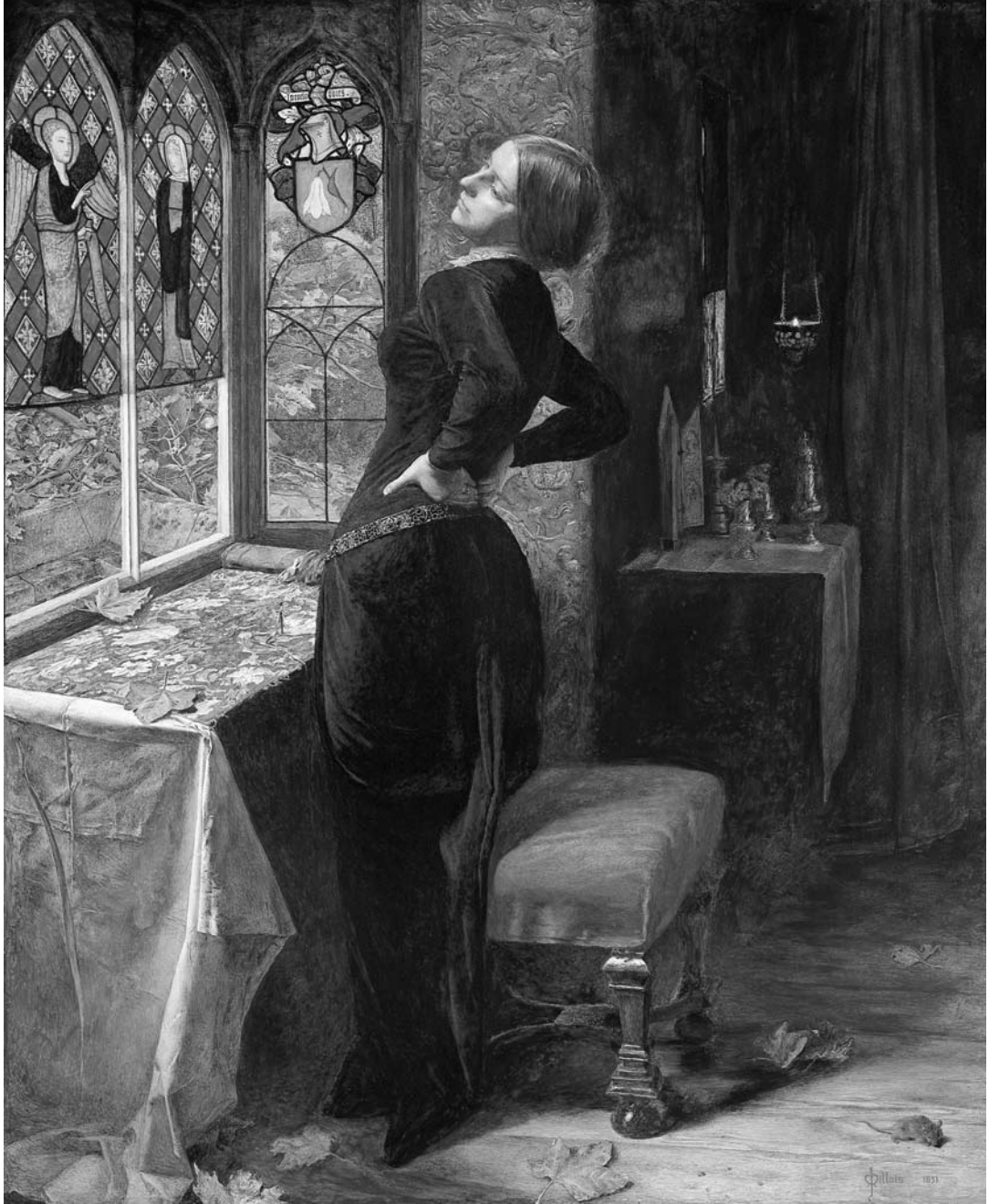


Figure 27 John Everett Millais, *Mariana*, 1851

woman at the window is a ubiquitous trope, so common that it is almost a cliché. One example will do: Millais's *Mariana*.⁶⁰ Mariana's arched back is not dead centre, a pillar of deep blue, hasped by a belt, she's pressing towards the window, prevented from going further by the blockage of a table in front of the tryptich-like stained-glass window. The window is also a barrier. The split between an upper half of stained glass and a lower of clear glass panes redoubles its power as boundary. The upper half, its latticed background another constraint, figures an annunciation, but it is awkwardly split into two panels while a third, the panel placed at a 90 degree angle to them, holds a white flower, the lily, within a defensive shield or coat of arms. This angularity is an uncomfortable constriction, compounded by the transmitted light's lack of interactive radiance. The stained-glass figures are flat, as is the embroidered arras filling the wall before it turns at right angles. The window transfers the outside back into the room instead of allowing the gaze to move beyond it. The stained-glass figures also transfer back to her the red/blue of Mariana's own blue dress and red stool (the faint haze of her hair is a parody of their halos). But the physical volume of the sexual body in the round (followed through in the red velvet skin of the stool), contrasts with this flatness and refuses to be abolished by the religious iconography, setting up intense pressure on it. Despite its crude symbolisms (the scattered autumn leaves) Merleau Ponty's 'metaphysical structure of the flesh' is registered here through volume and flatness, figure and ground.

Window Poetics

The complexities of glass culture immanent in the everyday sensory perception of reflection and translucency, experienced by the body and the mind, were available to the perceiver in the nineteenth century. Some or all of these experiences would be associated with modernity across classes, certainly by town dwellers. Turning to the texts of the overdetermined 'window moment' in prose fiction to explore further the poetics of transitive seeing, it is evident that the substantive physical visibility of the window's aperture as a ubiquitous fact of daily life enabled the window to become a textual aperture. It is an inlet, particularly for women, into real and imagined space, and a moment where reading—since we view the viewer—becomes a reflexive and textual act of seeing. A nineteenth-century novel without a window is inconceivable—windows are casually present, taken for granted, almost anywhere in any novel of this time.⁶¹ Moreover, some novels would simply not exist without them.

I Consuming Gazes: 'Three empty-looking, pretentious shops, with plate-glass windows, and a hopeless air of gentility' (Mary Elizabeth

Braddon, *Lady Audley's Secret*—Robert Audley in London). '[T]he dazzle of shops and cafés seen through uncovered fronts or immense lucid plates'; 'He looked into the windows of shops and he looked in particular at the long, glazed expanse of the establishment in which, at this time of the day, Millicent Henning discharged her functions' (Henry James, *The Princess Casamassima*, Hyacinth in Paris and London). The briefest mention of plate glass in commercial windows does the work of conjuring luxury goods. But commodity fascination often comes shaped by memory, or modified by histories that resist it. 'Oh there's Harrison's, where I bought so many of my wedding things. Dear! how altered! They've got immense plate glass windows, larger than Crawford's in Southampton' (Elizabeth Gaskell, *North and South*). Hardy's country dweller fuses glass and clouds: 'Great glass windows to the shops, and great clouds in the sky full of rain, and old wooden trees in the country round' (*Far From the Madding Crowd*). Consumption consumes, but never without question. 'Thither he was brought; the window becoming from within, a wall of faces, deformed into all kinds of shapes through the agency of globular red bottles, green bottles, blue bottles, and other coloured bottles . . . a strange mysterious writing on his face, reflected from one of the great bottles, as if Death had marked him: "Mine".' (Charles Dickens, *Our Mutual Friend*). Seen through transparent substances for sale in the chemist's shop the bodies of the lookers-in are distorted, as if the transparent symbols of consumption change the body shape. '[H]e had strayed simply enough into Bond Street, where his imagination, working at comparatively short range, caused him now and then to stop before a window in which objects massive and lumpish, in silver and gold, in the forms to which precious stones contribute, or in leather, steel, brass, applied to a hundred uses and abuses, were as tumbled together as if, in the insolence of Empire, they had been the loot of far-off victories' (Henry James, *The Golden Bowl*). The aura of glass invests the material, physical weight of commodities, 'lumpish', 'massive', with transcendental sensuousness that works on the flagrant 'loot' of empire. The shape-changing nature of purchase follows the Prince and Charlotte's clandestine meeting as they try and fail, behind the secrecy of the shop's glass door, to free a gift from its connection with transaction. The gilded, flawed crystal bowl they see there, marked with their secret, follows them into the narrative.⁶²

II Longing Gazes⁶³ 'Her elbow rested on the little work table beside her, and her full, dark eyes were fixed with an expression of deep melancholy on the blue and far-distant mountain boundary, which appeared through the open lattice' (Charlotte Brontë, *The Green Dwarf*). 'I went to the

window, opened it, and looked out. There were the two wings of the building; there was the garden; there were the skirts of Lowood; there was the hilly horizon. My eye passed all other objects to rest on those most remote, the blue peaks: it was those I longed to surmount; all within their boundary of rock and heath seemed prison-ground, exile limits. I traced the white road winding round the base of one mountain, and vanishing in a gorge between two: how I longed to follow it further!' (Charlotte Brontë, *Jane Eyre*). Charlotte Brontë's early Angrian sagas, taking place in and around 'Glasstown' or 'Verdopolis', the capital city of her imaginary country, already intuit an iconography of desire without a content. This is ambiguously liberating and emptying out. The boundary of the window incites another boundary beyond it. These figures look progressively into the vanishing point of an empty 'beyond'. 'She went and curled herself up on the window-seat in the small, deeply recessed window. . . gazed into the deep blue transparent depths beyond, and felt that she might gaze for ever, seeing at every moment some further distance, and yet no sign of God!' 'Again she took her place by the farthest window. He was on the steps below; she saw that by the direction of a thousand angry eyes; but she could neither see nor hear anything save the savage satisfaction of the rolling angry murmur. She threw the window wide open' (Elizabeth Gaskell, *North and South*). Dialectical window moments contrast Margaret's search for transcendence (the 'deeply recessed window', the 'deep' 'depths' of the sky: is it illusory?) with her vision from above of the striking crowd of violent men, where obdurate realities resist her 'view' and dramatize her limited perspective.

The window, doubling space by producing inside and outside, makes a subtle reference to reproduction. The longing gaze comes together with a hymenal space. '[W]hen Dorothea passed from her dressing room into the blue-green boudoir that we know of, she saw the long avenue of limes lifting their branches from a white earth, and spreading white branches against the dun and motionless sky. The distant flat shrank in uniform whiteness and low-hanging uniformity of cloud. The very furniture in the room seemed to have shrunk since she saw it before: the stag in the tapestry looked more like a ghost in his ghostly blue-green world; the volumes of polite literature in the bookcase looked more like immovable imitations of books. . . Each remembered thing in the room was disenchanted, was deadened as an unlit transparency.' 'White, white, whiteness': in this scene of sterile reproduction the text deletes the window frame, whites it out as third term. There is no differentiated space, just an ontological 'white enclosure'. The absent space of the window promises nothing except the narrowing perspective of the avenue and Dorothea's own psychic and sexual death. And Eliot brilliantly introduces a surrogate

window, the ‘**deadened**’ unlit transparency, that becomes visually transitive only through an artificial light source, and which makes everything seem like a failed reproduction. The white landscape is the mark of trauma, complement of the earlier red Easter landscape of St Peter’s (disturbingly menstrual), seen on the honeymoon, like a ‘**disease of the retina**’, and Rome’s glut of images (more sterile replication) as if seen by ‘**a magic lantern in a doze**’.

‘The view from my Lady Dedlock’s window is alternately a lead-coloured view and a view in Indian ink. The vases on the stone terrace in the foreground catch the rain all day; and the heavy drops fall, drip, drip, drip, upon the broad flagged pavement, called, from old time, the Ghost’s walk. She (‘who is childless’) sees another window from her boudoir, the latticed panes of the keeper’s lodge lit by fire, a child, chased by a woman, running to meet a ‘**shining figure of a wrapped up man**’. The scene, sketched in the colourless grey-black tones of deep depression, alternately in lead pencil and Indian ink (they might be, superficially, a lady’s drawings or ‘**views**’), screens the very images of her state that she has tried to repress through the ‘**screen**’ of the window itself. The mortal rhyming of lead with dead calls up the nearby churchyard of buried Dedlocks and the absence of an heir. The pen and inkwash sketch calls up her own lost child as she sees the domestic scene, the lit window. This window, looking out upon a duplicate window, puns on reproduction. The window becomes a printer’s screen or block on which her secret is inscribed. Possession comes into it. She owns the land outside but not the view.

The window allies the contraries of reproduction and death. Superstition and death wish cling to them. ‘**And it’s a sure sign, sir, that death is on its road to the house . . . The bats were flying about in scores, in hundreds, a cloud of them, diving down at the window**’ (Mrs Henry Wood, *East Lynne*). ‘**[H]er breath came thick and fast . . . she made for the window and threw back the curtain that covered it . . . She resolved to end the struggle, by setting her life or death on the hazard of chance . . . Dimly distinguishable through the mist, she saw a little fleet of coasting vessels slowly drifting towards the house . . . For one half-hour to come, she determined to wait there, and count the vessels as they went by . . . Two minutes to the end of the half hour. And seven ships**’ (Wilkie Collins, *No Name*). Even numbers decide for life, uneven for poison and suicide. Here *time* and duration, as well as space, transforms the random view from the window and mimes out mortal temporality in the time it takes to read. ‘Her breath came thick and fast’: Magdalen’s death wish perversely pushes the window towards the opposite purpose for which it is intended, to end breathing rather than to facilitate it. There is a bond

between breathing body and the opening of a window. Respiration marks the rhythms of duration.⁶⁴

III Power and violence through dream windows. Windows as significations of power often structure a text rather than being lyrical insets—the staring panoptical sockets of window go right the way through Dickens’s *Bleak House*. In the following examples violence can only be contained by the secondary revision of the dream, but they are condensed and coded narratives of the main text: ‘**I found myself in a room, standing before a long window. The only object of furniture or of ornament that I saw (or that I can now remember having seen), was a little statue placed near me. The window opened on a lawn and flower garden; and the rain was pattering heavily against the glass.**’ The Shadow of a Man stretches out its arm towards the statue, which fell in fragments to the floor (Wilkie Collins, *Armadale*).

‘I resolved to silence it [the fir-tree branch knocking against the lattice] . . . I rose and endeavoured to unhasp the casement. The hook was soldered into the staple, a circumstance observed by me when awake, but forgotten.

“I must stop it nevertheless!” I muttered, knocking my knuckles through the glass, and stretching an arm out to seize the importunate branch: instead of which, my fingers closed on the fingers of a little, ice-cold hand! . . . “Let me in—let me in!” . . . I discerned, obscurely, a child’s face looking through the window—terror made me cruel; and, finding it useless to attempt shaking the creature off, I pulled its wrists on to the broken pane, and rubbed it to and fro till the blood ran down and soaked the bedclothes’ (Emily Brontë, *Wuthering Heights*). These window dreams, both dreamwork constellations of subliminal knowledge gained in the waking state the day before the dream, are both vicarious dreams in the sense that the dreams properly ‘belong’ to someone else. Allan Armadale’s dream is worked out in the rest of the text through the person of his brooding double, Midwinter (and, unknown to him, his namesake). The epicene, repressed Lockwood steals Heathcliff’s dream of Cathy, making claims on his manhood. In both, dream windows lodge within real windows within dream windows, structuring a regressive and claustrophobic history. It is the mixed-race, introspective Midwinter who retraces the dream of his almost obtusely uncomplicated friend, Allan, discovering its windowscape, significantly, in the basement of Allan’s newly inherited property, like the repressed of the family dwelling. The dream’s components are reiterated: ‘**The fourth window . . . open to the garden . . . It was a statuette . . . the famous Niobe.**’ He reads a description of the room, further back in time, by Allan’s dead mother—‘**the garden, the**

window... the Niobe'. Lockwood dreams the window he is sleeping under, endeavouring to unhasp its soldered hook. In both novels, the window opens onto family violence, genealogical terror and sexual fury. But the dream window displaces and reorganizes these things. The statuette of the weeping mother figure, Niobe all tears, in *Armada*, for example, does not figure harm to Allan's loved women through Midwinter's agency and that of his violent father, as he thinks. It is Miss Gwilt, the criminal beauty, who shatters the mould of femininity and nearly kills both Allan and Midwinter. It is as if the window is in the wrong place, signifying gaps in vision rather than seeing. Allan overlooks his newly acquired property from a high window, but the window is a lacuna, a space that asks a question: do names entitle you to property or does property entitle you to a name?

The **importunate branch**: the dreamwork pun on the genealogical family tree, as Lockwood seizes Catherine Linton's hand instead of the expected pine bough, takes Lockwood into the heart of the novel's tortured generational family and destructive relations. A fascinated voyeur on Heathcliff and the Heights, he punches his way through the glass barrier to make an assault on Heathcliff's psychic possession, Catherine. The child's hand, rubbed up and down on broken glass, figures sexual terror and a savage phallic pun on dismemberment, turned against the girl herself—she is a **'minx'** in the retold dream. It must be after this dream that Heathcliff begins to lose his will to power, having to remind himself to **'breathe'**. Lockwood's insatiable curiosity instigates the entire narrative. Twenty years before, we discover later, at the point of death and delirious in Thrushcross Grange, Cathy uttered a piercing shriek at midnight (reduplicating Lockwood's 'yell' of fear). She sees something in the glass—**'That is the glass—the mirror, Mrs Linton; and you see yourself in it'** (Nellie). Could Cathy, in a prophetic moment projecting twenty years to the future at Wuthering Heights, have seen her usurped bed, and Lockwood's avid face, behind the window in the mirror, as he breaks into her history?⁶⁵

IV Take away windows, and some fictions would not exist. Windows fundamentally organize some texts. They are a hermeneutic space so important that the text subsists on their narrative presence. **When I ventured to look up at the window itself I found that the top of it only was open, and that the blind inside was drawn down. While I was looking I saw the shadow of Madame Fosco pass across the white field of the blind—then pass slowly back again. Thus far she could not have heard me...?...Madame Fosco's shadow darkened the blind again... The dim white outline of her face, looking out straight over**

me, appeared behind the window... She dropped the blind, and I breathed freely again. (Wilkie Collins, *The Woman in White*)

“The question is,” said my aunt, “if it is a real window with glass in it, or if it is merely painted... the oftener people look at it, the less they are able to say”: I am sure I can see the glass shining ‘... how absurd to say it was not a window, a living window. One to see through!... but the room inside had certainly widened. I could see the grey space and air a little deeper, and a sort of vision, very dim, of a wall, and something against it; something dark, with the blackness a solid article, however indistinctly seen, takes in the lighter darkness that is only space’ (p. 8) (Margaret Oliphant, ‘The Library Window’).

Both these narrators are in hermeneutic agony: ‘the white field of the blind’, ‘shadow darkened the blind’; ‘I could see the grey space’, ‘the lighter darkness that is only space’. Is the white field, the lighter darkness, only blank space, or does it mean something? Is perception a creation of the will?—‘and something against it, something dark’. The white field incites endless interpretation. In a physically tortuous position which is a travesty of panoptical knowledge, Marion is precariously hidden below the illuminated window and above the verandah windows from where overheard conversation comes. She risks her life to find out the secret plot against her friend only to learn of a further ‘Secret’ that mobilizes the rest of the narrative. The unnamed narrator of Oliphant’s story of ‘dreamy’ adolescence, gazing from her aunt’s window at the ‘window’ opposite, is consumed by the search for the reality of the ‘living’ window and its transcendent meaning—the story is subtitled ‘A Story of the Seen and the Unseen’. But what does she see? With a terrifying persistence that makes her ill, the girl figures out increasing definition behind the window—the mass of a desk, the ‘flicker’ that tells something has entered the room behind the window, and finally a male figure. Obsessed, increasingly alienated from the adults who fear for her mind, she searches for the place where the window should be when she visits the library opposite—there is a blank wall where it should be. The crisis of the tale, precipitating her collapse, is the bursting open of the window opposite and the appearance of the male occupant at last. No one else sees it. It may be an aperture into the unseen or a misreading of the incompatibility of the seen and unseen.

‘... become aware of a person on the other side of the window and looking straight in... His face was close to the glass’; ‘a figure on the stair... with a glimmer in the high glass and another on the polish of the oak stair below, we faced each other in our common intensity...’ ‘But it’s at the window—straight before us. It’s *there*...’ (Henry James, *The Turn of the Screw*). One of the ‘ghost’ Peter Quint’s habitations is the

window. He hovers by its thin film, earnest of a 'crossing' from the paranormal world. The power of seeing—'It's *there*'—carries the power of proof for James's governess. Seeing is power. Windows also intimate the terrible consistency of a paranoid narrative as the governess 'squares' her story with the evidence in an ever intensified spiral of hysteria: **'I simply make it out.'** But one window episode actually gives credence to her theories, at the same time pointing to the absolute limits of the power of gazing and the breakdown of common meanings. **'I uncovered the glass without a sound, and, applying my face to the pane, was able, the darkness without being much less than within, to see that I commanded the right direction.'** The child Flora is in one bedroom looking down at her brother who stands on the lawn in moonlight, looking, it seems, not at her or the governess, who has stealthily taken up her position at another window in order to overlook the scene, but a figure above in the tower of the country house. To **'command' the gaze** is exactly what the governess cannot do. The window will not let her. She can only infer the presence of Quince in the tower above. With its triple and perhaps quadruple acts of gazing (if we accept that Quint is on the tower) it is an exemplary moment of deflected gazes, and the impotence of panoptic seeing as the criss-cross of eyelines cuts each person's scopic field. And yet they are *there*, as the governess later has it, each seeing the other seeing. It is an existential moment of limited perspective.

Windows in Novels, Novels in Windows

'the upper window from which the funeral could be well seen'. In contrast to this casual superiority, seeing from above, Dorothea cedes her sense of entitlement to power in a moment of epiphany. **'She opened her curtains and looked out towards the bit of road that lay in view, with fields beyond, outside the entrance-gates. On the road there was a man with a bundle on his back and a woman carrying her baby.'** Now, with a new perspective after the crisis of what she takes to be Will's sexual betrayal, Dorothea, though still from an upper window, looks out beyond her estate, the boundary of her ownership.⁶⁶

Eliot makes great claims for this epiphany. Quotidian lives—the man, the woman and baby—come into being for Dorothea at the same time as she is aware of her disjunction from them. This experience is a type of the window moment in nineteenth-century novels. Mostly though not always experienced overwhelmingly by women, the window moment is structured by the physical properties of the window itself. Because it insists on the self and what is outside the self, consciousness and another, the window is always about a double experience of self and beholder. It enables neither a one-sided Benthamite glee of surveillance nor the solipsist

dialogue with infinity that makes the measure of the vertical window the measure of transcendent being, 'man himself'. The window's boundary marks a 'crossing', a crisis or epiphany that brings about existential change, a change inherent in the body's position by a film of glass. Freedom and limit come about through the physical pressure of its barrier.

The poetics of windows are supremely important at particular points in texts, but they also implicitly stand for the entire narratological structure of the novel form at this time. '[A] few personages or families . . . were slowly presenting new aspects in spite of solidity, and altering with the double change of self and beholder.'⁶⁷ Adapted from Hegel's master-slave dialectic, which Eliot and Lewes were reading at the time, this account of change from early on in *Middlemarch* stands for the central movement of nineteenth-century narratives.⁶⁸ Structured as a series of interactive encounters between self and beholder, they are records of individual and social transformation, an Aristotelian peripeteia or reversal. As if seeing through an invisible window selves and beholders experience 'double change' (in Eliot's wonderfully condensed vocabulary), double because each changes, double because each is checked by the other's subjectivity. This joint subjectivity is the third term that turns the gaze or 'cold stare' into a mediated relation of double change. Individual experience takes a social form. The novel calls for what Lefebvre termed a 'triadic' reading, where opposition is grasped for itself and in its relations.⁶⁹ Windows both figure and perform this triadic relation. For the novel the glass panel of a window is the single most important architectural form. The novel is founded on glass culture.

There is one proviso. The window is Europe's building type. In the colonial narrative there are no windows, or if there is a window, it is a grille, a grating or a barrier, acting as a frontier. In Rudyard Kipling's Indian narrative of atrocity, 'Beyond the Pale', the window, a blank space in a dead-end alley, is the site of a confusion of codes. Trejago, acting with the scenario of Romeo and Juliet in mind, confidently crosses the window's boundary and enters into a love affair with the 15-year-old widow behind it. Who seduces whom? Or is he set up? When Bisesa appears at the window holding out the mutilated stumps from which her hands have been amputated, it is still not clear. Trejago only knows, after the window is boarded up, that he can never find the front of her house in the labyrinthine streets. 'Of two bodies in contact, which one possesses the frontier that distinguishes them?' de Certeau asked.⁷⁰

In *Dombey and Son* Dickens recognised, ironically, that the peculiarly European window prepared recruits for the colonial frontier. At Sandhurst 'Joseph Bagstock, Sir, was held out of window by the heels of his boots, for thirteen minutes by the college clock?'

Glassing London

Building Glass Culture, Real and Imagined

Thick from the roof hang crystal drops, such as may be seen in the great caves of some parts of the world but which prosy folks would call chandelier. All round about the walls, the ceiling, and the floor, the most lustrous diamonds cluster, and send out their shoots of light. For a time we can enter into no details from the brilliancy round about . . . Our eyes, getting used to the tremulous scintillations, begin to trace the walls.

Apsley Pellatt's showroom¹

The glassing of London was complete by the mid-century. The idiom of glass had taken over. The glazed shopfront was London's genre, and 'Glass Town' or 'Verdopolis', the capital city of Charlotte Brontë's early fantasy land, Angria, came into being in London. The physical basis of glass culture had established itself. An 'ideal' glassworld appeared, grafted onto the noise and dirt of existing urban space. It superimposed a glass fantasia on the metropolitan rhythms of perpetually changing sensory stimuli, offering an answering landscape of glass aura that repeated the intensity of urban experience even when it seemed to promise release from it. Serving at once the needs of commerce and the cultural imaginary, the lyrical world of glass produced a landscape that conflated the real and imagined. Transcendental domes in air and the squalor of 'Victorian Babylon' were structurally related.² The pellucid glass membrane of this double world inevitably generated double meanings—the artificial lustre of consumer experience *and* urban pastoral, the spectacle as visual pleasure *and* reified commodity, economic exploitation *and* communal regeneration in the commercial winter garden, the false consciousness of orientalism *and* critique. Ferrovitreous glass fantasias were taken to be defining experiences of modernity by contemporaries, and later critics, associating their prefabricated lightness and transparency with Marx's famous statement about modernity—'All that is solid melts into air'—have elided them with the architectural modernism of the twentieth century.³ The experience of the glass building and its contradictory meanings in nineteenth-century glass culture, however, has its own distinctiveness. Returning to Benjamin's observation that architecture plays the role of the 'subconscious'

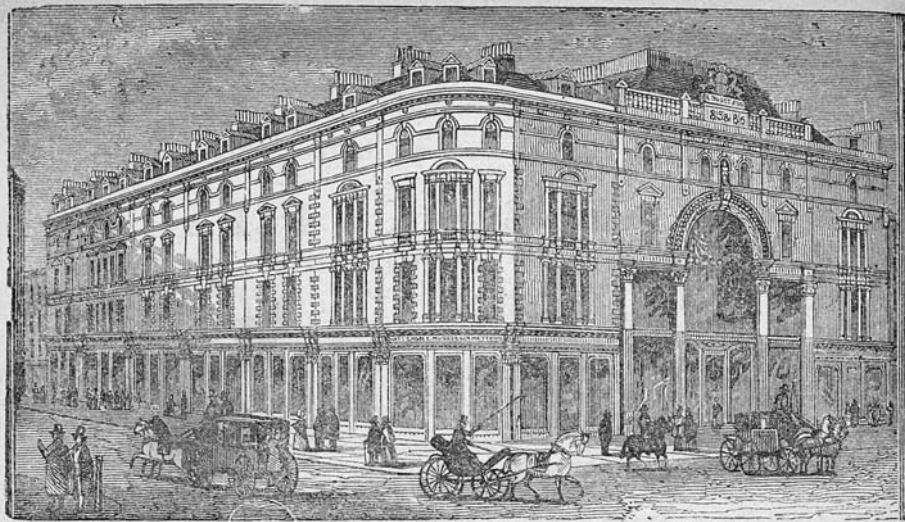
of culture, this chapter explores the glass-scape and its tensions, as the possibilities of a transformative environment developed in parallel with an avid response to commercialization.

I turn from the perceptual experience of reflective and transitive glass to the ambiguous fabric itself. Shops, glazed with the new transparency, in particular expose the way ideal and real spaces were mapped over one another. I move from the shop to the urban conservatory, not the pastoral antithesis of commercial glass but its idealized double. Paxton's Crystal Palace concentrated these meanings. The sections following describe the conditions of that idealization, an intense response to the overarching glass roof, the reading of the crystal interior as grotto, which was bound up with the reordering of space–time relations. I then turn to the plans for glassing London, heard by parliamentary committees. The end of architectural glass culture, superseded by modernist glass purism, from which it differs sharply, forms the chapter's final section.

Shops, the Glass Fantasia

Plate glass, invisibly sutured panels of polished sheet or crown, mirrors, and chandeliers, gave a sheen to urban experience. From Whitechapel on, Charles Knight's *Cyclopaedia of London* (1851) affirmed, 'commerce has taken such complete possession of the leading thoroughfare, that almost every house is a shop, until we reach the western ends of Piccadilly and Oxford Street'.⁴ A continuous glazed thoroughfare ran from East to West, from Whitechapel through Aldgate to St Paul's, including Fenchurch Street, Lombard Street, Leadenhall, and Cornhill, through Ludgate Street, Fleet Street, and the Strand to Oxford Street and down to the western end of Piccadilly. Even the humble goods of Whitechapel 'are nevertheless glazed with plate glass, and lighted with profusion of gas-jets, such as only gin-palaces equal'. In Aldgate one 'extraordinary shop', a clothing shop (E. Moses & Son), occupies 'the site of seven houses, and may be said to reach from the ground to the roof, every story being fronted with plate-glass, and filled with goods'. At St Paul's Churchyard 'we come to a very world of show. Here we find shops whose fronts present an uninterrupted mass of glass from the ceiling to the ground; no horizontal sash bars being seen, and the vertical ones made of brass.'⁵

These gas-lit, mirrored spaces that were all shop window had begun to contradict the received architectural principles that solids should outweigh voids. They opened out a new visual experience—the massive glassed chasm in a wall. The superstructure 'must rest on nothing', Charles Eastlake said. Shops aim to expose goods behind a 'single sheet of plate glass'. Iron columns 'are furtively introduced, and as carefully concealed by



**TO LONDON
ON ITS APPROACHING EXHIBITION.**

A few months more, thou great British Capital, and thou wilt be a scene of excitement and stir unparalleled in thy history. The Great Exhibition in Hyde Park will gather together the largest congregation ever known—a congregation that will flock from all parts of the habitable globe, to worship at the Temple of Industry.

I sometimes am at a loss to know what will be done with thy millionfold visitors in '51. "Lodgings to let," I apprehend, will not be quite so plentiful as blackberries, during thy Grand Exhibition. Some, I fear, will have to say, in the words of the ballad, "My lodging is on the cold ground."

The Railways will bring their enormous throngs from the provinces, and Steamers and Sailing-vessels will land their tens of thousands on our shores. Whatever will the butchers and bakers do? I am almost afraid that there will be not exactly "Corn in Egypt" for so vast a concourse of human beings.

I am not in the least degree apprehensive, however, with regard to an adequate quantity of clothing.

E. MOSES & SON are in a position to meet the greatest emergencies of '51.

Moses & SON are not the tradesmen to let so great an occasion as the Exhibition of this year take place without due preparations on their part. Were 500,000,000 individuals to pour into England, and were the whole 500,000,000 to require suits, I should still have faith in the capabilities of E. MOSES & SON to furnish this enormous aggregate with clothing. The extent and value of E. MOSES & SON's stock is beyond my poor powers of description. It is a stock of attire such as will bring down upon thee the honour and approbation of the world at large in the year 1851.

LIST OF PRICES.

Ready Made.	£ s. d.	Men's Silk & Satin Vests, from	£ s. d.	The Chesterfield Wrapper	£ s. d.
Autumn and Winter Overcoats in every style, from	0 8 6	„ Dress Coats „	0 17 0	from a warm material	1 8 0
The Paletot neatly & warmly lined, from	0 18 0	„ Frock Coats „	0 19 0	Autumn and Winter Trousers from the Newest and most Stylish materials	0 10 6
The Bulwer ditto, from	0 18 0	Youths' & Boys' Overcoats in every shape & warmly lined	0 7 0	Black Dress ditto	0 16 0
„ Chesterfield „	1 8 0	Hussar and Tunic Suits	0 14 0	Autumn and Winter Vests from Thibet, &c. &c.	0 8 6
„ Bequeme Overcoat, a very very handsome and superior style	1 5 0	Boys' Vests in strong materials	0 0 8	Black Cloth ditto	0 8 6
Shooting coats in every material and newest fashion	0 8 6	„ Trousers, Cloth and Doeskin	0 6 6	Black Silk Velvet, do.	0 18 6
Lounging, Morning, and Cambridge Coats	0 8 6	Made to Measure.		Black Dress Coat from	1 12 0
Men's Blouses in a variety of materials	0 3 6	The Nepaulese Winter Overcoat, a very elegant and superior style, from	1 15 0	Black Frock Coat „	1 15 0
„ Tweed Trousers	0 4 6	Do. Do. Lined Silk, from	2 2 0	Men's Shooting Coats „	0 15 0
„ Doeskin	0 7 6	The Snow Repeller, from a very stout and warm material, lined through with Doeskin	2 2 0	Hussar & Tunic Suits „	1 5 0
„ Shooting Vests	0 6 6	The Paletot neatly & warmly trimmed	1 5 0	Youths' and Boys' Overcoats made in every style „	0 18 0
„ Fancy Vests in various materials	0 2 0			Elegant Dressing Robes in great variety „	0 15 0
„ Silk Velvet Vests	0 13 6			A Large Stock of Fur Coats, from £3 to £20.	
				Naval & Military Uniforms, Liveries, &c.	

The Proprietors beg to call particular attention to their immense Stock of Elegant and Durable Overcoats, amongst which will be found all the newest designs both in material and cut.

NOTICE.—The Fur and Shawl Departments are now replete with every novelty of the Season. The New Edition of "Everybody's Book," containing a full report of the late important trial and full directions for self-measurement, can be had on application, or forwarded, post free, to any part of the Kingdom.

OBSERVE.—Any article purchased, either ready made or made to measure, if not approved of, will be exchanged or the money returned.

CAUTION.—E. MOSES & SON regret having to guard the public against imposition; having learned the untradesmanlike falsehood of being connected with them, or it is the same concern, has been resorted to in many instances, and for obvious reasons, they beg to state they have no connexion with any other house in or out of London, except their own Establishment, as follows:—

- London City Establishment, 154, 155, 156, 157, Minories, 83, 84, 85, 86, Aldgate, opposite the Church, all communicating.
- London West Branch, 506, 507, 508, New Oxford Street, 1, 2, 3, Hart Street, all communicating.
- Bradford (Yorkshire) Branch, 19, Bridge Street.
- Sheffield Branch, 36, Fargate.

Tailors, Clothiers, Hatters, Hosiers, Furriers, Boot and Shoe Makers, and General Outfitters for Ladies and Gentlemen.

The Establishments are closed from sunset Friday till sunset Saturday, when business is resumed till 12 o'Clock.

Figure 28 Notorious windows of E. Moses & Son, an advertisement on the back cover of part 1 of Henry Mayhew's 1851, or, the Adventures of Mr and Mrs Sandboys



Figure 29 Shopfronts in Cranborne and New Coventry Streets. *Tallis's Illustrated London in Commemoration of the Great Exhibition... 1851*

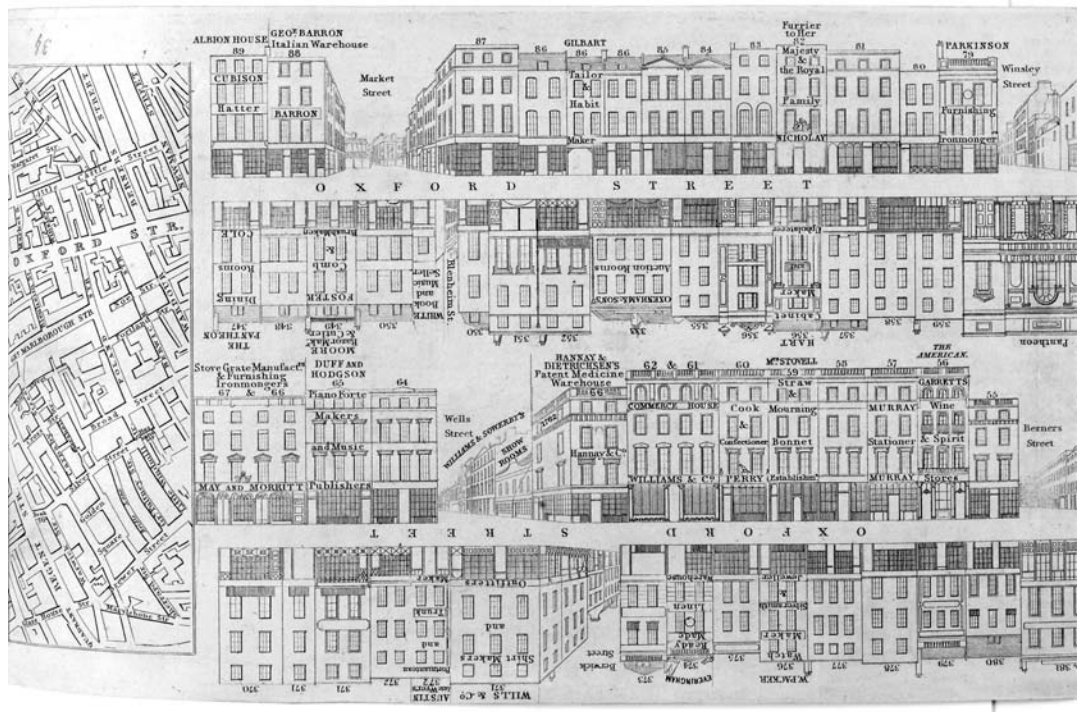
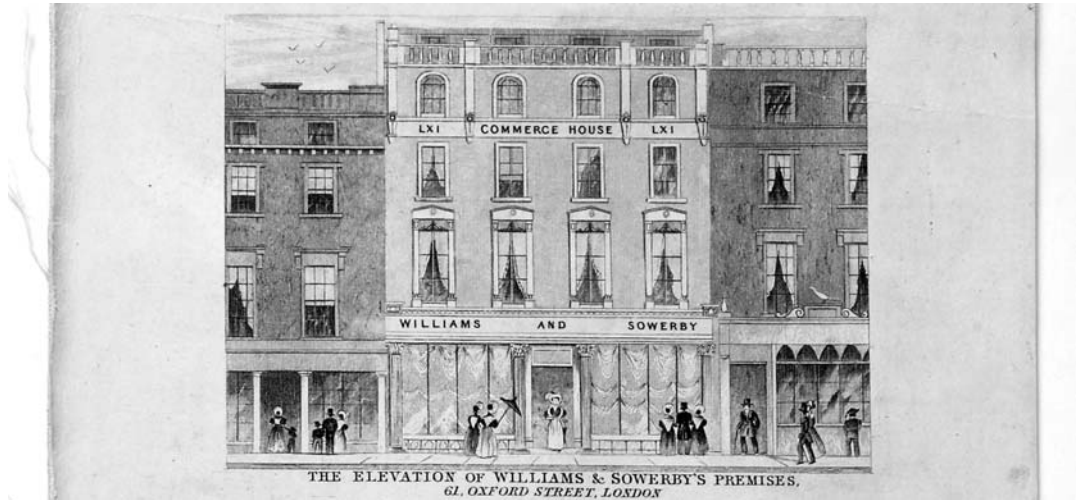


Figure 30 Oxford Street and the Pantheon. Tallis's London Street Map, 1839, no. 34

Figure 31 Errington's large plate-glass shopfront, Ludgate Hill, 1840, in N. Whittock's collection of designs. The elaborate windows of 'Temples of inebriation' pioneered the general adoption of plate glass



Figure 32 *Shop-Fronts*. Engraving of Truefitt (hairdresser) shopfront, Piccadilly, *Journal of Design and Manufactures*, 1851

Figure 33 'The London Season', Regent Street Windows, *Illustrated London News*, 1849



millinery, upholstery, or sometimes by craftily contrived mirrors, so that when all is finished the upper portion of the building seems absolutely suspended in air'.⁶ *Tallis's Illustrated London* combined shops with its metropolitan architectural tourism. Its engravings display walls of glass minimally supported by columns and pillars that soar above the onlooking pedestrians.⁷ *Tallis's London Street Views* of the principal London thoroughfares, illustrated with scale drawings of every frontage on both sides of the street, confirms Knight's statement, 'every house is a shop'.⁸ Both sides of Tottenham Court Road, for example, present an unbroken line of shop windows, as densely ranged as the purpose-built Burlington Arcade. Each of Tallis's double pages carries a small conventional map of the area at one end and an engraving of a sample shopfront at the other (owners paid for this), further illustrating the walls of glass that dominated London. Engravers learned to capture the gleam and aura of glass.

The sensuous allure of light and transparency created optical overload. 'It is high noon in Regent Street . . . The shops are as brilliant as they may be. How richly falls the drapery of those emblazoned shawls through the fair plate glass . . . How gorgeously shines the plate—massive lumps of chased, and carved, and graven, and frosted silver and gold . . . and the symmetrical one leg, in half of a pair of buckskin breeches and a top boot, which ornaments the shop hard by, seems positively about to hop through the window, and kick anybody who does not look happy, and flustered, and smiling, and hot!'⁹ 'In the magnificent linen-drapery establishments of Oxford and Regent Streets, the vast shopfronts, museums of fashion in plate-glass cases, offer a series of animated *tableaux of poses plastiques* in the shape of young ladies in morning costume, and young gentlemen . . . "dressing" the shop window'.¹⁰

This glamour coexisted with starvation wages. Knight's 'extraordinary shop' occurs in another context. It is the 'principal show and slop shop at the East-end', occupying the ground of several houses, Mayhew remarked, when he was interviewing tailors for his sociology of work in *The Morning Chronicle*. It is one of the most exploitative and ruthless employers. 'The windows are of rich plate glass—one window indeed, is nearly thirty feet high.' They were the target of window breakers: 'and it is said, that at the time of the attack on the house by the mob, the damage done by breaking two of the windows amounted to £150'.¹¹ 'All is light and brilliancy', Dickens said, but the glittering gin shops in London's slums, and obdurate poverty, are its source.¹² Knight's *Cyclopaedia* (authored by George Dodd) began its account of London streets by condemning the housing of the poor around them, the best 'featureless', the worst 'dense collections of hovels unfit for human beings to live in'.¹³ Demolished 'Rookeries' have not been replaced with decent cheap housing. The coercive dismembered leg on

display, ready to 'kick' spectators into visual pleasure, and the windows being 'dressed' show an awareness of the constructed fantasias of commerce.

These dazzling streets were Arcades turned inside out, but London possessed arcades. The Pantheon arcade, converted as a passage between Oxford and Marlborough Street in 1832, by Sydney Smirke, shows how the erotics of the glass fantasia, a fecund romanticized space, were superimposed on the urban landscape. A vaulted roof on thin iron sashes, looking like an inverted boat hull, a kind of elongated dome, overarched an area filled with fountains, Moorish and classical ornaments, and sculptures, fish in aquaria, and tropical birds. A hybrid of arcade and bazaar, it mutated into a conservatory at the rear.¹⁴ Outside it was the *mêlée* of the Oxford Street crowd. 'Its public is mixed; goods, wagons, and private carriages, omnibuses and men and women on horseback, men of business, fashionable loungers, and curious strangers, are mixed up; shops of all sorts . . . may be found in it; and there are, moreover, legions of costermongers and shoals of advertising vans.'¹⁵ What the shopper found, coming into the arcade from this 'mixed up' world, was not far different from the fantasy landscape created in Charlotte Brontë's Glasstown environment: 'graceful trees sprung out of the earth bearing delicious fruits of a perfect transparency intermingled with others which rose to a great height, casting down their branches all laden with white blossoms and dark flourishing leaves; crystal fountains, that fell with a murmuring noise, were seen glittering through bowers of roses and tall lilies; the melodies of a hundred birds was heard from myrtle and laurel . . . verdure . . . sparkled in the light . . . Over all this scene hung an atmosphere of crystalline clearness.' Charlotte Brontë's Glasstown glitters with reflective surfaces, but it is hollowed out from below, an underground complex of gothic caves and caverns, where prison and sepulchres are haunted with body snatchers and the urban poor, who work in these subterranean environments, giving out 'a rancid odour'. Unindividuated polyglot crowds seethe in the city. This adolescent mimesis of society intuitively grasps the double urban landscape.¹⁶ Brontë and Smirke might be recreating the Prince Potemkin's semicircular glasshouse of the 1780s, with its exotic trees, meandering pathways, shrubs, Greek sculpture, fish in crystal vases, and grotto of looking glasses.¹⁷ Here it is not easy to separate out the real and imagined glassworlds. In Smirke's glass space the principle of the conservatory as Winter Garden is urbanized and commercialized at the heart of London's shopping district as historical times and tropical spaces converge under glass, simultaneously transcendentalizing purchase and promising transformation in a new world of pleasure. The 'mixed up' crowd jostling classes and confounding hierarchies would be introduced to another 'mixed up' arena as layered times and spaces impossibly coexisted.

Smirke's Pantheon superimposes an ideal 'mixed up' transparent space on the heterogeneous realities of the Oxford Street upheaval. But, despite the

appearance of disjunction, it parallels rather than opposes urban experience—‘changing images, the sharp discontinuity in the grasp of a single glance’, as Georg Simmel’s classic essay describes it.¹⁸ The conservatory is the supplement of urban experience: it developed *pari passu* with the expansion of the glazed shopfront that burnished commodities. Indeed, it was in London that the huge glass conservatories of famous nurserymen arose. There was Knight’s exotic plant nursery in the King’s Road: by 1833 W. & D. Bailey of Holborn had constructed the largest glass building for plants in London; its palm house was 80 by 69 feet and 33 feet high. Conrad Loddiges of Hackney displayed a vast conservatory second only to Bailey’s. Conservatory builders turned to city projects. Richard Turner constructed the great bell-shaped Palm House at Kew and part of Liverpool railway station. Samuel Ware, architect of the Burlington Arcade, was also responsible for a 300-foot conservatory at the Duke of Devonshire’s Chiswick House.¹⁹

The absolute interdependence of urban environment and the conservatory recurs not only in Oxford Street, Regent Street, and Hyde Park, but in the back streets of London, in Whitechapel and Seven Dials. Ward’s inexpensive cases were developed in the East End as portable glass-covered boxes in which plants grew, protected from urban smoke and factory pollution. Their presence demonstrates the coexistence of city deprivation and genuinely emancipatory practices, satisfying the needs both of the body and the imagination. An artisan wrote to Ward: ‘I have, with great pleasure and greater profit, read your work on plants in closed cases, and have now outside my sitting-room window a Lilliputian landscape (entirely through reading that work), obtained by enclosing a space with glass.’ Such statements go beyond the bad faith of *Household Words*, who reported them in ‘Back Street Conservatories’.²⁰ The magazine argues for the moral education of the poor through cultivating inexpensive Ward’s cases, in which thrift and a ‘miniature conservatory’ can be achieved together. But it demonstrates the complexity of the glass fantasia, in which bad faith, an emancipatory moment—‘verdure in the depth of winter’ (p. 273)—pollution and beauty, idealization and the real, exist together. Working-class window sills became small conservatories—‘the boundary of his flower-pots and mignonette box’ (p. 271).

The Glass Phantasm: Outside the Glasshouse

A persistent need to describe the exterior of the glasshouse as immaterial and illusory runs through accounts of glass structures—John Claudius Loudon’s Chiswick conservatory was a ‘bubble’ that would dissolve in the wind.²¹ The Crystal Palace in particular seemed a fragile structure, dematerializing,

an ethereal building conjured—a constant orientalizing analogy—by an Arabian Nights genie and superimposed on the terrestrial landscape. ‘*Stolen* [emphasis added] from the golden country of the “Thousand-and-one-Nights”, *Sharpe’s* described it.²² *The Times* account has been quoted before, but its sense of magical unreality is worth reiterating.

The vast fabric . . . an Arabian Nights structure, full of light, and with a certain airy unsubstantial character about it which belongs more to enchanted land than to this gross material world of ours. The eye, accustomed to the solid heavy details of stone and lime or brick and mortar architecture, wanders along those extensive and transparent aisles with their terraced outlines, almost distrusting its own conclusions on the reality of what it sees, for the whole looks like a splendid phantasm, which the heat of the noon-day sun would dissolve, or a gust of wind scatter into fragments, or a London fog utterly extinguish . . . The vast extent of area covered, the transparent and brilliant character of the structure, the regular and terraced elevations, the light airy abutments, the huge transept, with its arched and glittering roof shining above the vitreous expanse around it, and reminding one of nothing that he has ever heard of before.²³

This derealization extended into *The Times*’ report of the Exhibition opening: ‘a “blazing arch of lucid glass” with the bright hot sun shining on its ribs and sides shone like the Koh-i-Noor itself . . . The heat of the sun, acting on the moist ground, produced a fluctuating haze or mist, through which the procession appeared in the same shifting uncertain light that you see in the magic lantern, and added an air of unreality to the scene.’²⁴

The virtual experiences of optical culture suggest the virtuality of the whole structure as a projection. Like the glassing of London the imagined and real belong together in the Exhibition building: ‘[R]eminding one of nothing that he has ever heard of before’ (*The Times*) ‘It is a new world—and what world is it?’ (*Sharpe’s London Magazine*).²⁵ ‘[H]e who offered a reward for a new sensation should have lived till now’ (*Athenaeum*).²⁶ Journalists and writers representing periodicals of almost every political position and status, reporting on the Crystal Palace write as if the unprecedented scopic experience has reorganized the senses and exempted the building from ordinary rules of perception and judgement.

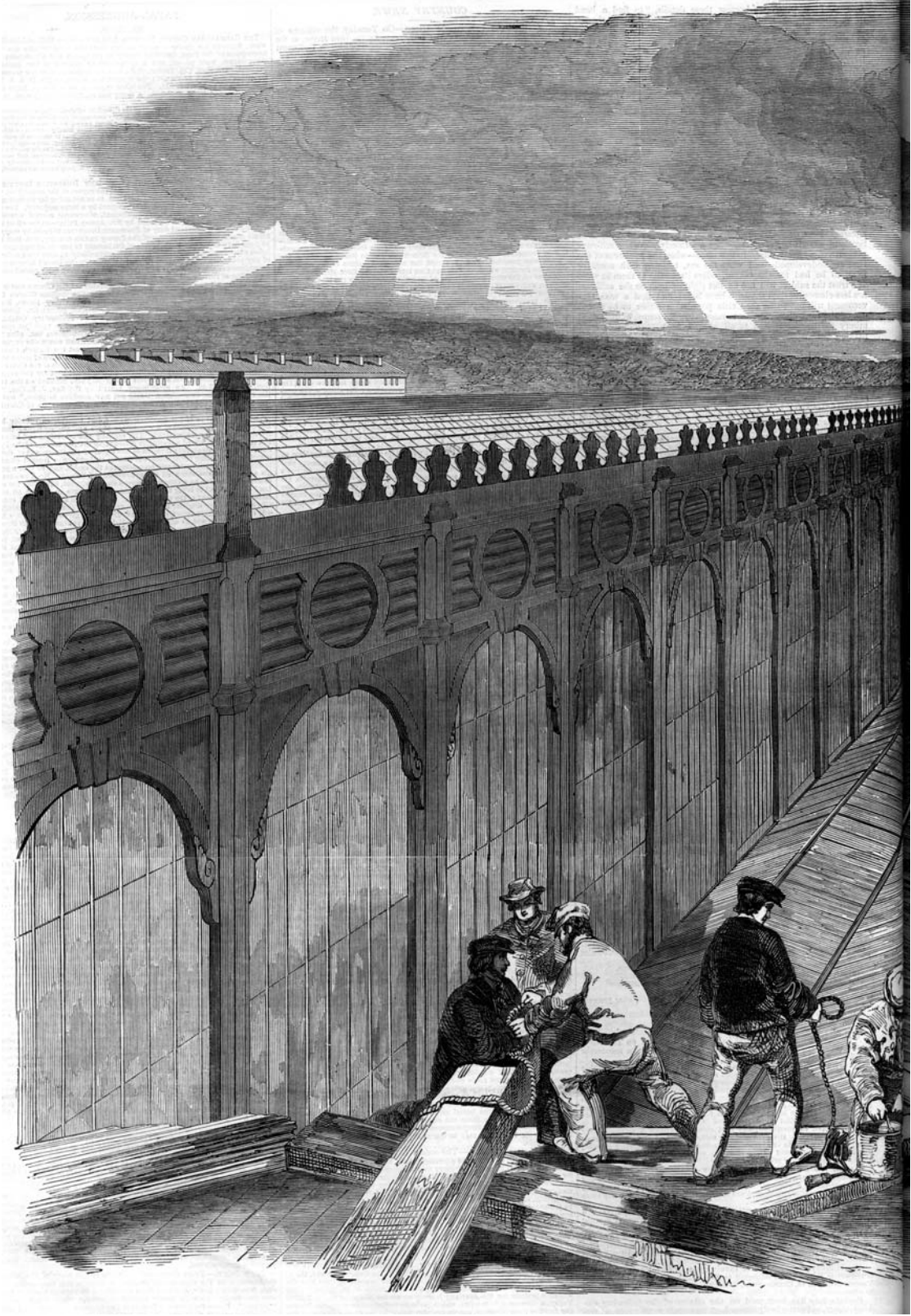
Charles Knight, writing in *Household Words*, invokes the moment ‘When Aladdin raised a palace in one night, whose walls were formed, not of layers of bricks, but of gold and silver’.²⁷ William Whewell, giving the lecture that was intended to be the master reading of the Crystal Palace, spoke of the ‘magical glass, which the enchanter of our time have made to rise out of the ground like an exhalation’.²⁸ The frequent and seemingly banal analogy with Aladdin’s magical palace is on the one hand a strategy of misrecognition. The real glass becomes an ethereal fantasy space imported from an exotic past, not the scene of modern

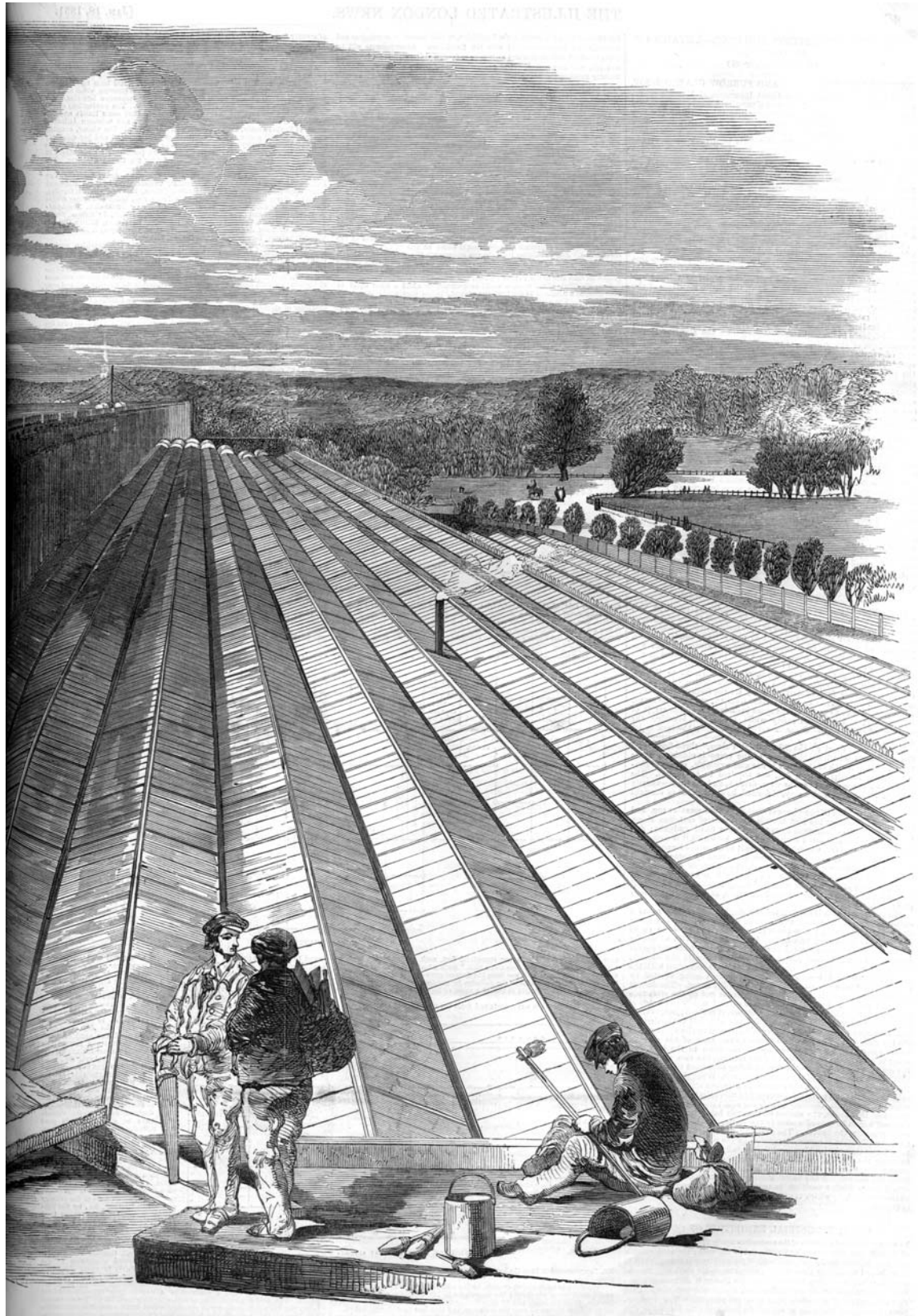
commodity, capital, and imperial appropriation. The Koh-i-Noor's violent history of colonial expropriation can dissolve like the mists. Yet there was a certain knowingness about the references. Aladdin is indeed a tale of theft and riches. Aladdin's palace was almost invariably associated with Milton's palace in *Paradise Lost*, as with Whewell. Milton's palace was Satan's Pandemonium. It was this that 'rose like an exhalation' out of the 'wound' of the earth, and it was Mammon who headed the rush to occupy it.²⁹ Knight's article continues, 'Let us consider how many Slaves of the Lamp have been employed in constructing the Palace of Industry—that "fabric huge", which "rose like an exhalation" in the winter of 1850 and the spring of 1851.'³⁰ 'The Genii of the lamp are at hand', but they can take on an affinity with nineteenth-century labour; 'Even as we write, the vast palace, destined to receive the stupendous gatherings of a world's industry, rises like an exhalation.' 'Enchanted palaces that grow up in a night are confined to fairy-land, and in this material world of ours the labours of the brick-layer and the carpenter are notoriously never-ending.'³¹ *Sharpe's* first article on the Exhibition asked for social change and the amelioration of the conditions of labour. The coded reference to Milton takes on additional resonance when we remember that glass is indeed an 'exhalation' produced by the breath of human beings. Thus the analogy was double-edged, leading back to the real through the flight to the imaginary.

Crystal Labyrinths: Space/Time inside the Glasshouse

Scopic and spatial responses to the interior physical fabric of the Crystal Palace attempt to create a poetics of the glass space—its 'sea of glass', its 'vitreous expanse', its 'artificial sky of glass', its 'crystal labyrinths', its 'variegated crystal'. If late modernism's obsession was with the transparent curtain wall, nineteenth-century modernism's obsession was the transparent roof. *The Times* reporter ascended the transept, looking down at the insect-like workmen. So did the *Illustrated London News*:

But few of the visitors to the great International Museum of Industry, during its construction, even if permitted, would like to ascend the ladders, for the purpose of viewing from the lead-flats on either side of the arched roof of the transept the extraordinary appearance presented by so vast an extent of glass as that by which the whole building is covered. In order, therefore, to gratify those of our readers who have taken the greatest interest in the details of construction which have been given in the ILLUSTRATED LONDON NEWS from week to week, we present, in the present number, a View of a portion of what has been called the 'sea of glass.' . . . we were induced to ascend a little higher than the lead-flat, even to the very top of the roof of the transept . . . we were





amply repaid by the magnificent panoramic views of parts of the metropolis and the distant hills of Surrey, and the country on every side.³²

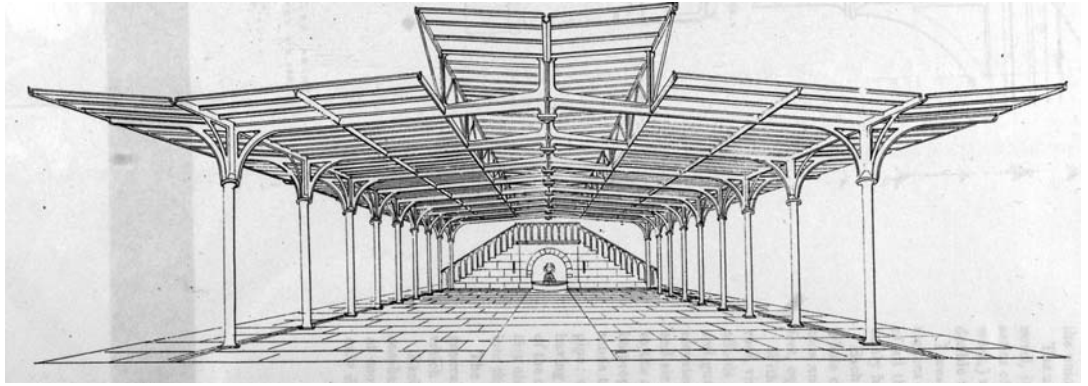
Geidion identified the source of the Crystal Palace in the Hungerford fishmarket's flaring zinc-covered ribbed tent, supported by iron pillars, designed in 1835 by Charles Fowler.³³ Though in truth there were innumerable prototypes, Geidion's insight grasped the essence of ferrovitreous constructions—it was the *covered* space that mattered, an environment later embraced by glass. One of the earliest public glass buildings, the circular glass menagerie in Surrey Gardens, designed in 1831 by Henry Philips, transferred the conservatory principle to the display of animals. It was one of the earliest urban glasshouses to be specifically adapted from the conventional conservatory, developing the romantic urban genre of glasshouse, lake, and pleasure garden that became a familiar populist idiom of the mid-century. Housing the animal species of all nations in a gesture of inclusion, what mattered was that it offered an encyclopedic space. It was reassuring because it appeared to contain urban dispersal, holding disparate entities together.

The transcendental roof and the factory space go together.

We are yet far from ascertaining the whole uses of glass and iron, but we are likely to make rapid progress therein. Five years only have passed since Sir Robert Peel removed the glass excise . . . perception shall grow, that an artificial sky of glass may be made to any extent, to roof out 'winter and rough weather,' whether to provide dwelling-shelter or factory-cover, or cover for the production of vegetation in the winter season. (*Westminster Review*).³⁴

The conservatory and the railway station co-habit. 'How he would stare at the flaming gas-lights—at the glittering roof with its light cross-work of iron bamboo!' The writer of 'A London Railway Station' imagined a stranger to the railway coming upon a London station in imagery that superimposes romantic space on utilitarian space, enabled by the glazed roof. By day 'the lofty walls and the glazed roof' together with alternations of silence and noise as the station emptied and became full would confound: 'the pleasant sunlight shimmers softly through the arching roof, and at the open end towards the country, you see the glistening rails winding outwards for miles.'³⁵ The station was perceived as an overarching modern and unifying civic space. When Queen Victoria made official visits to northern towns in the royal train the station was the centre of elaborate ritual ceremonies of greeting and farewell that consolidated royal populism. The *Illustrated London News*, quickly grasping the station as the icon of civic life under glass, portrayed the Queen's arrival at York with two

Figure 34 'Panorama of the Roof of the Crystal Palace, Portion of the Ridge and Furrow Roof, Looking West', *Illustrated London News*, 1851



pages of overarching station roof on 6 October 1849 (p. 236) and repeated the station motif in 1850 when she visited Newcastle and Edinburgh. Strangely, the station as nation is the place of transit. On 21 December 1850 it published a full-page engraving, *The Arrival of the Christmas Train*, confirming the pleasure principle of the crowd in mass transit under glass, where the traveller is self-contained and part of a social world. Ruskin also grasped the principle of the ‘enchanted’ dome in Shelleyan imagery. ‘If your style be of the ideal kind, you shall wreath your streets with ductile leafage and roof them with variegated crystal—you shall put, if you will, all London under one blazing dome of many colours.’³⁶

The dream of a single covered space was animated by a sense that space–time relations were altered by it. The *Illustrated London News*, at the opening of the Exhibition of 1851, wrote of ‘the practical annihilation of space and time which we owe to the railway system’.³⁷ This for Marxian materialism was the achievement of commodity, collapsing territorial boundary and distinctions and erasing history. For the idealist William Whewell it was the achievement of technology and machinery: ‘By annihilating the space which separates different nations, we produce a spectacle in which is also annihilated the time which separates one stage of a nation’s progress from another,’ he wrote of the 1851 Exhibition.³⁸ The resulting optical culture of ‘spectacle’ (Whewell’s word) flattens out the diachronic and assimilates it into the synchronic. But space and time were not neutralized. The enfolding of multiple times and histories within one another meant that heterogeneous objects with different histories occupied the same gigantic space. Rather than homogenizing objects and cultures, this produced the shock of infinite particularity, a sublime of heterogeneity. *Punch* called the Exhibition a ‘great commercial festival’, ‘crystal shop’, or ‘glass bazaar’.³⁹ The glazing of London’s commercial shops brought together goods from all over the world. The ‘dazzling, puzzling, confounding chaos of shapes and forms’ on the pavement, ‘all jumbled up together’, found its counterpart in commodities—old-fashioned lace,

Figure 35
Hungerford
Market, prototype
of the Crystal
Palace,
*Transactions of the
Institute of British
Architects*, 1836



Figure 36 'Interior of the Transept, Completed (View Looking North)', *Illustrated London News*, 1851

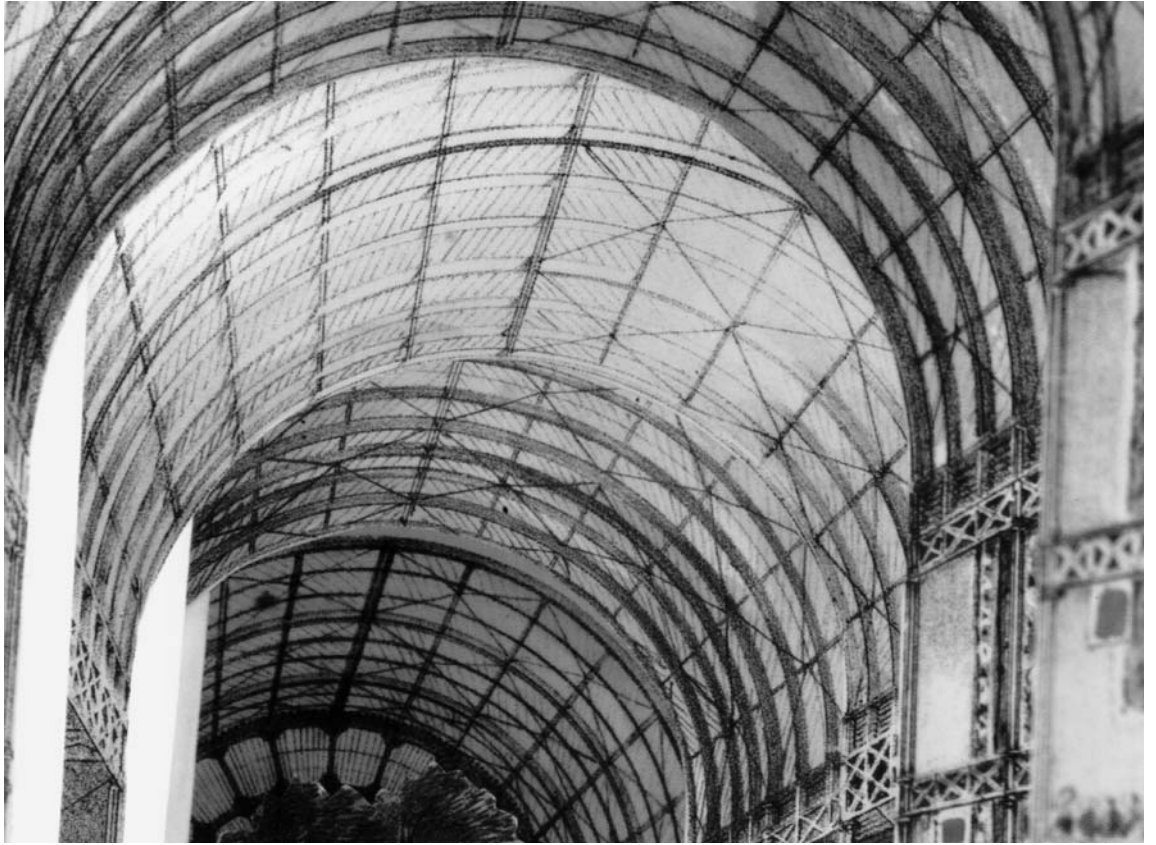


Figure 37
Peepshow and aerial views of the roof and glass of the
Crystal Palace, *Lane's Telescopic View*, 1851



massive ‘lumps’ of plate, music, prints, ‘scraps from Daumier’s pencil’.⁴⁰ In the ‘Romance of a Shop-Window’, from Charles Manby Smith’s *The Little World of London* (1857), animated abandoned goods in a pawnshop tell their life stories, arbitrary objects in search of meaning—‘Watches, clocks, gold chains, necklaces, bracelets, brooches, snuff-boxes, work-boxes, writing-desks, surgical implements, mathematical and scientific instruments, microscopes, telescopes, and stereoscopes; knives, forks, and spoons’.⁴¹

The bizarre non-correspondence of the Exhibition’s mapping of space–time with familiar experiential coordinates was a frequent source of topographical comedy, though, that deconstructs the transcendent superimpositions of space on time: “‘Now then, policeman, where is stair No. 5?’ ‘In China, sir. Go to China if you want to go to stair No. 5.’: ‘You must go round by Greece, sir, and along the corner of Persia’” (*Morning Chronicle*).⁴² [F]rom China to Europe—’tis ‘but a minute’s journey’: ‘You will find enough to do to take a general survey of this universal panorama. Five hours are not too much to prove to you, that you are not wandering at the same time through the five portions of the globe’ (*Sharpe’s London Magazine*).⁴³ What struck most readers of the Exhibition was precisely an unreadability that resulted from the impossible convergence of objects from all over the globe: ‘An examination of its contents! There is no man living, if he were to surrender his whole life to the task, could examine its contents.’ In this ‘World’s Bazaar’ attention must be limited. . . . ‘Multitudes have seen no more than the Koh-i-noor Diamond, the Greek Slave, the Great Organ, and the Crystal Fountain, which they could not very well help seeing’ (*Fraser’s Magazine*).⁴⁴ Even with a season ticket, a full tour would take three months. ‘Today you were in France, tomorrow in Austria, the day following you travelled into Italy, and the next week you crossed the Atlantic in imagination, and glanced over the United States.’ ‘A country family arriving by an excursion train . . . could obtain little better than a bird’s-eye view, galloping through, catalogue in hand . . . [to see] twenty thousand articles’ (*Dublin University Magazine*).⁴⁵ In other words, the Exhibition itself reproduced the conditions of impossibility that Whewell claimed it to transcend by the annihilation of space and time and created an intensified awareness of the disjunctions of space–time dimensions round the exhibit.

Observers were aware of the contradictory space/time of the exhibition and its sensory tensions. But they also responded intensely to its aesthetic charge. The aesthetic productions of popular culture, Adorno said, carry with them suggestions of their construction (he instanced a fountain whose mechanism is apparent).⁴⁶ To see the Crystal Palace as a wholly mystified space would be a serious misreading of responses to it. It was

‘beyond the reach of words’, as *Chambers* (who criticized its ‘misexpenditure’) put it, but commentators were aware of its constructed space.

you find that you have entered . . . into the most extensive covered space ever seen or imagined by man . . . Here are large and leafy European trees proudly extending their huge branches under the transparent roof; there, a thicket of palms and bamboos which speak of the East; a gigantic crystal fountain whose limpid waters rise to an extraordinary height, and sparkling in the sunshine descend noisily into the basin beneath . . . In the first moment of amazement you behold at the same time, in the midst of these confused sounds, carpets from the East, arms from India, a European Park with its woods and rivulets, and an innumerable army of equestrian statues around you. (*Sharpe’s London Magazine*)⁴⁷

Nothing has ever struck us as more preposterous than an attempt to convey by language any adequate description of the Crystal Palace. Everyone who has seen it will have felt the impossibility of giving an account of either the fabric or its contents . . . the gorgeous assemblage of objects of art—snow-white statues, brilliantly-coloured tapestries, golden vases, sparkling fountains, inscribed crimson flags, the sign-boards of nations—and last, not least, the streaming, the loitering, the sitting and standing crowds of well-dressed people from all quarters of the globe—all are felt to be beyond the reach of words. (*Chambers’ Edinburgh Journal*)⁴⁸

we strive in vain to create the gigantic portrait of the whole, or to construct mentally its gossamer of iron, or summon before us the innumerable and ever-changing pictures which from above and from below meet the eye while we wander in astonishment through its crystal labyrinths. (*North British Review*)⁴⁹

‘We *strive* . . . to construct mentally’. The contradictions call out analysis and are inherent to the aesthetic meaning of the building.

‘Crystal labyrinths’: ‘Crystal’ is the single defining term of glass culture and nineteenth-century modernism. Crystal is a derivation of rock, a growth of the geological world, product of vapour, minerals, and subterranean action. Quartz is faceted, *prismatic*, its multiple external planes replicating its internal structure. Even when man-made the ‘tremulous scintillations’ of crystal facets, glass against glass, declare crystal’s apparent nearness to the natural world of cave and grotto. The status of glass as a congealed liquid and the product of air, as rock crystal is, gave it an affiliation with the natural world. Crystal constitutes a living representation of the faceted multiplicity of convergent times and spaces. This is intrinsic to nineteenth-century glass culture, in contradistinction to the traceless purity of later glass culture. A free-standing volume of space, making the spectator aware of transparency above, behind, and below, phenomenologically both *in* transparency and *of* it, is the sensation that comes across from descriptions. It is conjured from new elements not

hitherto in existence, ‘vistas of space and light’, a self-subsisting light/space with its own micro-atmosphere.⁵⁰ Descriptions insist upon light and weightlessness experienced from *within*, as if from within crystal or quartz itself. ‘... it may be almost described as consisting of an assemblage of lines... we often hear people say, “How very slight[”]; but I would advise them to leave out the letter ‘s’ and then pronounce the word, as it should be, “light”; they will then be nearer the mark’, a lecture by Professor Cowper, reported in the *Illustrated London News*, explained.⁵¹ The famous description by Lothar Bucher suggests a vast grotto composed from spontaneously generated light and vapour, and the intersecting angles created by girders. Bucher is seeing in crystal, not seeing through it. It is an autotelic world apart, a space existing outside the norms of solids, weight, volume, and shadow.

We see a delicate network of lines without any clue by means of which we might judge their distance from the eye or their real size. The side walls are too far apart to be embraced in a single glance. Instead of moving from the wall at one end to that at the other, the eye sweeps along an unending perspective which fades into the horizon. We cannot tell if this structure towers a hundred or a thousand feet above us, or whether the roof is a flat structure or built up from a succession of ridges, for there is no play of shadows to enable our optic nerves to gauge the measurements. If we let our gaze travel downward it encounters the blue-painted lattice girders. At first these occur only at wide intervals; then they range closer and closer together until they are interrupted by a dazzling band of light—the transept—which dissolves into a distant background where all materiality is blended into the atmosphere.⁵²

‘Uncircumscribed’ space, a critic has called it, ‘yet measured and hence defined by the intersecting three-dimensional grid of horizontal and vertical coordinates of the ironwork’. The pillars would have suggested forest trees, for all their industrial assembly.⁵³ The chandeliers and fountains would have added a stalactite quality, turning the prefabricated fabric into a futuristic grotto.

It was experienced as an alternative world, a transformative space. The control of light in the building enhanced the sense of a newly made world. The sky could be seen above the glass roof, but the light was also controlled by calico blinds. Commentators experience it as a shadow-free environment, where the light is fresh and crystalline but filtered and slightly subaqueous. The unique atmospheric of its filtered light are repeatedly mentioned as an imperceptible mediation—a shadowless, limpid, indefinable medium. It is like living in an underwater world. ‘It is a wondrous fabric, sublime in its magnitude, beautiful in its simplicity. The venerated elms of Hyde Park are budding in their vast conservatory... Singular

effects of light are produced by the character of the building; and in the dim perspective of its roofs the prevailing blue shows like an aerial vault' (*Household Words*).⁵⁴ '[T]he azure tints of the roof... appear to bury themselves in the sky... [T]he freshness is extreme: we might imagine ourselves under the waves of some fabulous stream, in the crystal palace of a fairy, or of a naiad of whom Jupiter was the noble lover' (*Sharpe's London magazine*).⁵⁵ '[A]t a single glance [we] were able to realise not only the vastness of the structure, but its exceeding airiness; for as the whole canopy and much of the sides is transparent, there is no shadow. We feel as if in the open air'; '[T]he prevalence of light, resembling that of the open air, and an absence of all shadow; the aerial effect produced by this lightness, along with the delicate blue tinting of the numerous slender supports' (*Chambers' Edinburgh Journal*).⁵⁶

There were critics. The 'supply of light' is 'in excess' for display, the *Civil Engineer* complained: 'The calico blinding on the toplights acts very effectively for its purpose; but still the whole degree of light from the enormous surface of glazing is much beyond the general requirements' (*Civil Engineer and Architects' Journal*).⁵⁷ Yet even those who disapproved of the building, such as the high Anglican *Ecclesiologist*, mentioned its creation of an *alternative* atmosphere. 'And we freely admit, that we are lost in admiration at the unprecedented internal effects... a perspective so extended, that the atmospheric effect of the extreme distance is quite novel and peculiar; a general lightness and fairy-like brilliancy never before dreamt of.' Nevertheless, '*Form* is wholly wanting': the monotonous principle of repetition, and the enormous space, create a 'light blue fog'. 'Our industry, the treasures of which were to be housed, is in sooth a hot-house plant, and, generally taken, has as little in common with art as the architecture of the Crystal Palace.'⁵⁸

In this critique the *Ecclesiologist* invoked Ruskin, but it might just as well have invoked the functionalism of Pugin's gothic. For the journal, aligned with the Cambridge Camden Society and working with Tractarian ideas, sought to propagate the architectural principles of the gothic revival as an ethics of structural integrity where '*Form*', as it put it, was paramount, and the functional principles of physical construction revealed as the manifestation of spiritual experience. It was committed to the revival of ecclesiastical stained glass and its theological meaning, not to mass-produced transparency outrageously imitating theological forms (the 'nave' and 'transept' of the Crystal Palace). It was one of the patrons behind the great surge in stained-glass production and design for church decoration over the century. And yet its debates were symptomatic of efforts to make theological glass a protected genre uncontaminated by the ambiguities and contradictions of modern glass. Its refusal of modernity led it to

inconsistencies. It required symbolic and typological clarity to the design of painted glass, but insisted that this legibility should be subordinate to the structural stonework of the window. Stained glass should not have the characteristics of representational painting, and it should never become decoration or ornament. But its status both as 'fine' art or mere artefact was uncertain and the journal could never settle between these extremes. At times the journal adhered to a hierarchy that strictly aligned the craft window maker with mere artisanal standing in contradistinction to the architect-designer. It attacked writers, such as Charles Winston and William Warrington, who claimed high aesthetic status for stained glass and for its makers.⁵⁹ It advocated absolute historical fidelity to fourteenth-century models, but derided 'spurious antiquity' as modern lies.⁶⁰ Until James Powell manufactured a form of 'antique' glass, available glass produced a garish or 'tawdry' transparency that was generally 'antiqued', shaded, or enamelled to counteract crude transparency. But because these processes were deemed moral deception, the journal supported designs constructed of flagrantly modern material.

Despite its strong presence both in a discrete display in the North Gallery and in Pugin's medieval court, stained glass, one of its historians remarks, did not take the Exhibition 'by storm'.⁶¹ For stained glass was intended as a rebuke to glass culture. Its repudiation of the visual logic of crystal and its ambiguities set it apart. The hard, unreflective, hostile didacticism of Millais's stained glass in *Mariana* is instructive here. 'Anything will do for stained glass', Dante Gabriel Rossetti casually said, despite making designs for it, as if speaking of a marginal art.⁶²

Transcendent Arcades

There were plans, sanctioned by planning bodies and subject to the hearings of parliamentary committees, for literally covering London in glass raised on viaducts. Vast, elevated crystal boulevards and railways, crystal palaces in transit, superimposed on existing city space, were to create a glassy double of London in the sky, a kind of civic idyll. Huge commercial urban glass conduits cutting through central London's congestion would raise up a vitreous landscape. Ethereal avenues of glass were to rise above the city as massive aerial arcades. These transcendent arcades were seen as serious propositions, despite their resemblance to the glass conduits in the slightly crazed urban utopia of Fourier's Harmony. Their glass-scapes were in extreme tension with the slum landscape below. They were practical attempts to solve London's congestion and to facilitate the massive east to west flow of foot passengers and other traffic that blocked

the centre's streets. At one and the same time their overarching transparency promised inclusion—as if the work of social change would be achieved by a continuous glass casing—and engaged in a cover up. They operated to a principle of exclusion, screening out unassimilable elements of the society. Transparency, paradoxically, was to obliterate London's Babylon. On the other hand, they were attempts to think through the meaning of civic life in the conditions of Victorian modernity, and to identify the meaning of a 'public'. This is a project, however problematic, that runs through the glassworld. Thus it is misleading to say that these glass arcades were merely utopian plans for transcendent inclusiveness.

Frederic Gye in 1845, William Mosely and Joseph Paxton in 1855, put forward plans for the conservatory principle to operate as glazed elevated streets. When the House of Commons Committee on Metropolitan Communications, convened to consider ways of relieving London's congestion, listened to plans by Paxton and Mosely for glassing in parts of London, the *Builder* reminded its readers of 'Mr Gye's Plan for a Glass Street', a 'gigantic arcade', ten years before.⁶³ This, presented in November 1845 to Charles Barry and Mr Manby, secretary to the Society of Civil Engineers, was a plan for a massive, elevated glass and iron street raised on a brick viaduct over London—'constructed entirely on arches of sufficient height to pass the numerous streets, without presenting any obstacle to the ordinary traffic, entrances being made at the principal cross streets'. Above these arches a 70-foot-high glass roof was to soar, stretching from the Bank of England to Trafalgar Square (p. 603). The glass structure would not be developed as a straight line, but would present a series of 'direct arcades, crescents and rotundas, forming one uninterrupted covered promenade', creating approaches to churches and public buildings such as railways and theatres. The aim was to create a civic idyll in the air:

Portions of the arcade will be appropriated to reading-rooms, exhibition-rooms, concert-rooms, large apartments for public meetings, baths, cafés on the Paris plan, &c. as well as to shops of every variety of trade, except such as might from their nature be unfitted to the place. An extensive flower market, constructed entirely of glass, will occupy a portion of the line . . . combining the grand desideratum of a covered communication with a spacious and luxurious promenade. (pp. 603–4)

The flower market, residuum of the conservatory, the assumption that certain commodities are 'unfitted' to the aerial commercial space, operated on principles of exclusion. Gye casually observed that low-value properties would allow for the glass arcade to be 'greatly increased', 'expanding into several magnificent galleries or halls' (p. 603). Cheaply purchased slums would be overshadowed by the gigantic glass colonnades in the air, misery increasing in proportion with the expansion above. Property would be



Figure 38 Joseph Paxton's design for the Great Victorian Way, a glass viaduct over London, presented to the Committee on Metropolitan Communications, July 1855

inexpensively purchased, but the yield from the shopkeepers' rentals would be 'high'.

When it became necessary to rationalize London's transit system, Paxton put forward a colossally ambitious plan for a crystal 'girdle', or Great Victorian Way, of just over ten miles that would connect all rail termini by circling London. Moving from the Royal Exchange via Cheapside, the arcade would cross into Southwark and Lambeth, cross the river again to the Houses of Parliament, be routed via Victoria Street to Brompton, cross Kensington Gardens, follow the line of Oxford Street, and then move up to Islington to meet its point of departure, the Royal Exchange. 'From the City to Regent Street I apprehend it would consist entirely of shops,' Paxton said.⁶⁴ The planned route of the transcendental arcades of shops echoed exactly the route of glazed shopfronts described by Knight, quoted at the beginning of this chapter. Designed with Paxton's usual combination of flamboyance and business acumen, the arcade would be 72 foot wide and 108 foot high, flanked by eight raised railway lines (four on each side stacked two by two), also to be glass-enclosed, running 26 feet above ground, a crystal palace in transit. Fourier-like

idealism, hard-headed commercial calculations for the transit of 105,000 people a day, and a principle of occlusion that simply puts aside the environmental and social conditions unsolved by the plans, characterize Paxton's presentation. Mosely's less ambitious plan for a mile-long Crystal Way, a superway that would transport 50,000 people, built some 20 feet above ground, paralleling a railway built some 20 feet underground that ran roughly from Cheapside to Oxford Circus, shares the same contradictory impulses.

Both believed that their Crystal boulevards must ultimately become public property, though each formulated different funding structures distributed between different participatory bodies. For both ventilation and protection is an obsession. Paxton claimed that his arcade could be 'ventilated and made as perfect, as far as the atmosphere is concerned, as the country'.⁶⁵ '[I]t would be almost equal to going into a foreign climate from the manner in which the temperature could be regulated' (p. 81). Chatsworth's Great Conservatory contrived a 'tropical country and a temperate country under the same roof without division' (p. 92). The unending circle of glass pastoral was to elevate the passenger above 'all this heavy dirt and filth' (p. 80) and the social conditions that produced it. The therapeutic impulse coexisted with a belief that his superb promenade would attract and increase the annual number of 800,000 visitors to Britain. Mosely also envisaged an ideal peripatetic population circulating in transparent corridors. 'I call the attention of the Committee to the very inferior property through which this line goes', 'unless people were to walk though it, with a view to judge of the value of the kind of property, they would scarcely believe that in the heart of London it could exist; it is the very sink of vice, filth, dirt, and misery' (p. 54). Would he not consider it 'proper and prudent, rather to shut those objects from the eyes of the passengers above?' Mosely answered that the glass passages were constructed in such a way as to 'screen any objects which might be considered objectionable' (p. 56).

The longing for a democratic winter garden, an ideal civic space, frequently seen as a national and particularly metropolitan need, assuaging urban anomie and healing the physical wounds of city experience, coexists with commercial pastoral. For the winter garden and the urban glass thoroughfare go together as complementary constructions. Seemingly its antithesis, the winter garden offers an ideal artificial world, a protected world of nurture that is the twin of the commodified glass boulevard. Paxton's winter garden impulse is evident in his plans for the Crystal girdle that would regulate its micro-atmosphere. He campaigned for turning the Exhibition building into that 'great public want', a winter garden.⁶⁶ The 'climate of southern Italy' (p. 9) could be conjured in opposition to

the 'impure' and 'murky' atmosphere of London (p. 7). Walkers would have precedence over equestrians, as even 'the most delicate' (p. 13) of citizens wandered among the works of Nature and Art. Creeping plants festooning the pillars among which living birds were to fly, would furnish 'practical Botany, Ornithology, and Geology' (p. 10), a 'new and soothing pleasure to the mind' (p. 13). Concurrently, property in the immediate neighbourhood would 'considerably advance in value' (p. 12).

The ideal of an overarching civic structure, a 'communication' that encompasses rooms for 'public meetings' (Gye), was yet unable to achieve a definition of the 'public' that did not make silent acts of inclusion and exclusion.⁶⁷ The glamour of a transparent edifice signifying transformation was to rise over the obdurately unchanged squalor of London. Yet the appeal of building glass structures in the air suggests a need to think through the principles of a transforming space. In 1851 the *Builder*, which began life as a radical periodical, published a utopian solution to the disposal of the Crystal Palace. Its components were to be recycled as a 1,000-foot-high erection that was to become a public watchtower, commanding views of the whole capital and its environs, a seeming democratization of the Benthamite observatory.⁶⁸

A civic ideal driven by the pleasure principle existed in tension with principles of exclusion. The two prize glass and iron buildings in the competition for the 1851 Exhibition building design, those by Richard Turner and Hector Horeau, remained as plans, but they were both winter gardens, designed with exuberance and confidence, expressing the poetics of a new communality. Richard and Thomas Turner pursued a deliberately hybrid space, combining a massive squared conservatory with domes and minarets, all to be viewed by miniature train. The excitement of a public train journey and the pleasure of looking become entwined in their design, marking the technology of transit and the glass building as a paired entity. This seems to be the building praised by Richard Hengist Horne in *Household Words*.⁶⁹ It is neither 'ante-industrial', like the elegant pleasure grounds submitted by so many competitors, nor starkly utilitarian and coercive, as in the many railway station-like constructions. Horne's account of the designs for the competition assumes that 'prodigalities in glass' (p. 391) are the idiom of the time, from covered ways to temples. He was particularly attracted by C. H. Smith's design for three intercommunicating octagonal vestibules whose roof was to be upheld by suspension chains. This comprised a cast-iron frame containing overlapping platelets of rough glass. Horne is fascinated by the social pleasure implied by the designs. Turner's design, however, marks a truly modern glass architecture. 'Here, also, is a structure which arrests the attention even amongst the surrounding wonders, and appears to be several conservatories and

libraries on a colossal scale of glass framework [the Turner design included a 200-foot dome at its highest], delightfully intermingled with domes and turrets, and observatories, with here and there minarets and pagodas' (p. 390). It was acknowledged as impressive even by Matthew Digby Wyatt in the discussion following his detailed paper on the construction of the Crystal Palace in January 1851 to the Institute of Civil Engineers.⁷⁰ It may have been in deference to Richard Turner, who made plain his dissatisfaction with the selection process at the meeting, that a section of his design was included in the 'Minutes of the Proceedings'.

Horeau's five aisles ended with a half-domed apse in the central corridor. His building too was massively high. Limited material is available for the 1851 plans. The varied winter garden landscape of other of his designs, for instance, the Lyons winter garden of 1848, are a better indicator of his intention to produce an exciting social and visual environment. Certainly in 1859 he criticized the random and irregular additions to Paxton's building—'le bloc de verre aussie monotone que disgracieux'.⁷¹ He claimed that his own work represented the true '*style Victoria*', genuinely exploring 'industrie moderne'. It was light, rich, strong, mobile, easily disassembled and polychromatic in a way derived from the intrinsic colour of the materials. These quintessentially modern materials were to be 'le fer, les metaux divers, allies ouvrages de toute manière, les terra cotta, les china, les majolicas, les cristaux, le *stone glass* (pierre transparente)'.

From Victorian Glass Modernism to Modernist Glass Architecture

Glass culture's architecture modulated to the invisible transitive spaces of twentieth-century modernism. A transitional form is the garden city movement exemplified in Ebenezer Howard's hybrid 'Town-Country' genre of the end of the century. It follows faithfully the fusion of ideal space and commodity culture to be seen in the great glass town planning hypotheses of Paxton and Mosely. And it is just as mixed and complex in its impulses. Reaching back to an early radical tradition, exemplified by Blake, the first chapter of *Garden Cities of Tomorrow* (1898) quotes from *Jerusalem*. England's green and pleasant land is to host a transformed conurbation.⁷² Concentric belts of dwelling houses and park land pioneered by John Claudius Loudon, who is the subject of the following chapter, form the city. A central glassed ringroad, circumnavigating the Crystal Palace, the name both alluding to and deliberately revising the

urban resonance of its original, surrounds the civic buildings at the centre of the garden city. This is a social and shopping centre—‘Here manufactured goods are exposed for sale, and here most of that class of shopping which requires the joy of deliberation and selection is done’. Individualism and communality, private enterprise and municipal services, the market and a centralized economy—all the resistant elements that nineteenth-century glass theorists struggled with—can, Howard insists, be reconciled in the aesthetic of glass and the politics of transparency. However, the tension between the obdurate city environment and the openness of glass structures is not pressing here. The glassworld superimposed with flagrant idealism upon the resistant city environment was committed to contradictions that this pleasurable suburban zone does not possess. The purely aesthetic has superseded the tensions between ideal and real. The garden city approaches the monologic openness of twentieth-century modernism. Its positivist impulses align it with what Berman calls the ‘dream of modernization without urbanism’.⁷³ It was meant to exclude conflict and ‘dissonance’.

Howard’s abstract glassworld presages the global as well as local aspirations of glass culture. Hannes Meyer’s designs for the Palace of the League of Nations (1926–7), where open glass conference chambers were to preclude secrecy, is in the tradition of these unproblematized spaces.⁷⁴ It presupposes the success of technologized projects and an abstract ‘world’ space, a nowhere. In phenomenological terms, glass stood for total openness. ‘Transparency was not merely the simple glorification of industrial production and rationalization of the building process but symbolized the freedom and openness’ of the new democracy.⁷⁵

Though architectural Bauhaus modernism is the offspring of nineteenth-century glass culture, its principles were different. It is the difference between glass purism and the glass prism, one founded on abstraction, the other on idealization. It is the difference between the annihilation of space and time that envisages a cleansed geometry of space, in comparison with a collapse of space into time that maps multiple heterogeneous times and spaces together. The a priori of empty homogeneous time, matched with empty homogeneous space, is the nightmare of twentieth-century architectural modernism. The dream of nineteenth-century modernism is full heterogeneous space/time. The elimination of history, as opposed to the grafting of an ideal space on the present, look to different material conditions of construction. The invisible transitivity of glass, eliding inside and outside, is the possibility created by the curtain wall, and the wall is the dynamic of modernist practice. The overarching dome or canopy is the dynamic of nineteenth-century modernist practice, roof against wall.

Invisible, asocial transitivity contrasts with the dwelling *in* glass space as a social act.

Walter Gropius insisted on a breach with the past and the destruction of the ‘morphology of dead styles’ through standardization, a formal common denominator, and ‘the unification of architectural components’.⁷⁶ Rationalization is a ‘purifying agency’, the foundation on which mechanized standardization can build—‘the elimination of the personal content’ of design, and ‘all otherwise nongeneric or non-essential features’ (p. 26). This ‘mastery’ born of a ‘new spatial vision’ (p. 20) and a ‘new conception of space’ (p. 20) meant that the new architecture could be anywhere. Space and time were neutralized. ‘Geometry is the foundation’, Corbusier wrote in *The City of Tomorrow*, first published in 1924.⁷⁷ ‘Machinery is the result of geometry. The age in which we live is therefore essentially a geometrical one; all its ideas are orientated in the direction of geometry.’ His ideal dwelling place for the 1920s was ‘poised’ ‘sixty storeys high’ in the skyscraper, anywhere in the world (p. 91). The city of tomorrow could be anywhere in the sky or the earth.

Twentieth-century modernism sloughs off the contradictions and doubled meanings collecting round the conservatory in favour of a free monologism. Pure transitivity, so that glass becomes an invisible medium, is the ideal of architectural modernism, an abstract space to pass *through*, is its objective. According to Gropius,

Our fresh technical resources have furthered the disintegration of solid masses of masonry into slender piers, with consequent far-reaching economies in bulk, space, weight, and haulage. New synthetic substances . . . have made it possible to erect wide-spanned and *all but transparent structures* [emphasis added], for which the skill of previous ages was manifestly inadequate.⁷⁸

Glass and concrete’s geometry made possible an all-glass façade without load-bearing functions and a changed perception of the wall. The ‘glass envelope’ of the Bauhaus Workshop, with its ‘transparency and weightlessness’ (Button) made the Gropius Fagus factory of 1911, and Bruno Taut’s all-glass exhibition pavilion of 1914, markers of an innovative modernism.⁷⁹

One of the outstanding achievements of the new constructional technique has been the abolition of the separating function of the wall. Instead of making the walls the element of support . . . the role of the walls becomes restricted to that of mere screens . . . [and] naturally leads to a progressively bolder (i.e. wider) opening up of wall surfaces.⁸⁰

Effectively both wall and window disappear.

It is, therefore, only logical that the old type of window—a hole that had to be hollowed out of the full thickness of a supporting wall—should be giving place more and more to the continuous horizontal casement, subdivided by thin steel mullions, characteristic of the New Architecture. And as a direct result of the growing preponderance of voids over solids, glass is assuming an ever greater structural importance. Its sparkling insubstantiality, and the way it seems to float between wall and wall imponderably as the air, adds a note of gaiety to our modern homes.⁸¹

Benjamin, I have argued, elided nineteenth- and twentieth-century glass culture. He saw nineteenth-century modernism, which this chapter has been at pains to differentiate from later forms, in continuity with a catastrophic modernism of the present. True, there are anticipations of glass culture's later form. Fourier's ideal state, Harmony, with its phalanstery or hedonistic community organized round the pleasure principle, inflected only the utopian moment of culture under glass, and screened out a commercial world. His raised, glass-covered ways, or street galleries, another ancestor of the Crystal Palace, were sublimed versions of the arcades, insulating a whole community.⁸² Marx thought of him as the humorist of bourgeois culture. He crosses both nineteenth-century and twentieth-century modernism. So too, though moving in the opposite direction, does Dostoevsky's deconstructive rage against the Crystal Palace, called out by Chernyshevsky's *What is to be Done?* This work envisaged a rational utopia, the universal subordination of machines to men, and a self-evident moral order that satisfied material wants and thus achieved the termination of desire—all set in a glass pastoral of ever-duplicated monster crystal palaces. Dostoevsky wanted to stick out his tongue at the Crystal Palace. To him it regulated desire through commodity and quelled dissent. Commodity culture and coercive spectacle assume transparently obvious universal norms of human want. 'What has led you to conclude that it is absolutely necessary for human desire to be altered?'⁸³ The imperturbable sheen of glass fails to recognize the importunity of irrational needs, and pathologizes dissent. Dostoevsky anticipates the state 'Gas Bell Glass' of Yevgeny Zamyatin's anti-utopian, anti-Bolshevik novel, *We*, and its operations for 'the surgical removal of fantasy'.⁸⁴

Caprice, the non-totalizing response to the glassworld that accepts a fragmented and discontinuous experience, psychic and social, was the surrealist response to capital's bland universalization. It is the genre of later ludic glass artists, Paul Scheerbart and Bruno Taut, who reacted against coercive purism and functionalism even when they designed for it as pioneers of the modernist movement. To change the culture, argued Scheerbart, coloured glass architecture that lets in 'the light of the sun, the moon, and the stars, not merely through a few windows, but through every

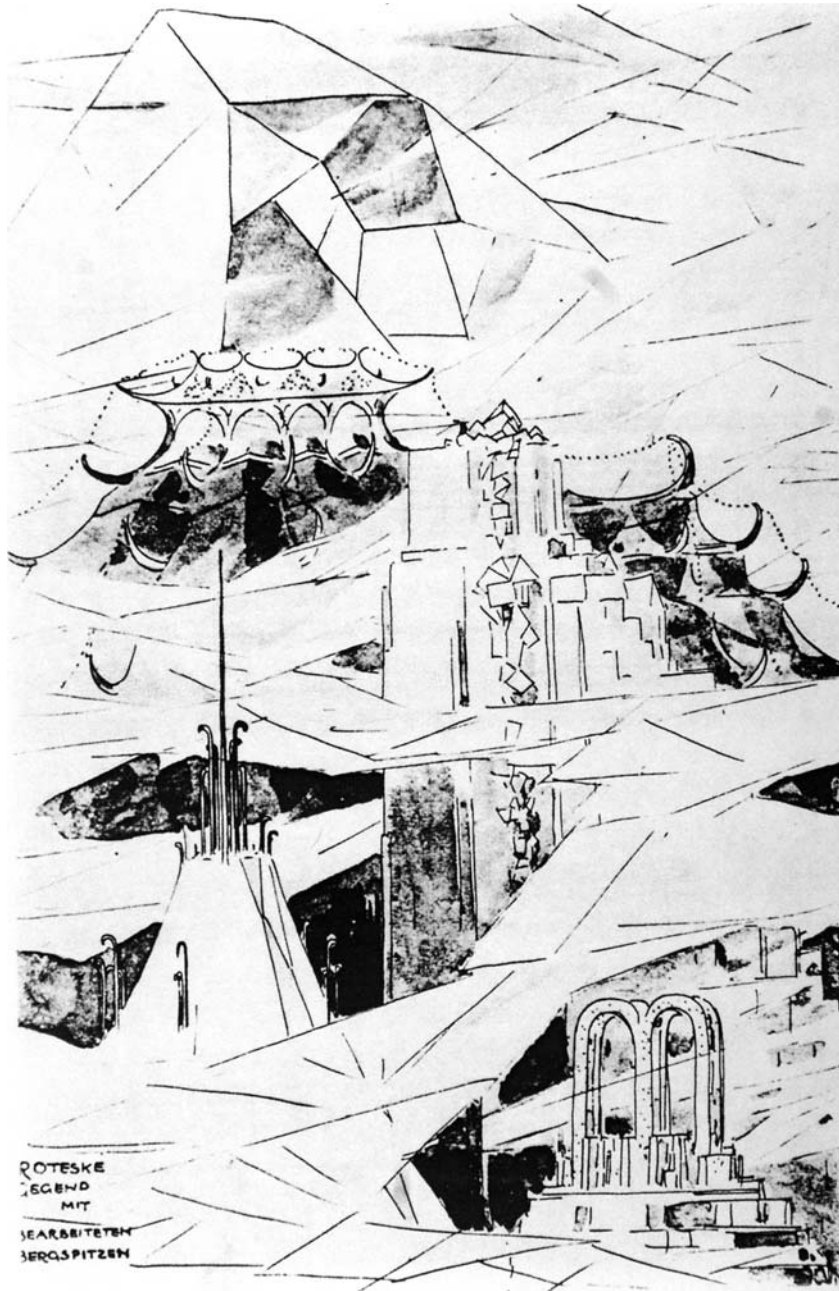


Figure 40 Bruno Taut's Alpine Architecture

possible wall, which will be made entirely of glass', is the only liberating form.⁸⁵ Taut's drawings playfully sculpted the alps in glass, arranged crystal pillars and lamps on their precipices flagrantly confounding nature with artifice: 'Yes! Impracticable and without profit!'⁸⁶ These glass caprices lampoon war, capital, and standardization. They differ from the magical fantasias of earlier glass culture in their surrealist extremity and deconstructive urge. The collision of the transcendental and the real in glass structures and the double meanings of glass were irrelevant to these projects. They belong to a later phase of modernist insouciance, when glass becomes a sort of id in opposition to the functional, abstract transitivity of twentieth-century modernism.

Benjamin's formidable standing as the analyst of glass culture in the Arcades project can disguise the extent to which he is embedded in it. The self-reflecting though grimy passages of the arcades represented 'the fossil remains of a vanished monster', the early form of capital now lost to us.⁸⁷ His project also belongs to that monster. If only we could read its coded rebus and the secret affinities in its remnants—the comic morphological affinity of the 'palm tree [the conservatory again] and the feather duster'—the meaning of the history congealed in materials would bring some revelation. Benjamin sees there is a profound cultural secret yet to be yielded up from the urban debris where historiographical meaning lurks, and which his cultural anthropology addressed. The hermeneutic secrets alternately depress and energize him. At one moment glass experience is like the mirror over a whore's bed, at another a complex psychic state of modernity that is new, strange, and exciting. 'How one ought to read' physical objects from the past becomes an obsession. Glass, dead, inorganic, ferrovitreous architecture, already an archaism, could tell us something about the history of its own modernity and our own. It was in the essay that prefigured the Arcades project, 'Paris, the Capital of the Nineteenth Century' (1935), that he quoted Sigfried Giedion, 'Construction plays the role of the subconscious'.⁸⁸ Architectural form belongs to a cultural imaginary whose significance is concealed from those who use it. He speculated that one could divine 'repressed economic contents in the consciousness of a collective' at work in material objects, just as Freud read the unconscious sexual wishes of an individual through her or his speech (p. 540). And just as Freud understood that such wishes are always misread by the dreamer so Benjamin was rigorously aware that bourgeois capital colluded with its own fantasies, even when these were emancipatory dreams, and that the modern reader of these dreams could also be deluded by them. Glass's dialectic of longing and consumerism possessed a dangerous aura.

And yet excitement is the unsaid of the huge archive of quotation and commentary, juxtaposed like a surrealist collage, in the Arcades project, which constitutes both a critique of and a monument to the glass culture of the nineteenth century. The project exhaustively charts the interrelation of glass experience with the altered rhythm of rail travel, with city planning, with the flaneur's city gaze, with boredom, with the panorama, with photography, with fashion, through endless connections, layered with anthologies of statements by Baudelaire, Marx, Fourier. Material objects, visual experience, theory, psychology, overlap in his cultural anthropology. But he was so suspicious of mere historical tourism that distrust and pessimism dominate this work.

If construction plays the role of the unconscious then the contradictory desires of the commercial pastoral through glass mediate more complex needs than the false consciousness of commodity. For the *Westminster Review*, for instance, the winter garden principle did not entail the repression of divisive social conditions, made invisible by the invisibility of glass, but their transformation. Social relations could attain a new transparency affirmed in the material itself: 'As a structure, though still of an imperfect kind, this erection is indicative of what will be possible in wintry lands when progressive human cultivation shall have obviated the necessity of guarding against acts of violence and of unjust appropriation.'⁸⁹ In other words, violence and the inequitable accumulation of property are predicated on opaque building types. The following chapter explores ideologies of the conservatory that range from emancipatory readings to critique.

Politics of the Conservatory

Glasshouses, Republican and Populist

May not therefore glass roofs be rendered expressive of ideas? . . . Imagine, instead of a row of glass sheds, a row of detached sections of spherical bodies . . . of an almost perfect transparence—the genial climate and highly coloured productions within, obtaining during the whole day the unobstructed influence of the sun’s rays, and the construction of an edifice combining the greatest strength and durability—what will be the expression? . . . imagine a lofty arched roof, wholly transparent . . . and joined to it according to the magnitude and style of the mansion, globular projections, elevated circular towers surmounted by Eastern domes of glass, or other beautiful and characteristic forms, all transparent.

John Claudius Loudon¹

John Claudius Loudon believed that glass architecture could express ideas. It could express the idea of beauty and civil society. An astonishing ‘village of glass’ is how Soulange Bodin described Loudon’s experiments with varieties of conservatory when he visited his Bayswater workshop.² The conservatory, a major nineteenth-century building type, was a pre-eminently philosophical form for Loudon because it created a democratic space.

But it was a complex space. The rival politics of the glasshouse came about because the conservatory was a nursery and a forcing house. Its ‘perfect transparence’ was predicated on violence and nurture, beauty and coercion. Managing light and accelerating growth through technology, the conservatory, while it offered an aesthetic of freedom, could not but question the nature and control of our species being, based as it was on experiments with the hybridity and cross-fertilization of flora. Its function was to store under glass exotic botanical species culled from all over the world, juxtaposing indigenous and exotic varieties: it intimated abundance, but it could not but act out a horticultural imperialism that raised questions about the colonizing role. Moreover, the very means of cross-fertilization, the conservatory sexualized and raced its contents. Sex and race were endemic categories to a commodified botany. As the line between hybridity and miscegenation could not be fixed, a grotesque body lurked in the conservatory. The public conservatory as genre also raised crucial questions for civil society—how and by whom it should be funded, managed, owned—who it was *for*? The conservatory, literally the soil in

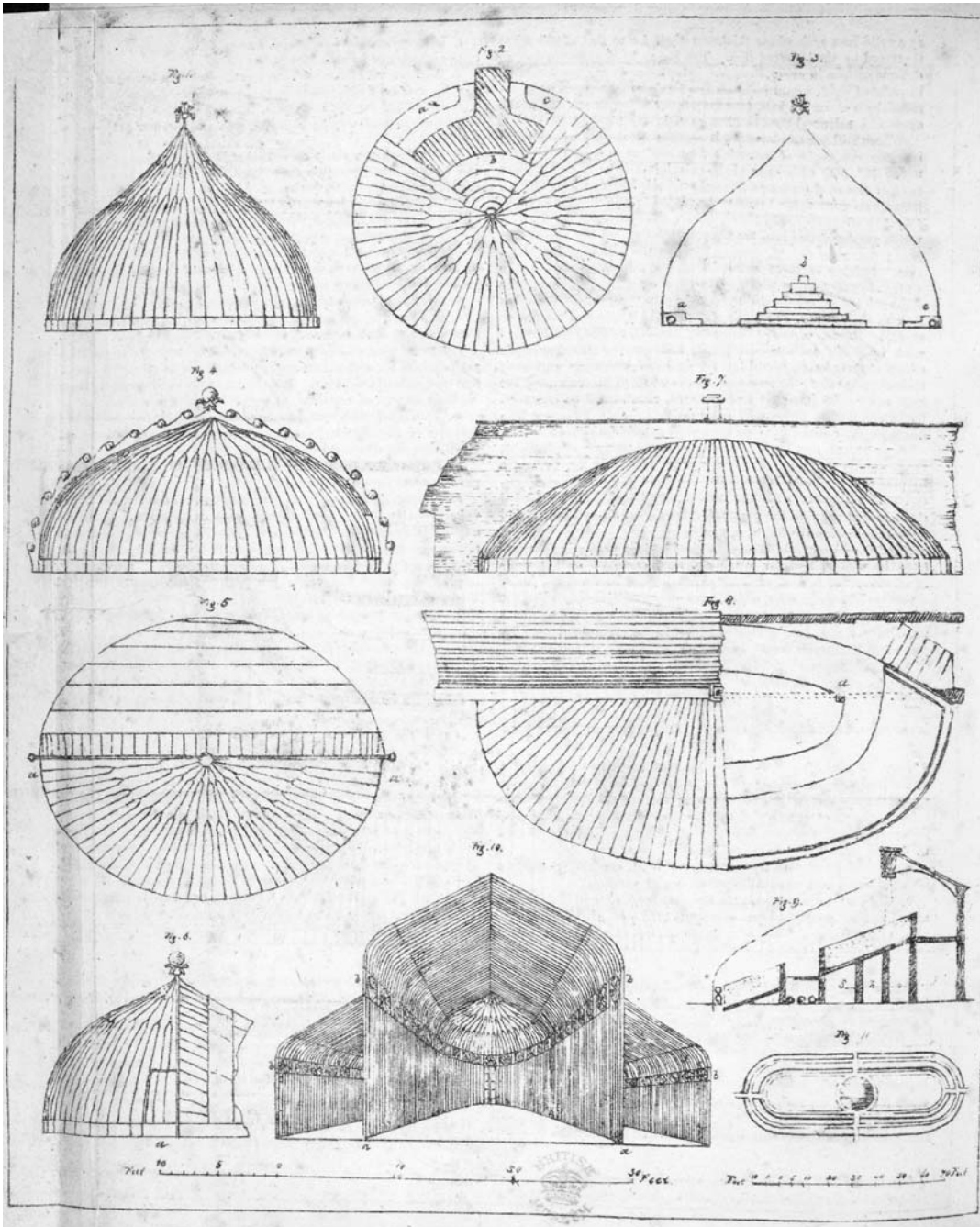


Figure 41 Curvilinear plans from John Claudius Loudon, *Sketches of Curvilinear Hothouses*, 1818

which it grew, raised two fundamental problems for glass culture. First, since the glass ecology could manipulate the a priori categories of space and time, how were these to be handled? Secondly, since the glass environment could change and adapt species, what taxonomy did it require? Taxonomical categories, determining how things are kept apart as well as how they are related, structure knowledge. The hothouse generated rival taxonomies. These came to a crisis in the Exhibition of 1851.

Antagonistic readings of the conservatory and its dialectic of nursery and forcing house by John Claudius Loudon and Joseph Paxton form the first part of this chapter. The *habitus* of the conservatory was formative for the debates of nineteenth-century modernism. The second section moves to the way glass culture, enunciated through the rival politics and poetics of Loudon and Paxton, shaped the ‘hothouse’ rhetorics of the Exhibition of 1851. Well before the ‘monstrous greenhouse’, as *The Times* initially called it, was planned to house them, the different logics of exhibits under public glass were at work.³ Glass culture instigated a kind of taxonomical panic and a struggle for power among taxonomies in 1851. I identify those elements of the Exhibition debate that derive from different readings of the conservatory, both emancipatory and exploitative. These readings were one of the most powerful sources of the strains that came from within the Exhibition debate. Received accounts of 1851 follow the vectors of commodity culture, spectacle, empire, and global capital, honouring the great traditions of Marx, Benjamin, and Guy Debord, or more recently, Anne McKlinton and Edward Said.⁴ In arguing that inner contradictions and tensions in the Exhibition debate on commodity are constituted by glass culture my emphasis is rather different. It stresses debate and critique and associates glass culture with the idea of a civil society (however flawed and contested) as well as with the emergence of global capital. The grotesque body lurking biologically in the conservatory emerged in manufactured articles and destabilized commodity. That the genre of the Exhibition was difficult to locate, subject to the proliferation of contradictory meanings and to the constant revision of those meanings, arises from the inherently contradictory nature of the hothouse itself. Glass culture met with and created contradiction. These antagonistic readings *were* the meaning of the Exhibition.

Two Rival Glasshouse Makers: John Claudius Loudon (1783–1843) and the Glass Democracy; Joseph Paxton (1803–65) and Glass Populism

Loudon was the great technological innovator, scholar, philosopher-theorist, polymath, and lyricist of the glasshouse. He kept its beauty

constantly before his readers. His was a radical aesthetic, in love with glass. Paxton was the glasshouse's pragmatic engineer, rejoicing in the virtuosity of technology. Loudon was a visionary materialist, a Benthamite, a republican revolutionary, democrat and feminist, who worked for rich men and used (and lost) his fortunes to promote a civic ideal and an emancipatory poetics of the conservatory.⁵ A generation or so older than Paxton, his moment was the extraordinary decade of the 1830s, when Unitarian and Utilitarian networks of intellectuals believed that social transformation was possible.⁶ Paxton was a royalist and a confident practitioner of self-help in the context of the aristocratic *noblesse* of the Duke of Devonshire and deference culture—he adopted a common-sense populism. Loudon's philosophy held that people were energized by pleasure and desire. Paxton was quick to see the possibilities of the society of spectacle: enjoyment, entertainment, mass tourism, the publicity stunt. His moment was the decade of the 1850s, when his astonishing energy brought the Crystal Palace into being. Loudon's idealistic materialism financed the glasshouse through *surplus* wealth. Paxton's realist vision concluded that the glasshouse itself should make profits. Both men saw themselves as modernizers. Both overworked compulsively. Their careers repeatedly overlapped in the management of the new civic spaces coming into being, as town planners, as designers and administrators of public parks and gardens, as planners for the new extramural cemeteries.⁷ They both exploited a burgeoning cheap print culture to edit gardening magazines and reach a popular readership, one to educate, the other to instruct and entertain. It is typical of both that while Paxton's opportunistic skill seized on technological innovation in lithography, enabling him to publish larger-than-life-size full-page coloured prints of flowers in every issue of *Paxton's Magazine of Botany*, Loudon hated their superficial glamour. 'The plates, however, are execrable' (he mistook them for engravings).⁸ Paxton's flowers swell off the page, frequently in flamboyant scarlets and crimsons. Loudon's journal, *The Gardener's Magazine*, retained sparse, puritanical monochrome engraving from woodcuts. At once egalitarian, authoritarian, and visionary, his impassioned, hectoring prose surges from the pages in a way very different from the blander, sensible tones of Paxton.

Two incidents, in which both used the new mobility of travel in the nineteenth century, and the resources of print media, to propagate accounts of the conservatory, dramatize their differences. These are Loudon's attack on Chatsworth, and Paxton's notorious success in the competition to force flowers from a vast tropical lily in 1849.

Obsessed with the emancipatory possibilities of the conservatory, Loudon, a tireless researcher, rushed to see the great conservatories of Russia in

1812 as soon as a pause in the war with France allowed. The ‘three English acres covered with glass’ and the semicircular sweep of the Gorinka conservatories owned by Count Razumovsky made a permanent impression on him. The glazed plenty of the Empress Catherine’s strawberries amid snow at Tsaritsyn, which he saw in 1814, spectacularly showed the way glass could transform the environment and be utilized for democratic equalization of resources instead of aristocratic consumption.⁹ Visiting Chatsworth, the estate of the Duke of Devonshire, Paxton’s employer, in 1841, he noticed the 3,000 pots of strawberries forced annually. But earlier, in 1831, he used the new speed of travel to embark on country house tourism, inspecting estates and hothouses for the *Gardener’s Magazine*, and at this point he attacked Chatsworth and Paxton’s management.¹⁰ Calling first at the Earl of Shrewsbury’s Alton Towers estate, he found a policy of exclusion governing public visits (too ‘aristocratic’ by far), but ideal conservatories.

The conservatory of the house, with its plants, trays of choice flowers, sculptures, candelabras, vases of alabaster, stained glass windows at the extreme ends, chandeliers with coloured burners, exotic birds in magnificent cages, &c., surpasses anything of the kind we have ever seen, and forms a suitable approach to the splendidly furnished gallery into which it opens.¹¹

At Chatsworth he found an open policy (Chatsworth became the most frequently visited country house in England) but it was an ‘unsatisfactory place’ (p. 395). He derided the old-fashioned conservatories, structures of wood, not iron, heated by fire, not steam. Paxton, he learned, disapproved of modern metallic houses: ‘the public will have an opportunity of judging between his productions and those of other first-rate gardens where metallic houses and hot water are alone employed’ (p. 397), such as Syon House, Woburn Abbey, and Bretton Hall (his own design). ‘We regret that we did not find Mr Paxton at home,’ he adds heavily. Pioneer of steam-heating and artificial rain, supporting the firms that manufactured the technology to produce them—Kewley and Loddiges—Loudon was the first to perfect the iron sash bar that enabled the hothouse’s forms of ferrovitreous building to be transferred to general architectural structures. He invented the curved and grooved iron astrogal, or rafter, a component that enabled domed constructions. He was first to see the significance of ridge and furrow roofing for the hothouse.¹² Chatsworth, ignoring these advances, was perpetuating the ‘defective’, ‘offensive’ ‘shed’, he had earlier attacked in his account of curvilinear hothouses, refusing the responsibility of innovation. He portrayed Chatsworth as the product of an archaic aristocracy, unable (in his deliberately idiosyncratic republican view) to stand up to public accountability and modern standards. The walks were

gravelled, not paved with stone: the flower beds were edged in the same way as 'common shrubberies'; the box-edgings of the kitchen garden were 'ragged'; the edgings of ornamental plant beds were inappropriately 'vandyked', or edged with V-shaped indented borders as in a kitchen garden; the flower garden intended for the head gardener's wife was 'placed at a distance from her residence' (p. 397), a feminist point. Chatsworth was not 'expressive of ideas': above all, it did not express the republican idea.

Paxton replied good humouredly, but his defence seals the two men's differences: the grounds were meant to be looked at from the house, he said.¹³ Chatsworth was spectacle, a scene looked *at* and overlooked by the possessing eye. The conservatory, too, must be a free-standing scopic experience: it required 'complete and decided isolation, and must be situated in a spot where its own influence can be felt . . . the Conservatory . . . should not be near the mansion', he wrote later in 1841.¹⁴ The Great Conservatory at Chatsworth, commenced in 1836, was planned as spectacle, so that a carriage and horses could sweep down the centre of the building. It was a performance space demonstrating bravura technological innovation and industrialized consumer display under the same roof. Loudon's own 'gardenesque' style, a fusion of Humphry Repton's principles of picturesque arrangement for the wandering eye with his own understanding of arousal and curiosity, was a way of being bodily *in* landscape, not outside it. It was a phenomenological experience. His Derby Arboretum of 1840 places trees on mounds and embankments and winds paths along their base at the periphery so that the eye continually makes discoveries. (He chose trees, not herbaceous plants, because their constant changes offered more to the aroused observer.) He planned central walkways to converge in a public meeting place with benches and a fountain. It was always a principle with him that a civic right to free parkland was fundamental to public parks, as was Sunday opening (so that working classes could use them) and access by women and children.¹⁵ Paxton's Liverpool park of 1844, on the other hand, surrounded by private housing that funded the construction, combined broad open spaces for the ownership of the eye and, the complement of this spatial possession, a withdrawn pool and 'private' scene of water and woodland at the centre.¹⁶

Dictating to an amanuensis even as he dressed for his wedding, Loudon was the author of 40 million words, and he died in the same way, pacing his room. He created his own propaganda publicity, whereas Paxton mobilized print media for promotion.¹⁷ His lily feats culminated in 'the honour of presenting a leaf and flower of the above plant to her Majesty and his Royal Highness Prince Albert, at Windsor' in November 1849. The *Illustrated London News* reported the venture, *Household Words* printed accounts of the 'Titanic' tropical water lily, and the editor of *Punch* was on

hand to watch Paxton adroitly revive the flagging bloom on its arrival at Windsor.¹⁸ It seems to have been sheer delight in showmanship rather than interest that motivated him: he had refused an appointment to the royal household at £1,000 a year.

In renaming the tropical lily Paxton erased its former identity and incorporated it into a new set of cultural, imperial-royalist and sexual meanings, assimilating this gigantesque bloom into the hierarchies of deference culture. It was given a completely fallacious nomenclature and reclassified as 'Victoria Regia', an act of taxonomical hubris. His flair for exploitation of the exotic, his technological expertise, his publicity and marketing skills, employment of royal aura, and populist patriotic gesture, exemplify his politics of spectacle. The lily enterprise was an aristocratic stunt, the deliberate creation of a myth of Brobdignagidian botanical birthing in some ways akin to the sensational events—the balloon flight, animal freakery—arranged by popular urban gardens such as the London gardens of Cremorne and Surrey. When he mentioned the lily house—in fact, he created two huge artificial habitats for the flower—at his Society of Arts lecture in 1850, the audience broke into applause.¹⁹

Paxton skilfully used his access to networks of institutional bodies to perform the feat of getting the massive South American water lily to flower in a temperate country. The lily was 'discovered' on three occasions according to Paxton's granddaughter, who gives the clearest account of it, in Peru on the Amazon (1801), on the Rio de la Plata (1828 and 1832) by D'Orbigny, and by Sir Robert Schomburgh (1837) in British Guiana on the Berbice river. Deposited at the Royal Gardens at Kew (whose restructuring Paxton had helped to oversee), after its collection by an expedition under the aegis of the Geographical Society of London, a small sample of seed was fetched from London by Paxton early in August 1849 (with exuberant speed he was in London at six and had left with his sample by nine the same morning). Bringing the forcing house of the conservatory to perfection, he used a small water wheel to ensure that the lily was 'deluded into thinking she was on her native waters', and would have used electric light—'the light it produces is exactly like bright daylight, and would make up for the short winter days'—had it not been prohibitively expensive.²⁰

By the end of September he had managed to get the lily leaf to a circumference of 11 feet with a diameter of 3½ feet. Flowers followed on 1 November, measuring about 10 inches across, pure white, shading to pink. The leaves were enormously heavy (in Bolivia the lily had had to be carried on poles by two 'Indians')—Paxton affirmed that their structure gave him the inspiration for the structure of the Crystal Palace. A 'young lady' (actually a child, Paxton's 7-year old daughter Annie) was set upon

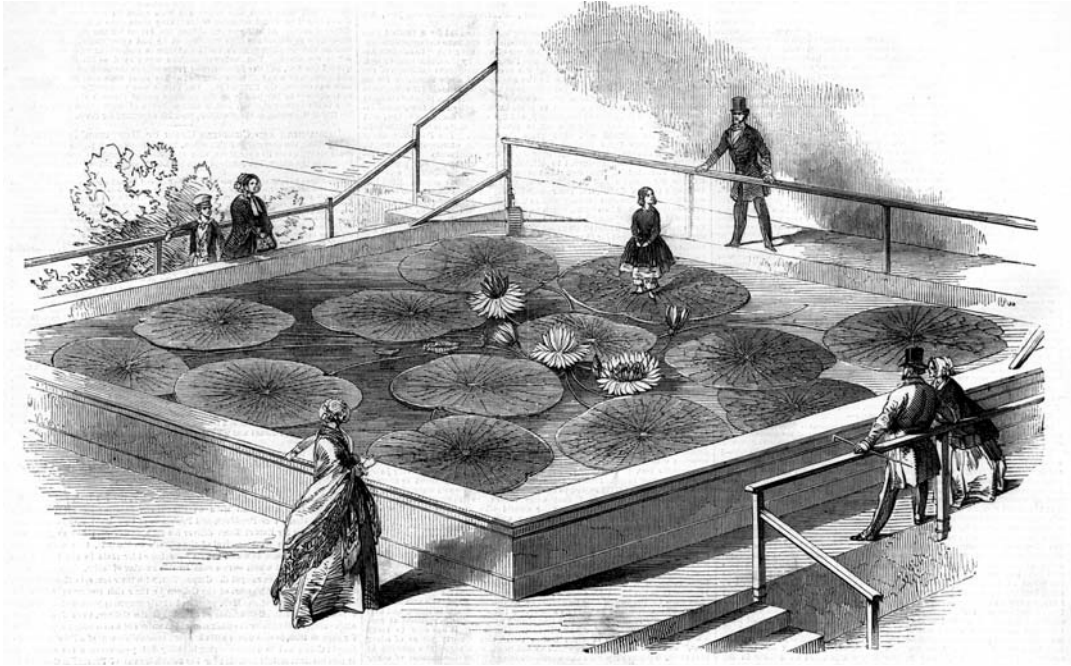


Figure 42
 'The Gigantic Water-
 lily (Victoria Regia) in
 flower at Chatsworth',
Illustrated London
News, 17 November
 1849

one of them as an 'experiment' to try their weight-bearing capacity of up to 100 pounds and to demonstrate their magnitude. He set a tray beneath her to spread the load.²¹ The *Illustrated London News*' engraving appeared on 17 November. It shows a scopoc theatre in the round, as people view the exotic flower from different levels and perspectives. Arranged on exhibit like a diminutive fairy on a toadstool in the wonderland of the conservatory, dominated from above by a showman figure in a top hat, the small figure, looking away from the onlookers as if she belongs to the water world of a bourgeois naiad, is eroticized as the cynosure of the eyes of five other spectators surrounding the pool. Here, childishly mature, she wears a cloak and a short crinoline. At other times the 'little girl, dressed like a fairy, made a pretty picture'.²² Douglas Jerrold wrote a poem to her:

On unbent leaf in fairy guise
 Reflected in the water,
 Beloved, admired by hearts and eyes,
 Stands Annie, Paxton's daughter.

Looking is as much the subject of this engraving, as the 'Titan' lily itself. Glass here creates an environment for solitary looking. The exhibition of plants and people, as spectacle and for spectacle, comes together here. The little girl in the forcing house's controlled atmosphere, fused with vegetation in a water world, is a poignant figure. The 'fairy' child hints of an alliance with human and vegetative worlds, and anxieties of hybridity that

enter the genre of the grotesque. Disproportion created by unsettling size that has no norms—a lily leaf becomes larger than a child—and which undoes the boundaries of plant and human is an aspect of the Victorian grotesque. After Paxton's feat great houses hastened to create their own watery grottos for the *Victoria Regia*. Weale's guide to London described how Kew caught up with Paxton, and pictured the lily 'aquarium' at Syon House.²³ In 1851 a nurseryman, John Weeks of the King's Road, managed to grow a *Victoria Regia* in the open air.

The glass building type favoured by each man follows from their different readings of glass culture. For Loudon, inventor of the spectacular curvilinear form, the glass dome was a truly republican space, 'expressive of ideas', the republican ideal. Under the conditions of its circularity light comes from every direction and no space is a privileged space. The dome encircles and unifies: it does not hierarchize. It encloses and protects, mimicking the inclusive curve of the sky. The *transparent* dome asserts the universal conditions of human space, placing every person in the middle of his earth. This positioning satisfied Loudon's potentially contradictory demand for democracy and individualism. He tested, at his Bayswater home, almost every possible spherical glass building form. Crystal rotundas, domes, undulating curves, circular walls, and glassy convexities gleam from his pages, combining the beauty of geometrical precision with the allure of glass and light as the engravings of his designs endeavour to represent the new transparency. His 'double detached house' in Porchester Terrace (produced with a flourish in his own *Gardener's Magazine*), had an ingenious bell-like dome projecting with confident and supremely elegant artfulness from the frontage, glassed verandas, and a row of ensuite hot-houses at the rear.²⁴ At Bayswater he experimented with the most difficult structural details, 'such as the intersection of doubly curved surfaces, or turning points in the ridge line of the vaults', thirteen different types of beam and seven kinds of glazing.²⁵ His zeal drove the construction (at a cost of £10,000 to the owners) of the soaring conical 'campanulated' conservatory, 100 feet in diameter, at Bretton Hall (1827), a massive engineering feat,²⁶ and plans for a huge anti-panoptical cupola-shaped glasshouse for the Birmingham Botanical Gardens, 220 feet in circumference and a hundred feet high, whose centre contained services and the periphery public walks, in 1830.²⁷ The Royal Horticultural Society conservatory at Chiswick, constructed according to his curvilinear principles by D. & E. Bailey, was engineered as 'a steeply rising glass barrel vault', a 'gigantic glass bubble'.²⁸ Kohlmaier and von Sartory describe Loudon's work as the forerunner of Paxton's Great Conservatory (1836–40), and Richard Turner's vaulted hothouse at Kew (1844–8). His work influenced Smirke's Oxford Street arcade and the glass menagerie in Surrey Gardens and continued as

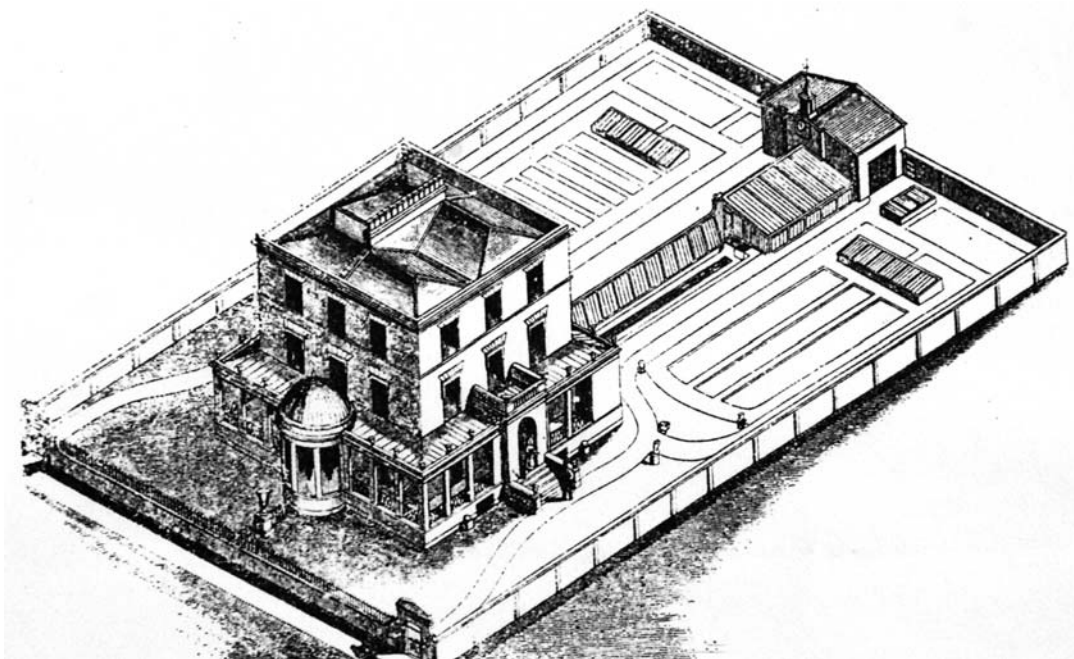


Figure 43
Isomorphic drawing
of John Claudius
Loudon's Porchester
Terrace House

an extraordinary influential force throughout the century. Throughout the century gardening books cite Loudon as the authority of the conservatory.²⁹ But we need to know what the glasshouse meant to him.

Architecture for him was *the* democratic form, simply because buildings were in daily use by multitudes of people. The principle of the conservatory space, an artificial world, democratized the glasshouse by guaranteeing a humanly made environment that would change the conditions of rich and poor alike. It was a 'fictive' space, *creating* the environment. Stations, shops, markets, warehouses, factories, hospitals, universities, galleries, swimming pools, homes, and offices could all become humanly made social spaces through the agency of glass.³⁰

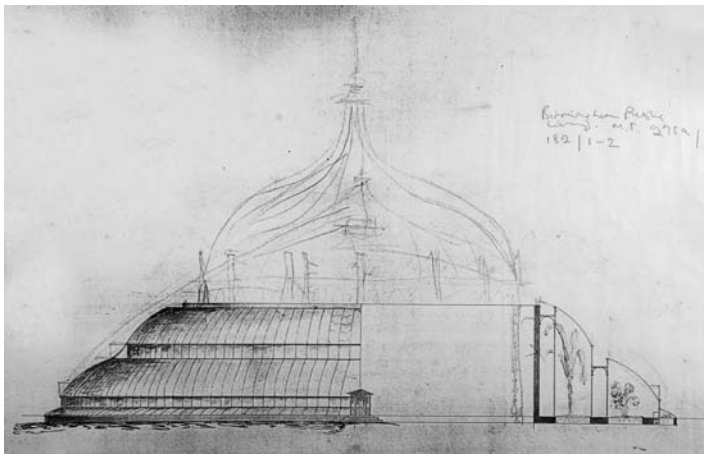
For Paxton the glasshouse was a prefabricated populist space engineered for looking. His greatest innovation was the use of single large panels of glazing up to 4 feet rather than 'the numerous overlap connected with the old system of glazing with short lengths'. Looking for glass for the Chatsworth Great Conservatory, 'I heard that Messrs. Chance and Co., of Birmingham, had just introduced from the continent the manufacture of sheet glass . . . I observed, that since they had so far advanced as to be able to produce sheets three feet in length, I saw no reason why they could not accomplish another foot, and, if this could not be done, I would decline giving the order, as, at that time sheet glass was altogether an experiment for horticultural purposes'³¹ (Lecture at the Society of Arts November 1850). It was this that enabled him to arrive at a formula for the



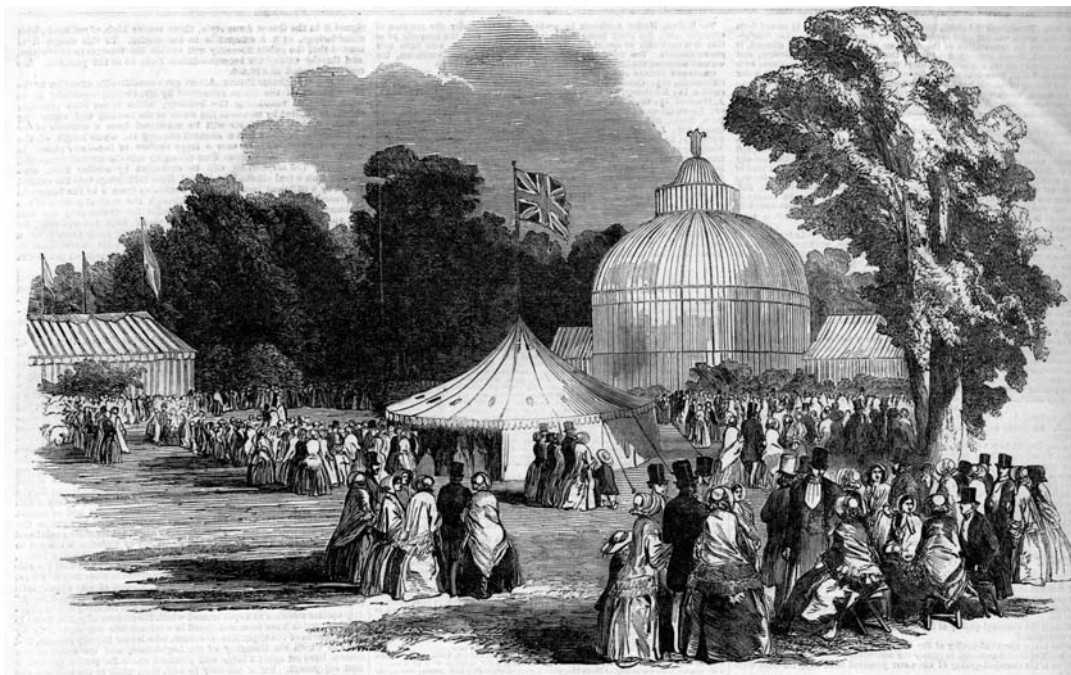
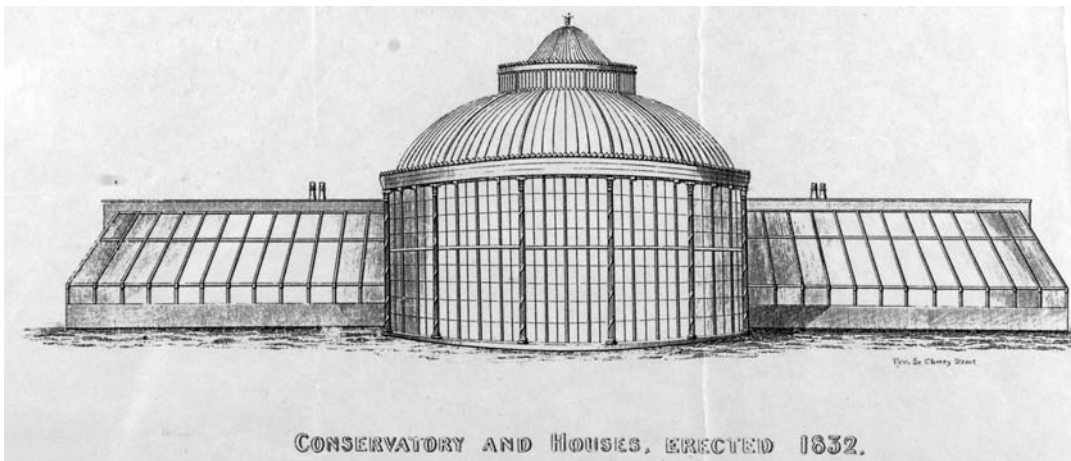
Figure 44
The dome of Loudon's
Porchester Terrace
House under
scaffolding at the
time of writing

proportions of prefabricated glass panels and other components of the Crystal Palace in multiples or dividends of twenty-four, making it possible to expand a glass-covered public space rapidly and indefinitely—the Crystal Palace was four times the size of St Peter's—and this, in its turn, that enabled mass spectatorship under glass. With hindsight Paxton saw his ridge-and-furrow lily houses as prototypes for the Crystal Palace. The first house was 60 by 26 feet, the second 60 by 46 feet, constructed on exactly the same mathematical principles of repetition as the building of 1851. Originally formulated by Loudon to equalize light and heat, the ridge and furrow roof, constructed with a grooved sash bar, required iron columns as supports but no supporting walls, and could theoretically cover acres. Crowd control under glass became a realistic possibility. Whether or not he was aware of plagiarizing Loudon, the differentiating aspect of his work was the brio and ambition of his willingness to use industrial methods and to standardize. To find a grooving machine he scoured workshops in Birmingham and London and attached it to a steam engine to power the work on the Great Conservatory. For this he was awarded a medal by the Society of Arts in 1841.

These differences follow through to their periodicals. Disseminating democracy as a Benthamite planner and modernizer on the one hand, and marketing the shows of Chatsworth, deference culture and tourism on the other, the *Gardener's Magazine* and *Paxton's Magazine of Botany*, a rival from 1834 until 1839 that depleted Loudon's profits, sapped earlier by Paxton's *Horticultural Register* (1831–5), look superficially alike in typographical form and content, even to their shared fascination with the conservatory. They were aimed at a broad labouring to middle-class readership, though Loudon targeted the unemployed labourer. Even at a costly 5 shillings, the first issue of the *Gardener's Magazine* sold out. Its



Figures 45 & 45a John Claudius Loudon's rough sketch, probably made at a planning meeting, for a domed conservatory for the Birmingham Botanical Gardens, c.1830, and the compromise conservatory finally erected. Fête Champêtre at the Birmingham Botanic Gardens celebrating 1851.



policy was to ‘to disseminate new and important information on all topics connected with horticulture, *and to raise the intellect and character of those engaged in the art*’ (my emphasis).³² This is of a piece with his belief that nurture is a state duty: education, for instance, is ‘the birth-right of a child in a community’.³³ Paxton, on the other hand, limited himself to ‘utility’ and practical information, and to recording ‘the regular annual increase’ of plants imported into England.³⁴ Loudon ran his magazine as a dialogic space, encouraging active debate in his correspondence pages. A running critique in the first volume bitterly attacked the Royal Horticultural Society’s ‘monopoly’, for instance, and plays out a civic drama (‘There is something rotten in the state of Denmark’) in which the very definition of the ‘public’ and a ‘public’ institution was at stake.³⁵ *What* is the Society for? For profit-making or botanical research and education? *Who* is the Society for? The richest subscribers or for more general groups, including the working classes?—‘the gardening comforts of the laboring classes is totally neglected’ (p. 150). How should the Society be governed and funded? What are the powers of the Secretary and should he be paid? (All themes in the run-up to the Exhibition.) If rather than subscription, ‘money is to be borrowed and repaid, or bestowed by the government, I as a Fellow of the Society, and the public as taxed for the gift, have a right to speak’ (p. 395). More basely, Where does all the produce go?

Paxton, who had started life as a Royal Horticultural Society apprentice gardener (with typical insouciance claiming to be older than he was), was unworried by such debates. In the first volume of the *Magazine of Botany* he suggests that funding public gardens can be done by joint stock garden companies, like a gas company.³⁶ In the *Horticultural Register* a garden plan designed round sections representing flora from Africa, Asia, Europe, and America presages his alert interest in the global and colonial possibilities of horticultural trade.³⁷ The synchronous existence of species from different areas of the world presaged the simultaneous presence of commodities under one roof in 1851.

The Space–Time of the Conservatory

Loudon

For Loudon the conservatory is a lyrical space for communality and communing. A truly civic achievement, it is the epitome of the humanly made transformative space of nurture. It is literally a breathing space, a place for therapy, respiration, and creative reverie, as green spaces were the

lungs he envisaged for cities, or as the plane trees he had planned for the relief of London squares.

In warm summer evenings, when the weather is dry and sultry without, to sit in a drawingroom, and see and hear a shower falling in the conservatory, cannot fail to impart a sensation of refreshing coolness, as delightful to the spectator as it is invigorating to the foliage and roots of plants.³⁸

It was no contradiction to him that the making of a conservatory depended upon technologies that altered and controlled, even coerced, space and time. But along with these peremptory Benthamite technologies, went the emancipatory democratic and domestic meanings of the glasshouse developed in his writing. Along with his technological innovations Loudon imagined a life-world that depended on the protected and planned environment that glass implied for him. The glasshouse was an exercise in imagining another time. Beginning his *Encyclopaedia of Gardening* with a political history of gardening, claiming that where a society consists of 'lords of the soil, and of slaves', aesthetic 'taste' is impossible, it is part of his utilitarian ethics to endorse the arousal of pleasure and desire.³⁹ Intellectual and civic life could only begin at the point when subsistence level, which thwarts the energizing play of imagination, has disappeared. That is why the 'pernicious apathy' bred by poverty must go. (Dorothea, in George Eliot's *Middlemarch*, who has read 'Loudon's book' (*A Manual of Cottage Gardening, Husbandry, and Architecture*, (1830), believes that the rich should be 'beaten out of their beautiful houses' with a 'scourge' for repressing the poor.)⁴⁰ It is typical of Loudon's confidence in his visionary materialism that he did not see the difficulties of keeping apart the republican rhetoric of desire and the language of commodity, where the latter works surreptitiously on the need for possession.

Loudon writes, as a deliberate strategy, as if the glass imaginary is in being in practical life for rich and poor. 'The mature Loudon had a flair for making his fondest dreams and visions seem inevitable.'⁴¹ His rhetoric performatively *presupposes* the real existence of the scenes and pleasures it brings into being, a community imagined through a multiplicity of wants and gratified desire. A professional gentleman's drawing room, 45 by 22 feet, could boast a 'window at the west end' that 'led into a conservatory of about the same dimensions as the drawing room, having a broad walk along the centre, terminated by folding sash-doors leading on to the lawn'. But '*A Green-house, Orangery, or Conservatory*, ought, if possible, to be attached to every suburban residence.'⁴²

He cites the possibilities: an orangery, with its solid tiled or slate roofing, differs from the conservatory with its glazed roof, admitting perpendicular

light and growing, in winter, specimens unfit for the orangery—‘camellias, heaths, acacias, and all those Cape and Australian trees and shrubs which, by their flowers and newly produced foliage, constitute the great charm of British conservatories during the winter months’ (p. 108). A conservatory differs from a greenhouse by virtue of its capacity to house ‘a few plants to a large size, and so to produce scenery of a magnificent exotic aspect: while that of a green-house is, that it produces a great many different kinds of plants, of small size, which may be considered as merely living botanical specimens of exotics. The green-house is, consequently, much better adapted for the smallest description of suburban residences’ (p. 109), and he adds, for women, for whom it becomes a source of exercise and pedagogical aid in educating children about the world of plants. A greenhouse *quotes* an exotic landscape rather than manifesting it, but in doing so democratizes it: and there are ever-decreasing micro-forms of the conservatory that enable an allusion to plant landscapes in the smallest of houses. A movable botanical plant cabinet that can be restocked (here he anticipated Ward’s plant cases, about which he was subsequently enthusiastic), the ‘substitute’ (p. 109) of the window-sill, which can enclose a ‘view’ from ‘the interior of the room’ (p. 110), the garret that can be glassed over and used for creepers trained up from the ground (p. 110), all these structures create the experience of glass, growing, and greenery. If the householder cannot afford an externally built range of ensuite specialist glasshouses of different types, moving from exotics to palms,⁴³ sweeping from house to garden,⁴⁴ or if he cannot sustain a 40 by 16 foot peach and grape house,⁴⁵ then the artisan’s lean-to construction will serve, placed against the house or even a wall.⁴⁶

He works with three space–time principles, all of which *double* space and time: first, the necessity of attaching the conservatory to the house; second, the importance of transforming space and time by producing ‘spring and summer in the midst of winter’; lastly, the transformation of time by labour.

The glasshouse’s independent ecology creates a self-sustaining space within space at the heart of daily life. The conservatory *must* be adjacent to the domestic interior. The conservatory’s contiguity with the home seems to cheat the a priori oneness of space by preserving a *double* space at the heart of social life. Two simultaneous spaces coexist, the house and the glasshouse. Loudon insisted that the conservatory be heated and ventilated independently of the dwelling, lest humidity and damp invade the fabric of the home, thus marking off the glasshouse space. At the same time it is ambiguously ‘one room’ and two, separated ‘by glass doors’, made of single panels to preserve its transparency and thus both its independence of and continuity with living space.⁴⁷ The conservatory

can be heard and seen from the house, in dialogue with it. The shower of artificial rain falling in the conservatory and heard from the house, refreshes body and mind. The two mediate one another, the conservatory holding out the possibility of an altered, alternative world.

The hothouse transforms space and annihilates time by producing 'spring and summer in the midst of winter...splendid flowers of the torrid zone in a temperate or cold country', synchronizing the seasons. It manufactures ideal time concurrently with the real time outside. So 'proud a command over nature' is, Loudon says realistically, a skill 'the opulent' buy.⁴⁸ 'When subsequent improvements in communicating heat, and in ventilation, shall have rendered the artificial climates produced, equal or *superior* [my italics] to those which they imitate, then will such an appendage to a family seat be not less useful in a medical point of view, than elegant and luxurious as a lounge for exercise or entertainment in inclement weather' (p. 49). But Loudon's ambitions extended beyond this. He envisaged the enclosure of large tracts of glass-covered land, steam-heated and controlled by artificial rain, another new technology that fascinated him, and ceaselessly researched the ideal conditions of artificial environments, particularly steam-heating, the key to a controlled environment. This created ideal conditions for the body as well as the mind. The sick and the healthy body could be fundamentally changed.

The simultaneous fruiting of produce whose ripening would be successive in the outer world is the corollary of double time. To force the maturation time of the peach and the grape as closely as possible together was one of the supreme ambitions of the hothouse specialist. In his *Suburban Gardener* Loudon gives elaborate instructions for this. By judicious manipulation of temperature in relation to sunlight, peaches can be made to fruit in July, while the grape may be brought on a full three months, fully ripe in August.⁴⁹ The time of the sun and the pace of growth could be recalibrated in the hothouse. The management of light was the principle of the forcing house. The oblique movement of light over the glass roof in the course of a day could be as nearly as possible arrested and retained to fall perpendicularly for as many hours as the temperature of the sun was favourable through the ridge-and-furrow roof. Sloped to a 45 degree angle, it enabled light to fall perpendicularly as the sun moved across the sky, maximizing the sun at its weakest and avoiding overheating when the sun was at its most powerful.⁵⁰

Christina Rossetti's *Goblin Market* fruit 'All ripe together', are no illusion, but a fact of technology.⁵¹ The distorted physical body also lurks here. The repercussions for human reproduction of this technological violence, and the management of female sexuality, cannot be avoided. Fiction, as we shall see in the next chapter, makes countless

references to the erotics of the conservatory. It is the space both of taboo and licence. Yet both Loudon's feminism and his philosophical reading of the conservatory enabled him to circumvent these meanings. What interested him about this double time was that the gardener's mind/body time is double. He or she is tied to the labour of the present, immersed in the physical effort required to transform space, yet the fruition of labour is always in the ideal time 'beyond', which has to be envisaged in order to activate labour. This gap between two times not only establishes the limits of control—for Loudon always recognized that the gardener's management of the future is unpredictable—but offers up an alternative imagined time in the midst of quotidian time. Yet, a phenomenologically ambiguous reality principle, it also offers postponement as a necessity, living as the future. Loudon's remaking of time and space recognizes the material and ideal aspects of the experiment, problematizes them, and actively negotiates between them.

Paxton

Paxton's reading of the conservatory's space–time was also threefold, but governed by different principles. The glasshouse did not belong to the domestic *habitus*, as we have seen. Secondly, the object of transforming the categories was to unify space and time as a single optical field, not to produce an ideal climate. Lastly, the identity of the glasshouse was associated not with labour but with mechanized speed.

For Paxton the conservatory was to be deliberately separated from the umbilical relation with the dwelling house, because it was a new and autonomous *public* space. The 'Great' conservatory was an alternative world for scopic consumption and display in the grand style, not an extension of the domestic world. It was probably inspired by the vast glass ranges Paxton saw on his first visit to Paris with the Duke of Devonshire in 1834, where they saw the Jardin des Plantes.⁵² At Chatsworth 30,000 feet of ground space were filled with species from all geographical regions, from temperate to subtropical zones. It had a wrought-iron viewing gallery approached by circular steps. The Great Conservatory was 277 feet long, 123 feet wide, and at its highest point 67 feet. Paxton's biographer comments that the conservatory was greater than Lime Street, Liverpool (1836), Euston Terminus (1839), and the first Great Western Terminus.

Gleaming rock crystals from the Duke's collection were also brought here for display, exotic birds flew among the branches and silver fish swam in the pools beneath a plant collection that was simply unrivalled. There were massive, exotic foliage plants and ferns brought from the jungles and mountains of distant continents, orange trees brought from Malta, altingias and araucarias, date palms from the Tankerville collection, the feathery

cocoa palm and the giant palm *Sabal blackburneana*. There were hibiscus, bougainvillea, bananas, begonias, cassias, pepper and cinnamon trees, massive sterlitzias,—the bird of paradise flower—and hanging baskets of maidenhair fern . . . sugar canes, arum lilies and cycas.⁵³

Eight subterranean boilers reproduced the full range of graduated temperature required to match these globally differentiated flora (the botanical species of all nations were already under glass), while ventilators were fitted in the roof and foundations. Every time in one space, it was less the synchronous, universal time–space of the Loudon ideal than the condensing of space and time into the single optical field that William Whewell was to theorize after the 1851 Exhibition. Different national spaces and different histories were displayed simultaneously in the species of the Great Conservatory, and the temperature was modulated from temperate to tropical heat. It would be theoretically possible in the new conditions of modernity, Whewell thought, to have bodily experience of the whole of history in inverted order as a simultaneous spectacle by manipulating light, and travelling just a little faster than the sun's rays.⁵⁴ Psyche and sensoria would fundamentally change as all global differences were experienced together. The Great Conservatory aimed for exactly this.

Paxton's high-spirited ambition recognized that the key to the speed and mobility required of the new spectacular culture was the railway. 'There has been a perfect tribe at Chatsworth today,' his wife, Sarah, wrote to him.⁵⁵ His agreement on cheap excursion fares to Derbyshire with Thomas Cook, which turned out to be practice for administrating the excursion trains of the Great Exhibition, established the railway as a mode of populist transport. He and his wife were keen railway speculators: in 1845 his wife wrote—'I am looking out for a line [*a railway line, that is*] to have a bit of a private go.'⁵⁶ Indeed, by the mid-1840s, Paxton had interests in a number of companies besides his later directorship of the Midland Railway (1848).⁵⁷ A close business partner of George Stephenson, who understood that rail links with London were crucial to profit and industry, Paxton by 1846 subscribed £101,750 towards railway contracts. And the drive towards London inevitably meant a drive towards that 'natural' extension of the Capital (and of capital) into colonial space. In 1858 he became involved in the Eastern Bengal Railway. By the time of his death he had financial rail interests in Milwaukee, the Argentine, St Lawrence, and Antwerp.

The railway reorganized space, Wolfgang Schivelbusch has famously said.⁵⁸ Loudon had seen the railway station idealistically as a democratic art form, admiring Derby Station because it presented powerful architecture to all ranks. 'Railway Time' standardized differing regional times of

the country. ‘He who, during the “flight of ages past,” has only deigned to “measure his motions by revolving spheres,” is now obliged, in many of our British towns and villages, to bend before the will of a vapour, and to hasten on his pace in obedience to the laws of a railway company!’ *Chambers’ Edinburgh Journal* wrote on ‘Railway-Time Aggression’. Paxton understood that modernity and the new time went together.⁵⁹

The Glasshouse and a Crisis of Taxonomy

Both Paxton and Loudon were hypersensitive to the acts of naming that control the meaning of specimens and structure how we know them. Paxton’s friend and colleague John Linley named a new orchid after him, ‘*Dendrobium Paxtonii*.⁶⁰ As has been seen, he unscrupulously renamed the great tropical lily he persuaded to flower with such flamboyant virtuosity, ‘*Victoria Regia*’. Loudon once went so far as to wish that his favourite shrub, ‘*Benthamia Fragifera*’, had been named after Jeremy Bentham instead of after the Botanist, George.⁶¹

Paxton and Loudon both understood as a matter of course that the glasshouse was founded on the importation of flora and specimens from non-European and colonial environments and thus depended on horticultural imperialism. This produced taxonomical problems.

The exotic stocks of the Chatsworth conservatory were the consequence of a deliberate principle of collection purchase and plant-seeking expeditions. The Royal Horticultural Society, where Paxton had become an apprentice in 1823, had a policy of supporting colonial ‘collectors’, whereby employees were sent out to gather exotic flora and seed from distant parts—Bengal, China, East Africa, the United States, Colombia, the Sandwich Islands. (Chillingly, the 1824 *Transactions* record that out of three collectors sent to different parts of the world ‘it is melancholy to add, that only one . . . survives’.)⁶² Loudon objected to this practice on the grounds of monopoly, believing this to thwart individual enterprise and competition. In residence as Head Gardener at Chatsworth Paxton twice organized transcontinental expeditions, financed by the Duke of Devonshire, to hunt for new species. Expeditions to Mexico in 1833, and to Burma and Assam in 1835, were followed by a disastrous expedition to Canada in 1839, when two Chatsworth gardeners died in the rapids of the Columbia river. Orchids were the great prize. The second expedition produced a thousand tender exotics, and a hundred species of orchid.⁶³ Paxton’s taxonomical policy was to separate out species—Chatsworth had

separate orchid and lily houses. The Great Conservatory classified plants by region, but this was as artificial as any taxonomy.

Loudon, however, had taxonomical misgivings. Horticultural imperialism put the flora of the other on display, and, as long as this was achieved by individual effort and without monopoly privilege, Loudon accepted this as the natural function of the glasshouse, just as he delighted in Cape and Australian exotics in the greenhouse. In the *Green-House Companion*, Loudon remarks on the range of eighteenth-century importations from America, China, Mauritius, Canary, the Levant, and the Cape.⁶⁴ Since then the world had been ransacked for specimens. He had no qualms about displaying human beings in a living 'museum' of plants—'human species from the different countries imitated, habited in their peculiar costumes, and who may serve as gardeners or curators of the different productions'.⁶⁵

Here, like Paxton, he worked with national and regional categories, but, in his anxiety of classification, he sustained at least three other different and irreconcilable taxonomies. He rejected customary botanical classifications according to Linnaeus. Linnaean taxonomy, he said, resembled the discrete items in a dictionary, relying on discrete, isolated particulars. It codified an abstract schema of specific structural items based on the number and position of the reproductive features only, stamen (male) and pistil (female): a genus of flora belonged to one another by virtue of a single aspect of the organism, assigned a generic name and a modifier relating to the species of the genus. Thus he abandoned classification by sexual characteristics. He turned to Jussieu because his was a 'natural' method.⁶⁶ This system arranged orders and groups according to formal relations of likeness, 'their agreeing in the greatest numbers of particulars' (p. 4). For Loudon it was essentially relational. Jussieu's system 'may be compared to words arranged according to their roots or derivations' (p. 7). This etymological botany ordered species less through a synchronic restricted structure than the manifold diachronic history of those structures. Instead of classification by open-ended list, Jussieu's system operated through binary relations according to the histories traced in the formal composition—vascular or cellular (or veined and unveined)—of species. Within this binary another formal division of monocotyledonous and dicotyledonous classification can be derived, and these fundamental forms organize the characteristics of leaf and flower in all their variation, the totality of the plant. Loudon believed that Jussieu's system of similarities sanctioned the grouping together of natives and exotics in the garden and conservatory. Thus the native/exotic binary was reconfigured through juxtaposition. (Compare the regional taxonomy of the Chatsworth conservatory.)⁶⁷ Strangely, the analogy to linguistic principles actually draws on a metaphorical account of language that depends on the 'root' of plant life itself.

But this circularity is instructive. Loudon was engaged unawares in racing the botanical world, already sexualized in the taxonomy of Linnaeus. For racial theory and accounts of national identity also worked to an etymological paradigm of separate roots and derivations from common ancestries, differentiating characteristics consolidating themselves as they evolved through history.⁶⁸ The typological anxieties of Linnaeus are compounded by the need to determine the boundaries of similarity and difference. The sexual system avoids racing, the racing system avoids the sexual system. But hovering behind these taxonomies is a problematized, sexed and raced, human species being. He preferred the system of Jussieu, but the two systems coexist uneasily in his work. In the *Green-House Companion* he set out both systems in elaborate detail, as if recognizing that no taxonomy is monologic.

Ill, in debt, it is the book that killed him, the eight-volume *Arboretum Britannicum*, which began publication in 1838, and was as ambitious in its way as *The Golden Bough*, that demonstrates quite different aspects of Loudon's scientific project of classification. Here it is clear that taxonomy is bound up with the human because taxonomies are *constructed* and their 'fictive' categories depend on the imagination. Another massive taxonomical work, it is a classification of British trees. It is a post-romantic codifying project, profoundly influenced by the German cultural theory, notably Herder's, which insisted on a characteristic culture and literary imagination unique to every nation. This principle is extended into the realm of biological taxonomy. (Characteristically, he inflected Herder's thought democratically in terms of 'the people'.) Loudon's project is to re-mythologize the human and vegetable world and to demonstrate their interdependence.⁶⁹ Every tree, has a 'biography', as one of his critics describes it:⁷⁰ but this biography is compounded indivisibly of cultural, anthropological, and botanical data; species, class, character, variety, propagation and culture, diseases, geography, history, commercial availability, price, poetical meanings, legendary associations and superstitions, religious allusions, culinary and other uses—these are the categories Loudon brings to each variety under discussion. It is a catalogue of the sensory and psychic presence of tree life in human experience, men, women, and children. Of the Mock Plane Tree '*the Sycamore, or Great Maple*', for instance, Loudon notes not only its botanical characteristics, but its appearance in Turner's *Herbal* (1551), and in the work of Chaucer and Cowper, its functional uses for charcoal and furniture-building in Germany, France, and Britain. Children in Scotland play with the buds, termed 'cocks and hens': 'In Scotland children amuse themselves by cutting openings in the bark and sipping the sap that flows from its wounds'; in England children 'suck the wings of the growing keys'. The Sycamore signifies curiosity in the language of flowers because it was

supposed (incorrectly) to be the tree on which Zaccheus climbed to see Christ's entry into Jerusalem, when the people strewed palms 'exclaiming "Hosanna to the son of David!"'⁷¹ Though the tree was not Acer but a Ficus Sycamore, Loudon gives full weight to the myth because of its imaginative power, at the same time as he corrects with the characteristic exactitude just this side of pedantry.

The details may seem unselective and random. But this should not detract from Loudon's attempt—it may have been the last—to remake and modernize an earlier radical anthropological tradition. This held that human beings created the earth in mythological terms investing every landscape and 'the genius of each city', as Blake called it, with a 'mental deity' or human meaning. Such imaginative work on the world affirms an interaction between human and cthonic, or earthly forces, that enlarged the possibilities of mind and body. It is a way of owning without possessing: 'The ancient poets animated all sensible objects with gods or geniuses, calling them by the names, and adorning them with the properties, of woods, rivers, mountains, lakes, cities, nations, and whatever their enlarged and numerous senses could perceive,' Blake wrote, in *The Marriage of Heaven and Hell* (1790–3), describing a state before power relations mystified symbols and images.⁷² Blake's own engravings, in which human bodies rise out of flowers, are entwined with branches and tendrils, or appear to put out roots into the earth, emblemize this interactive state. Loudon's work was a protest against the time-space and taxonomies that violated this relation.

Loudon is sometimes dismissed as an idealist: Almost forgotten, but when remembered, this is to demean his ambition, vision, influence, and actual practical achievements. True, Paxton's populist spectacle and global commercialism was to dominate the late century. Paxton, representing a sublime example of the confident, respectable, and successful working man, exploring a populist civic humanism, and expressing a popular plebeian radicalism that made common cause with middle-class interests, made Loudon's rigorous Benthamism look like a much more old-fashioned republicanism. But to forget Loudon's glasshouse ideal, and his intellectual challenge to glass culture, is to endorse the power of the dominant by repressing the ways of thinking and imagining otherwise. As the next section suggests, the dialectic of the glasshouse moved into Exhibition space.

Glass Culture, Exhibition Rhetoric, and the Struggle between Taxonomies

The givens of hothouse practice, and contradictions of nursery and forcing house, formulated the terms of debate on the Exhibition even before the

glass of the Crystal Palace, not made public until July 1850, consolidated conservatory rhetoric. From the start it was a struggle between taxonomies. Horticultural imperialism finds its parallel in Henry Cole's predatory oratory at the first Mansion House publicity meeting of 17 October 1849.



With respect to raw materials, we shall most likely have, from all quarters of the globe, specimens of animal and vegetable life, as well as of minerals,— samples of what is in the earth and of what is produced on the earth. In the class of animal substances, we shall probably have enormous elephants' tusks from Africa and Asia; leather from Morocco and Russia; Beaver from Baffin's Bay; the wools of Australia, of Yorkshire, and of Thibet; silk from Asia and from Europe; and furs from the Esquimaux. As an evidence of what we may expect from the suggested exposition, I may state that the Court of Directors of the East India Company intend to exhibit the best of everything that India can produce; and we shall therefore probably obtain, by this means, the best practical notion of the value of our East Indian possessions. (Hear, hear.)⁷³

Figure 46 Critique of the Exhibition: three panoramas from Augustus Sala, 'The Great Exhibition "Wot Is to Be" . . . Society for Keeping Things in Their Places', c.1850. Headed by police, exhibits include a patent shower bath to quench chartists, Africans and cauldron with 'plain boiled missionary.'



Sir Robert Peel spoke daringly of the 'intercommunication of knowledge' as populist spectacle at the third publicity meeting, a funding dinner and national launch in the Egyptian Room of the Mansion House on 21 March 1850, when the funding principle of subscription had been established as 'public' enterprise, rather than private loan or government subsidy.

There still remain the ruins of ancient edifices, almost uninjured by time, in which, for the gratification of the people, there were shows and costly

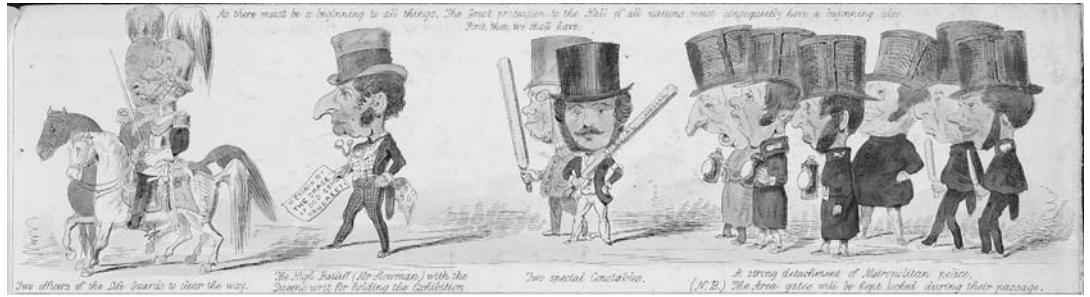
spectacles, when, on a Roman holiday, there were hetacombs of wild beasts slaughtered and sanguinary contests of men against men. We propose to gratify the people by a very different spectacle. (Loud cheers)⁷⁴

At the same Mansion House dinner, where, at this all-male gathering, he was guest of honour, Prince Albert, in a speech more subtle than is generally credited, took up the familiar categories of space, time, and their transformation by technology as ‘the property of the community’ rather than the privileged. ‘The distances which separated the different nations and parts of the globe are gradually vanishing before the achievements of modern invention, and we can traverse them with incredible speed.’ ‘[T]hought’ travels like ‘lightening’. In the terms of idealist thought, the ‘end’ of history is ‘the unity of mankind’. But its end is also to ‘conquer nature’ through the agency of ‘competition and capital’. This speech, whatever its false consciousness, intuited that some of the energies of reformist activism were changing direction and beginning to flow towards a popular radicalism of community.⁷⁵ Forcing house and nursery coexist in his speech.

The simultaneous presence of indigenous and exotic species, the founding principle of conservatory taxonomy, elicited differently inflected languages, all governed by the rubric of biological species life. Albert struggled to theorize a ‘unity’ composed of difference—national ‘varieties’ and ‘antagonistic qualities’ (a kind of Hegelian Darwinism). The juxtaposition of ‘large and leafy European trees . . . a thicket of palms and banboos’ (quoted in the previous chapter), conjured an oratory of ‘republican’ spectacle from *Sharpe’s London Magazine*—‘here are carpets from the East . . . a European park . . .’.⁷⁶ The same conditions provoked a violent racist rhetoric of revolution and miscegenation from the reactionary Colonel Sibthorpe: ‘That miserable Crystal Palace—Let them beware of man-traps and spring-guns. They will have their food robbed—they will have a piebald generation, half black and half white; but I can assure them that my arm will be raised to prevent such a violation.’⁷⁷

At the third Mansion House dinner the Egyptian room was decorated with the iconography of a bucolic pastoral representing the cornucopia of agrarian products of every county. ‘Industry’ was largely interpreted as the processing of pastoral products. Two ‘colossal’ ‘transparencies’ (reported as such by the *Illustrated London News* of 9 March) recalled the sexed and raced hothouse genre, representing respectively ‘Peace and Plenty’ (fertility) and ‘Britannia’ (native stock). Britannia held a sketch of the imagined exhibition building, a ‘circle’ clearly envisaged as a Loudonesque dome.⁷⁸

It was the Benthamite *Westminster Review* that continued Loudon’s reading of the conservatory’s artificially juxtaposed categories as the



reconciled community under glass. The article was by William Bridges Adams, who had known Loudon. (Earlier the journal had praised his advocacy of urban parks.) It rightly claimed to be the first journal to suggest the modern materials of glass and iron as the medium of the Exhibition, a controlled atmosphere, and ‘a great metropolitan conservatory, or winter garden’, that would be ‘thrown open to the poorest’ and rival the conservatories of the Duke of Devonshire (Chatsworth again).⁷⁹ The great building material of the future was to be glass (‘of any required thickness, length, breadth, or colour, transparent or opaque’(p. 383)). Brickmaking by hand would disappear. Slums were to be transformed by glass bazaars. The glass building, filled with fountains, tropical trees, and flowering shrubs, must be predicated on the absence of crime in an aggressive society, and the ‘atmosphere of suspicion’ that forces opaque buildings upon us. The flowers and fountains of Bentham’s panoptical village turn up here again. Adams reiterates a social reading of the conservatory as nursery and place of nurture. ‘Nature is greater than art. In all that gorgeous pavilion of the wonders wrought by men, eclipsing the fabulous tales of Araby; amidst the works whose perfections have been ransacked from all creation, in brain and matter, and amongst which the eye tires and covetous thoughts grow sick with satiety, the spectator turns back for repose to the almost Eastern beauty of the Transept.’ The conservatory proves that ‘Human misery is not a necessity’. Brotherhood—‘God hath made them [the nations] all of one blood’ (p. 349) (race again—this phrasing recalls anti-slavery rhetoric)—education, democracy, and a ‘more intimate union of all classes’ as they promenaded ‘on equal terms’ at the Exhibition (p. 356) were possible. Following Loudon’s strategic idealism, this is a deliberate attempt to imagine a civic ideal against the grain. ‘Imagine . . . imagine’, Loudon had exhorted the readers of his pamphlet on curvilinear hothouses.

For the working-class periodicals that hated the exhibition, hothouse rhetoric avails itself of a eugenic language which sees the Exhibition as a strategy of the rich and the privilege of ‘blood’ to cull the poor: it consisted of ‘works of art and plunder wrung from the people of all lands, by their

conquerors, the men of blood, privilege and capital met to exult over the prostration of labour’—the failure of the 1848 revolutions, Julian Harney’s *The Friend of the People* insisted.⁸⁰ ‘Every city and town has two divisions: in the one is countless riches, in the other incalculable misery. The poor are the producers but not the possessors of riches; the rich are the repressive force . . . the restless spirit that has moved them to action [the Exhibition] is a ceaseless and insatiable love of gain’ (*Reynolds’s Weekly News*).⁸¹

An anxiety of taxonomy is evident throughout Exhibition rhetorics, acknowledging that it could not be a monologic event. Categories break down. ‘I am the Catalogue of the Great Exhibition. You are the Public. . . I, as a celebrated Catalogue had much to go through with ere I learnt that which I teach now in the Illustrated edition, the official edition, the French edition, the German edition, and the twopenny edition.’ When the Catalogue ‘spoke’ in its mini-autobiography in *Household Words*, temporarily deciding to ‘un-catalogue myself’ in informal discourse outside the ‘bondage’ of taxonomy, it conveyed a sense of frenetic dispersal.⁸² The anarchic, exponential multiplication of classification actually defeats ordering principles. The shilling catalogue, the only official guide available before the larger version appeared late in the life of the Exhibition, that ‘scarcely intelligible’, ‘little fat book, in its drab cover’, as *Chambers’* described it, was profoundly unhelpful.⁸³ The Exhibition catalogue was ostensibly organized round Prince Albert’s four grand categories, the taxonomy of capital—raw materials, machinery, manufactured articles, fine art. Whewell claimed that its ‘ordering hand’ had reduced the ‘chaos’ of heterogeneous objects to ‘permanent order’.⁸⁴ (Lyon Playfair had in fact substantially modified this grand scheme into thirty classes and sub-classes derived from Trades Directories from Birmingham and Manchester.) He reminded his audience of the bizarre taxonomies and random classes of previous exhibitions. But the *Daily News* of 2 May could see no ‘laws of order’ in either the Exhibition or the shilling catalogue and gave up on it. *Household Words’* ‘The Catalogue’s Account of Itself’, and *Chambers’* ‘Fifteen Thousand Authors and their Book’, lampooned the catalogue, the first as a Frankenstein’s monster composed of fragments and the second as an impossible heteroglossia.

‘From the north and the south, from the east and the west, my fragments were brought together in ships and deposited by postmen at Hyde Park, in one party-coloured heap’, the catalogue’s autobiography begins.⁸⁵ Categories proliferate. It ‘existed’ first as four varieties of form, printed in black, blue, red, and yellow, to reflect the four governing or seemingly governing categories of the Exhibition. But the forms themselves multiplied the categories of production and circulation of goods, requiring information on the exhibit’s sponsor: Producer, Importer, Manufacturer, Designer,

Inventor, Proprietor. Fifty thousand forms and the work of fifteen thousand 'authors' were sorted into the thirty sub-categories of the Exhibition and went through three checks. For *Chambers'*, the multiple 'authorship' of the catalogue posed questions of generic definition: 'At all events, such a book is a phenomenon absolutely new in the literary world.'⁸⁶ In emphasizing the uniqueness of a volume by fifteen thousand authors, it warns against the babel of disparate languages of description and at the same time espouses the homogenizing work of scientific terminology that sought to bring all exhibits under the same rubric of technology, smoothing out the differentials of provenance, whether of class or country. Yet 'scientific synonymes' cannot dominate. They were at odds with 'grammatical and orthographical construction' of artisans, and the 'grammatical entanglement of a foreigner's translation of his description of a piece of machinery' (p. 393), discordant voices disrupting linguistic norms.

The speaking catalogue dramatizes the strange paradox of taxonomy. 'I was a Catalogue before the Crystal Palace was an Exhibition.'⁸⁷ The final numbering of items could not take place until all slips had been received by the printer. 'It was not until all, or nearly all, the fragments were in the printer's hands, that the final numbering and arrangement could take place; so that, at the last moment, all my inside was twisted up and down. Classification this was called. The classification began at the printer's just before the arrival of the last corrected slips' (p. 522). The catalogue was both an anticipatory and a retrospective production. It *projected* classification, existing in fragments until it was finally compiled, and thus came into existence through an act of revision. It was a self-fulfilling prophecy at the same time as its categorical prophecy was retroactively revised. (The Catalogue was classified, made up, printed, and ten thousand copies bound, in four days, including two silk-lined Morocco-bound, gilt-edged copies (that took six hours to complete) for the royal couple, who were exempt from the 'drab' cover.)

It is as if the meta-language of the Exhibition has become unbound in these accounts. There were three significant attempts to restructure a taxonomy and to enter into new relations with manufactured objects and machinery. Two, by Robert Hunt and Dickens, belonged to reforming, radical constituencies. The other, William Whewell's Tory idealist account of the material artefact, which provided the taxonomy of the catalogue with an ideological justification, was presented as a lecture in a series after the Exhibition closed, and intended by the Commissioners to be part of a defining exercise. Its Kantian purity, aspiring to an ideal teleology of production, has to be read against the attempts of Hunt and Dickens to wrest the terms of the Exhibition into the lived experience of use value.

Both abandoned the catalogue. Robert Hunt's *Handbook*, in fact, became the preferred guide.⁸⁸ Though Hunt's synopsis described the classification system adopted for the Exhibition as a 'natural one', he ignored it, or rather, gave it an ethical and educational gloss by making a highly selective reading of the exhibits. His tour is about utility and a determined refusal of commodity excess: it is a journey through industrial use value. Fittingly, he begins with the manifold uses and intellectual challenges of glass. The aesthetic objects can be 'their own interpreters'. He began with Class 1, mineral productions and mining, and then skipped to class 22, iron and general hardware, and then to woven materials. The practical was his object—'The history of the steel pen is among the wonders of the present day'.⁸⁹ In this short cut to use value Hunt adapts the Exhibition to a tripartite taxonomy only (raw materials, manufactured objects, and machinery). Hunt bypasses the aesthetic objects of the central walkway, whether the statue of Shakespeare or the glass fountain. In opposition to ecclesiastical ornaments in the Medieval Court, it is 'the great industries' of Birmingham and Sheffield in this vicinity that have priority for Hunt, brass-founding, casting, stamping, countless buttons, pens, swords, muskets, stoves, fenders, kitchen ranges, gas cooking apparatus. Hunt's reading of the Exhibition object is practical and deictic, a pragmatic philosophy of the visibility and democracy of knowledge. Knowledge is embodied, and available for all to see, as 'nature's geometry' and the laws of crystal immanent in matter become self-evident in the mimicry of the model, or as, in the visible experiment showing how hydro-sulphuric acid and sulphur is held in solution, the medicinal waters of Harrogate yield up their nature. And knowledge is there to use, inseparable from cooking stoves and cotton. This goes far deeper than the notion of 'applied' technology: knowledge belongs to bodily experience and to matter in order to belong to the mind. Machinery cannot work without mind. 'Passing by the Medieval Court', he passes continually to his own functional 'classification', stripping down the categories of Civil Engineering (Class 7) to the sources of energy—human power, wind, water, and heat.⁹⁰

Dickens, co-writing with Richard Hengist Horne, also proposes an alternative taxonomy. 'Suppose, therefore, we lay aside the Catalogue, and turning over Porter's "Progress of the Nation," adopt his divisions to guide us in our examination.'⁹¹ This virulently xenophobic article, 'The Great Exhibition and the Little One', makes a Whig reading of 'industrial' as opposed to 'revolutionary' 'excitement'. It is based on a series of rhetorical contrasts between the 'Tory' spirit of a moribund civilization, China, which is seen to be at a 'dead stop' (p. 257), and the 'progressive' principles of a modernizing industrial culture. It shares Hunt's functionalism, but whereas that was based on a respect for transforming resources

into artefacts for use, Dickens's and Hunt's fierce concern is with basic, primal needs, food and scarcity.

Thrusting aside the categories of the Exhibition, their use of Porter's sociological analysis and population statistics reverses the priorities of the three categories of the Exhibition—raw materials, machinery, manufactures, which are no longer free-standing, reified classificatory terms, divorced from human agency and need. Porter's study codifies exponential Malthusian increases of population throughout Europe. The article makes a straightforward correlation between machines, food production, and the creation of an industrial infrastructure that will not simply support a population at subsistence level but enable it to reach a 'superior condition of society—politically, morally, intellectually, and religiously' (p. 356).

Steam engines, steam boats, bridges, lighthouses, mechanical clocks, the electric telegraph, surgical instruments, all these go hand in hand with technology. These machines, because they earn food through commerce, are 'by an indirect process' (p. 357), ploughs. The sophisticated exchange value economy enabled by mass-producing machines, is, by means of a kind of backwards exchange through the medium of metaphor, transformed to the use value suggested by the plough and takes us back to raw materials. Farm engines, the compound plough, the harrow, the clod-crusher, the revolving sub-soiler, the draining plough, the centrifugal pump, the sowing-machine, the reaping, thrashing and winnowing machines, the chaff-cutter, the barley-hummeller, the straw-shaker, the thrashing, shaking, and blowing machine, culminating in the 'machine to sow and hoe an acre of turnips in five minutes' (p. 358), accumulating in Horne's and Dickens's hyperbolic list like the accumulation of produce, are the excitement of the Exhibition, its cardinal justification. Machines, both mystified as technological miracles and demystified as simple ploughs, are taken back to an atavistic, primal state of nurture. Metonymies for the satisfaction of hunger, the contents of the great greenhouse of the Crystal Palace still insist on the function of the conservatory as provider of produce. Loudon's radical ideal of universal satisfaction of want is still active in Dickens's and Horne's writing.

But at a cost: this modernity achieves meaning only by being marked off from oriental inertia and by a violent racializing of the Exhibition—the other side of conservatory rhetoric. Disgust, hatred, and fascination with the oriental other runs through the writing. Despite their confident assertion of the category of need, they appear radically uncertain about the relation of human bodies and machines. Contempt for the alien Chinese body is a mask for this uncertainty. Dolf Sternberger has argued that the categories of 'Natural' and 'Artificial' were themselves transformed in the nineteenth century as 'the blend of the technological and the

organic' and the interchange between men and machines grew more insistent.⁹² The machines whose utility Dickens defends 'are not a little alarming, like instruments of torture for the Titans' (p. 358). In the subtext of torture and violence he cannot resist a pun on the 'ostracide'—'grand and killing term for the easy oyster opener' (p. 359).

Traces of Dickens's atavistic impulse towards the organic and agricultural world cling to Whewell's lecture in his fascination with gutta-percha and India Rubber, and his belief that renewable vegetable resources are the basis of modern chemistry, as if the agricultural iconography of the Mansion House dinner remains in the lecture. But he displays little uncertainty about their status. His brilliant and disturbing, suavely subtle deconstructive determinism identified the categories of raw material, machinery, manufactures, and fine arts as the inevitable categories of capital that would create a homogeneous language for the material artefact. Inspired by glass culture, this is one of the most contentious documents of Victorian modernism.⁹³ Space and time, the conservatory a priori, organize his thinking.

Whewell perceived that the catalogue was not intended as a guide but as a research document, aspiring to 'pure' philosophical description. It was intended as a model of empirical description both of product and process. It was to be a modern encyclopedia of contemporary industry, whose commodities were broadly defined as products that have been *worked* by means of instruments or tools (hence the absence of painting, and the presence of sculpture, a contentious issue). It was to represent a pure science of applied technology, an enduring record of the Exhibition. He is unworried by the disjunction between actual and ideal taxonomy. There is something bathetic in his final proposal, that all the work of the Exhibition could issue in standardized screws. But this was not really what his argument was about. True, these could provide a common, homogenized language to facilitate the exchange of goods and material construction, an essential for global power. But their basis was the globally scientific explanatory categories that went beyond the eye to make *general* propositions possible. These *fix* relations, stabilizing demarcations and establishing ordering principles that organize our lives. *The order of things* effectively orders our experience. Citing Cuvier and Bentham as the great taxonomical innovators of modernity, Whewell gave an example of the direct impact of 'generalizing' scientific research on industry—chemical processes and products only made possible by the laboratories of Scheele, Kirwan, Berthollet, Lavoisier. 'The great chemical manufactories which have sprung up at Liverpool, at Newcastle, at Glasgow... occupy spaces not smaller than that great building in which the productions of all the arts of all the world were gathered... they shoot up the obelisks which convey away their smoke and fumes to the height of the highest steeples in

the world; they occupy a population equal to that of a town' (p. 13). With general propositions we see the functional relation of things to one another: good classification brings essential relations into view and changes perception (as with his own provocative analogy between industrial and religious buildings, both dominated spaces). Taxonomy, in other words, is crucial in bringing about material, social, and economic change and the *acceptance* of it. It is characteristic of his argument that it cuts both ways. Taxonomy is liberating because it transforms knowledge: but it closes down questions, and makes action unnecessary. Whewell writes as if lived experience, contradictory experience, class experience, disappears into the pure realm of classification, the realm of the concept. It is an iconoclastic idealist materialism, claiming to establish a liberal epistemology and confirming the hegemony of pure science as the privileged knowledge of the modern nation state.

An epistemology of the artefact based on the technology of spectacle underlies his philosophy of the artefact. He is one of the earliest theorizers of 'material art' (p. 3). Material production, from which in fact our accounts of poetry's *techne* are derived—'texture', 'machinery', 'imagery'—must implicitly supersede literary production with a language not of words but of things. Whewell formulates four 'laws of operative power in material production', (p. 3), or mind 'stamped upon matter' (p. 2). The first is exemplified by the new aesthetic technology of the photograph, with its instantaneous reading of a synchronic moment. The laborious agency of individual research, its unevenness through time, false memory, and anachronism, is swept away—'His knowledge is only his' (p. 5). A *simultaneous* global understanding of material cultures can only be achieved by the collective resources of capital as nations converge in one space under the single rubric of display. The second law, the annihilation of time, follows from the first. A *bodily* and contemporaneous reading of the totality of history through the transmission of 'visual images' (p. 6) is possible. Combining scientific fantasy and astronomical data, Whewell bizarrely imagines travelling a little faster than light, so that in 'inverted' order we might see all the successive events which have passed even to the arrival of the 'first inhabitant' (p. 7). This literally preposterous proposition generates the third law, that if we read time backwards we read experience as a continuous stream of *images*, a seamless continuity of event created through the mechanization of experience. Whewell presciently imagines a visual archive of images stored in light. The fourth law of the artefact follows: modernity presupposes a peculiar mobility and hyperactivity of the eye. Mobility itself is a value, with the machine as an index of mobility. Without offering a crude law of progress the dynamism of a machine-created society can be seen to supply the wants of 'millions' (p. 8). In comparison with oriental magnificence,

where the many serve a single potentate in a culture of the ‘delicate craft’, this is a democracy of the machine—‘We were students together at the Great University of 1851’ (p. 16).

The Taxonomy of Exhibition Jokes

The joke and taxonomy are strongly allied. One disrupts categories, the other attempts to hold them down. The joke and incessant schemes of classification emerge jointly in responses to the Exhibition’s disorientation and repeatedly disrupt the ordering process. The incessant crowds and ‘daily recurring thousands’ (*Dublin University Magazine*)⁹⁴—‘Where are all the people coming from?’ *Fraser’s* asked⁹⁵—the optical shock and exhaustion of the eye, produced an intense disorientation that undermined ordering principles: a surreal heterogeneity juxtaposed erotic and mundane objects; ‘naked gods, demi-gods, heroes, muses, graces, in plaister of Paris or marble, which are placed between Manchester wares and Sheffield cutlery, Birmingham buttons, Persian carpets, ploughs, and circular saws’ (*Ecclesiologist*).⁹⁶

Death, the undead, galvanized, or distorted body, precipitate jokes. Voltaire’s ghost, come to inspect the achievements of ‘progress’ in *Blackwood’s Magazine*, walks by accident into a wooden case and is confronted with a life-size model exposing the ‘great viscera of the human frame’. He speculates on a bizarre pyramid built as a modern democratic solution to ‘stowing away’ the dead.⁹⁷ The High Anglican pseudo-Catholic knickknacks of the Medieval Court mystify him. For the *Dublin University Magazine*, dream overload derealizes the body and offers it up to a kind of ghostly revolutionary violence: ‘On a sudden the street was filled with cabs and omnibuses, loaded with passengers and luggage, as if every train and station in the kingdom had moved up to town by simultaneous action . . . all were skeletons. Skeleton omnibuses and cabs, skeleton passengers and drivers, skeleton portmanteaus and carpet bags, and a *mêlée* of skeleton police . . . breaking wheels, heads, arms, and legs, in indiscriminate liberality’. (Does the Irish famine return in this nightmare?)⁹⁸ For *Chambers’* there are beds that cannot be slept in, ‘groaning under the weight of gold, enamel, embroidery, and tassels’.⁹⁹ For the *Westminster Review* ‘A manufacturer of beds has contrived a remedy for not hearing the mistress’s bell. The first pull rings the bell, the second pull rolls the servant out of bed.’¹⁰⁰ For *Sharpe’s* a tassel-covered German bed on a dais resembles ‘instruments of torture’.¹⁰¹ For the *Westminster Review* there is an absurdity in the gutta-percha fountain, surrounded with gutta-percha trees, animals, rocks, and lilies.¹⁰² For *Tait’s Edinburgh Magazine*, the mock

life-like movements of an entire military band in a Swiss musical box. Galvanized mimicry is another element of the German absurd for *Sharpe's*; an immense relief model of Prince Albert's birthplace contains country figures: 'The affair is wound up and the worthy folks commence a waltz';¹⁰³ it notes the British ludicrous, 'pointed boots, on the ends of which the portrait of Prince Albert is embroidered'; the North American ludicrous is exemplified by a 'paletôt; you have never seen its equal. At first sight there is nothing to distinguish it from an ordinary Macintosh, and it resembles those worn by the dandies of Hyde Park and the Champs Elysées. But in one of the pockets you will find a small tube, the end of which you must adjust to a button-hole. The paletôt instantly swells; it is metamorphosed, and takes the form and qualities of a good canoe. Two little oars are concealed at the bottom of the trunk' (p. 317). (Things that turn into something else are a frequent theme, as if the object is fundamentally unstable.) A robot tailor sews 'with feverish activity' (p. 318).

The stuff of un-innocent jokes is here—death, sex (the beds), class privilege, national rivalry. Mysogyny, race, and class emerge, often simultaneously, as raw joke themes: 'What! Can those but little known and less understood people be savage, whose work bears such an impress of distinction and dazzling richness?' *Sharpe's* asked, half seriously (p. 253). *Fraser's* imagined the uncomprehending eye of the savage, analogous with the working-class gaze: these 'chaw-bacons' would traverse the exhibition space in ignorance, 'wondering with their great eyes'.¹⁰⁴ *Punch's* famous cartoon put workers satirically under glass, 'Specimens of Mr Punch's Exhibition of 1850', a needlewoman/prostitute (we think of the robot tailor), a 75-year-old labourer, a sweater.¹⁰⁵ The exhibition's 'universal bazaar', *Sharpe's* said, has 'put an end to the visits of ladies in their carriages to the shops of Piccadilly and Regent Street'.¹⁰⁶

What these writers did not see as ludicrous subsequent history has supplied, and there are now classics of Exhibition absurdity: the knife containing eighty blades with gold inlaying and etchings of Windsor Castle, the engine driving cotton machinery in the Egyptian style, the papier mâché Daydreamer's Chair, where naked bodies and lilies fuse with the legs and surround the stuffed seat—literally the stuff that dreams are made on. One could add the garden seat made from a single block of coal,¹⁰⁷ or the twelve pairs of miniature scissors almost invisible to the naked eye (noticed by the *Illustrated Cyclopaedia*), or, conversely, a pair of 16-inch nail scissors noticed by *Tait's*.¹⁰⁸ Pevsner's classic critique of the Exhibitions bastardizations of form and style presupposes this absurdity.¹⁰⁹ Forms are bloated, bulging, depending on the broken line, he said. Materials perversely imitate other materials (glass and wood marble,

for instance) or materials familiar in one context are reproduced in another (brass drawing-room furniture, iron beds) or new materials such as papier mâché, india rubber, and gutta-percha are invoked as substitutions. Styles range from Cottage Ornée, Tudor, Stuart, Anglo-Grecian, Moorish, Spanish, French Rococo, Chinese, and mixtures of these. Often commentators responded without irony to the industrial grotesque of mixed and hybrid styles. The *Civil Engineer* quoted Wornum's lecture on the aesthetics of the Exhibition without criticism, though earlier it had complained of the muddle of the catalogue and unsystematic display: 'There was the Greek style developed to some extent, the Oriental or Byzantine, a tolerable sprinkling of Cinquecento, a little Gothic as shown in the Mediaeval Court, some Elizabethan, and an immense quantity of Louis XIV, and Rococo.'¹¹⁰

Yet the uneasiness of the Exhibition joke responds to Exhibition aesthetics with irony, and critique in particular to commodity. These jokes played on the shifting categories of need and luxury, need and exploitation. The hyperbolic 'spirit of ornamentation' calls out hyperbole in *Chambers*. 'A cut-glass lustre of huge size, adapted for holding twelve dozens of candles, oppresses with its elaborate magnificence.'¹¹¹ David Brewster in the *North British Review* produced an uncomfortably equivocal triumphalist rhetoric:

There are the mechanisms which have made man a tyrant over matter, cutting and twisting, tearing and moulding its most adamant as well as its tenderest elements—which break and pulverise the crust of the earth—which lift up its heaviest and most solid strata—which span its rivers and its valleys—which transport the riches of our commerce across the deep, and which hurry us on wings of iron.¹¹²

'Voltaire', pondering the unresolvable gap between the triumphalist optimists of capital and the 'pillage' of commodity society and its slavery, meditates on 'fictitious wants' and 'gew-gaws' through the joke: 'I put my elbow on the mantelpiece and am in danger of precipitating some china mannikin.' 'Costly nonsense': it is not simply that 'Voltaire' has discovered Marx's fetishized commodity. He tries to shut out that mediated middle range of luxury consumer objects that do not fall into the binary of pure aesthetic and pure use. Yet his construction of the binary itself cannot but expose a question of definition—the problem of what these categories are, and what things fall in or outside them. 'I honour the arts, and I respect also every useful manufacture . . . but there is a province of human industry lying between these two, which is neither fine art nor useful manufacture, which I do not honour, for which I have no respect whatever—ornamental nonsense for which I feel something very near akin to contempt.'¹¹³

Luxury has at least ‘made hunger reflective’, he comments, on working-class discontent.

Above all for ‘Voltaire’ the category of manufacture ‘lying between’ beauty and use systematically distorts the human body, and combines the naked human form with *things* in an abusive way. Unclad Nymphs surge round a clock. The grotesque fusion of a man’s head with a coffeepot lid, or the human head crushed under a teapot spout, is for him a violation of species being, an unsettling distortion of the human. ‘If I pour water from a ewer into a basin, must I seize a river god by the waist?’ The conservatory’s hints of grotesque violation reappear in this confounding of species being by blending the biological and the artefactual body, which fails to separate the categories of thing and being.

Tait’s Edinburgh Magazine, one of the blandest readings of the Exhibition, remarked that ‘never before were the producer and the consumer brought so closely into juxtaposition’. The new era, in which ‘eight hundred million of men’ were to be witness to commodity spectacle no previous generation experienced, was, it believed, a philosophical issue for ‘contemplative’ thinkers.¹¹⁴ For most writers today, the ‘monstrous hypertrophy of ornament that transforms the simplest objects into nightmarish creatures’, ‘the spoils of the object’, and the ‘bluish halo’ (as Mrs Merrifield called the Crystal Palace light) cast over them, signal the moment of the commodity fetish: the commodity becomes an ‘*enchanted object*’, as imaginary exchange value eclipses use. For Giorgio Agamben Freud’s fetishism and Marx’s commodity fetishism come together in the Exhibition.¹¹⁵ He reads the double meanings of Freud’s fetish, where symbol and the negation of symbol coexist (phallic lack in the mother precipitates the impossible search for its disguised symbolic replacement), alongside the ambiguous double meanings he attributes to Marx’s fetish. The ‘mystical character’ of the commodity comes about because the ‘crystals of this common social substance’ of the labour constituting use value are transformed to a ‘grotesque’ symbolic imaginary by exchange value. Thus both psychological and economic fetish are characterized by conflicted meanings of metaphorical possibility and lack.

Agamben elides the structure of the exhibit under glass with the historical necessity of its dominance. As with most twentieth- and twenty-first century commentators he takes for granted an agreement that the *things* and *artefacts* in the Exhibition are too gross to warrant investigation. Such assumptions underestimate the work of interrogation aroused by the Exhibition. The ambiguity of the artefact is an object of contemplation, as were the conflicting meanings of the Exhibition as a whole. Contemplating the grotesque body of the Amazon (a ‘dauntless damsel’, ‘evidently not indebted to the milliner for her costume’) fused with her horse and

with the tiger ‘wanting to breakfast upon her horse’s shoulder’, the *Tait’s* reviewer negotiates gender shock, animal violence, and the existence of this triple being seemingly outside both use and exchange, the ‘milliner’ and the ‘mart’, as he terms it.

The Exhibition’s six million visitors outnumbered Britain’s 850,000 franchised voters.¹¹⁶ Multiple responses, multiple meanings: the Exhibition generated an investigation of paradigms. What was it? An Arabian Nights Structure, the great international museum of industry, a truly republican idea, an enchanted dome, a monstrous greenhouse, an assembly, a spectacle for the gratification of the people, a festival for the working man and woman, the House of Commons of English Industry, a reflective enterprise, an intellectual festival, the great Olympian festival, a world jubilee of industry, a museum of progress, a Temple of Peace . . . to teach and to learn, to give and to receive, a bivouac of all the villains in London, pillage, plunder, a dupe, that most tremendous humbug? Even the lexicons of individual publications vary: Temple of Peace, May Palace, Glass Theatre, diorama, bazaar, glazed park, pleasure garden (*Household Words*). The great Commercial festival, the great industrial show, the great gathering of all nations, the Exhibition of Idleness, Pageant, Glass Hive, Warehouse, fair, stupendous spectacle, orange-peelery (*Punch*). A modernizing agenda,¹¹⁷ the impulse of capital, the indigenous tradition of Mechanics Institutes exhibitions which, as Susan Barton has demonstrated, had their own educational agenda,¹¹⁸ the French commercial ‘expositions’, the most recent of which, in 1849, Henry Cole had seen and envied, all created different paradigms for the Exhibition.¹¹⁹ But it was Loudon and Paxton who founded the terms of the debate.

The Exhibition defied classification. But its existence ensured that glass culture, arising as both cause and effect from the conservatory, was at the centre of the debates and conflicts of Victorian modernism. If Henry Cole had not persuaded Prince Albert that the Exhibition was viable, the complexities of glass culture would not have emerged. A caesura in the myth of progress and the projects of capital would never have been. Time, space, taxonomy, the grotesque body, these continued to resonate. The following two chapters take these themes into the display of glass under glass.

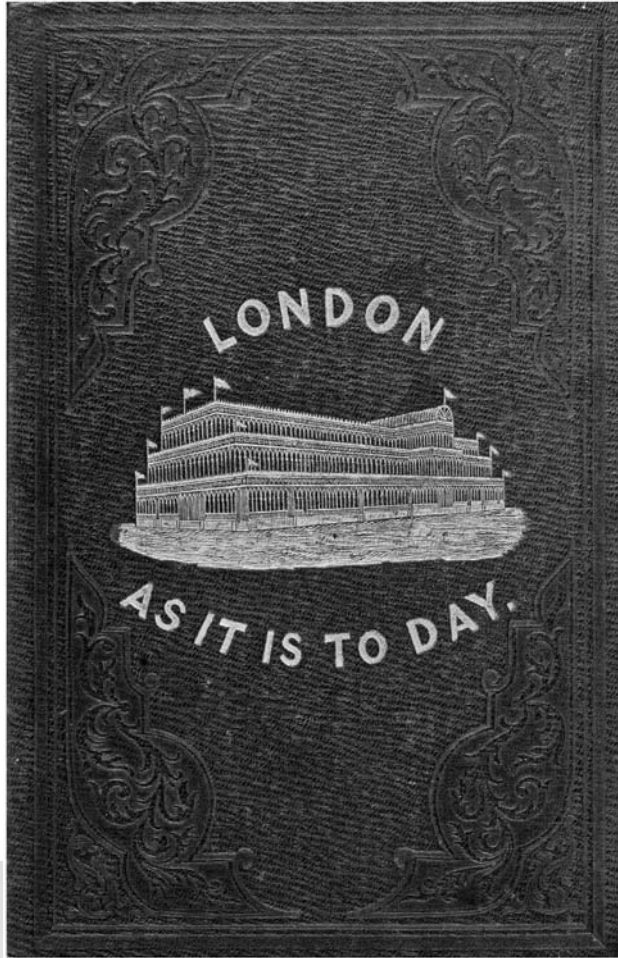


Figure 47 The dissemination and commodification of Crystal Palace images. Front cover and frontispiece of the Crystal Palace from a guidebook, *London as it is Today: Where to Go and What to See, during the Great Exhibition*, 1851. Note that the Exhibition is described as a 'National' Exhibition, excluding the international participation by other countries.





8

Mythmaking

Cinderella and her Glass Slipper at the Crystal Palace

This central part of *Glassworlds* has shown how glass culture was active in the phenomenology of reflection and translucency, in the aesthetics of the urban glass structure, and in the politics of the conservatory. Far from being Benjamin's traceless entity, glass is marked with the complexities of perception itself, with the contradictions of the transparent urban fantasia superimposed on city squalor, and the opposing meanings of nursery and forcing house that governed the hothouse. The new modern transparency was the meeting point of the debates of nineteenth-century modernism, crucially those debates over the Exhibition of 1851, a monstrous 'greenhouse', where rival taxonomies of the glasshouse circulated.

Glass under glass is the topic of the final chapter, which concludes with 'Exhibition' fiction by Charlotte Brontë and Charles Dickens. The present chapter turns to the fairy story, to magic, and to some nineteenth-century versions of *Cinderella*. It recapitulates two elements provoked by glass that emerged in earlier contexts, the crystal grotto (the glass building) and the grotesque body (the conservatory), that transgression of typological boundaries that disturbs the categorical relation between animate life and human beings and human beings and things. *Cinderella* stories produce a mythography of glass and its transformations that explores these boundaries. This mythography provides a framework for glass display in the final chapter. Here the concern is the way fairy story and myth tap those archaic elements of culture, the knot or navel (to transfer Freud's metaphor from individual to collective), where meanings are mysterious, as well as attempting to re-form narrative to interrogate the modern. Even a cheap garishly illustrated version of the glass slipper will say something about a profound cultural enquiry.

Elastic Glass

It was Perrault, in 1697, who first introduced glass into the Cinderella story. Up to this point the slippers were not glass, though they could be gold. So the collector of the 345 variants of the Cinderella story has established.¹ ‘Verre’, glass, was a mistranslation of ‘vair’, fur. But the Opies believe that this was no accident. ‘There is no doubt that he himself intended that the shoe should be glass.’² Glass became the founding element of the story—it was essential that the glass slipper fitted the right person—and Cinderella’s magical transformation became mediated by glass.

Between 1830 and 1890 seventeen Cinderella stories included the glass slipper in their titles. Two were plays for children and one was a poem. What would half a dozen stories chosen at random suggest about the glass slipper? (Except for George Cruikshank the stories are anonymous.)³

To these she added a beautiful pair of glass slippers. (1830)⁴

Then taking from her basket a beautiful pair of elastic glass slippers, she caused Cinderella to put them on. (1850)⁵

Her godmother then took from her pocket a pair of beautiful glass shoes or slippers, and bade Cinderella put them on. Now the soles and lining of these slippers were made of an elastic material, and covered on the outside with delicate spun glass. They were exceedingly small. (1854, George Cruikshank)⁶

The fairy took from her pocket the most beautiful couple of elastic glass slippers. (1861)⁷

Then taking from her basket a beautiful pair of elastic glass slippers, she caused Cinderella to put them on. (1870)⁸

a pair of elastic glass slippers . . . (1876)⁹

Only in the earliest story, from 1830, are the slippers pure, magic glass: they are otherwise *elastic*, elaborately so in Cruikshank’s case. Why does the slipper become ‘elastic’?

Carlo Ginzburg remarks that the ‘Assistant’ of Cinderella’s transformation is a fairy in Perrault’s version, but more often an animal who entrusts her with its resurrection and the gathering of its bones (though one is often missing). ‘Cinderella’s monosandalism is a distinguishing sign of those who have visited the realm of the dead’ (which he interprets as the Prince’s palace).¹⁰ Residual shamanistic elements occur in this group of stories: the fairy is a dwarf in Cruikshank’s 1854 version and a spectre in 1861. Perhaps the glass slipper is still connected with a corporeal depletion or distortion, an encounter with death. But what does this mean in a nineteenth-century context?

In all these stories a culture of excess emerges. Sumptuary excess, public feasting, addiction (gambling and alcohol) constitute the elaborated details, a festival of consumption. The versions of 1850 and 1870 repeat each other verbatim, though illustrated differently, and offer the sparse essentials of the

story, as does 1876. The others elaborate the narrative prolifically. The version of 1830 abounds with highly moralized sumptuary excess: the sisters plan scarlet velvet, white satin, jewelled stomachers, and saffron-coloured velvet shoes: 'it is the sure mark of egregious vanity';¹¹ 'their attentions to the looking glass were so unremitting, that it might have been doubted whether they had not become enamoured of their own representations' (p. 19) ('the looking glasses were so large that they could see themselves from head to foot', we have heard (p. 13), indicators of new glass technology). The story ends with libertarian celebrations. The Prince and Cinderella exercise philanthropic benevolence, the Prince gives marriage portions to a hundred orphan women and almshouses to a hundred widows, while Cinderella endows a college for a hundred industrious young men. The prisons are thrown open, debtors released, playhouses are free, twenty nights of fireworks ensue. The version of 1861 continues the sumptuary theme—with scarlet and green velvet, the sisters' broken corset laces (the vanity of tight lacing and its bodily distortion), and narcissistic attention to the looking glass. Cruikshank (1854), too, adds the mirror—'such looking in the glass'—and is hyperbolic on the designer frippery and conspicuous consumption of the sisters: silks, satins, laces, ribbons, braids, bodices, flowers, trains, dresses, feathers, jewels, ornaments, shoes, buckles, sashes, slippers.¹² He adds the theme of gambling, the stepmother's addiction, and puts the father in a debtor's prison (1830 and 1861 kill him off). The Dwarf intervenes to create a teetotal wedding and denies the couple 'fountains of wine'. 'The history of the curse of strong drink . . . is marked on every page by excess' (p. 25), quarrels, brutal fights, and violent deaths. Cruikshank wrote a temperance pamphlet, *The Glass and the New Crystal Palace*, illustrated with a wineglass sprouting Medusa-like snakes.¹³

It is not difficult to see these additions through an obvious anxiety about an intensified, feminized commodity culture of endless consumption here, as the show of goods under glass accelerated. The father's disappearance or lack of care suggests real familial uneasiness, a gap in patriarchy. But this does not help with the 'elastic' glass slipper.

More helpful are, not the 'new' elements, but those that do *not* change. They do not change, but they remythologize for *modern* experience two central elements of the story—transformation, turning things into something else, and the transgression of typological boundaries, as species cross categories. Every story clings on atavistically to the traditional animal and vegetable components whose transformation enables Cinderella's and transports her to the ball—the pumpkin, the rats, mice, the six lizards behind the water butt or water can. In particular the hidden creatures, non-domestic mammals and reptiles normally lodging intimately but separately in the walls, crevices, and holes of human dwellings, feeding off human

debris or quietly sharing resources (water), are utilized. With magic, vegetative life becomes a vehicle, a thing, a moving object, creatures are *mobilized* as human bodies, crossing categories, their species being metamorphosed, captured to work the will of 'higher' beings. Whether transformation is a transgression is the problem. The boundary firstly between animal, vegetable, and human, and secondly between living beings and things, bodies and objects, is disrupted. There is a double violation. The boundary is both a point of contact and a division, intimating an evolutionary anxiety about the breakdown of species categories, and pointing to its corollary, the amalgam of organic life and inorganic artefact or machine. Ginzburg's shamanistic agent attends the grotesque body.

The glass slipper is a magical product, but in the nineteenth century its origins in inorganic debris, sand, would be known. It too was the product of transformation. It was dead matter transformed by human labour and by breath. It thus was a kind of hybrid, the residues of sand and human corporeality. (Here is where Ginzberg's realm of the dead appears.) In this it has an affinity with the pumpkin, the mammals, the reptiles, sharing with them the crossing of boundaries. But it is closer than they are to the *manufactured* object, modernity's way of transforming things into something else. Because of this its *magical* transformation is in difficulties. Magic guarantees that the crystal shoe will neither fracture nor lacerate the foot. The *elastic* glass shoe emerges from a literalism that is now sufficiently conscious of the real agony of glass—it splinters and pierces the flesh—to be uneasy, unable to see it as magical or symbolic. (Cruikshank's spun glass is particularly laborious here.) The explanatory function of the elastic, though, as manufactured object, works against mythology, and yet exposes the need to incorporate the intractable manufactured *thing* into myth.

The work of mythologizing, redressing the difficulties of transformation and transgression, is done here through an alliance of manufacture and reproduction. The glass shoe, a feminine vessel, brings reproduction into the reckoning as well as being *made*. The mythological solution exposes another 'problem', feminine reproduction, but one at least that comes into visibility. Glass repeatedly calls up feminine symbols in this era. Generally feminine sexuality and glass are perilously related. But perilous though they are, the power of feminine reproduction cannot but be recognized. A miniature 'glass ship', stored in a box, becomes the rival of a heavily embossed silver cup in male ownership in a story, almost like dreamwork, written by the 14-year-old Charlotte Brontë at a crucial point in adolescence (its 'delicate cordage' is smashed by a girl child just at the oedipal moment, another sexual turning point).¹⁴ '[I]nert glass moulded from within caught the semblance of such an alien grace,' Christina Rossetti wrote of the indivisible sexual and spiritual being of arrested 'blossom bells'

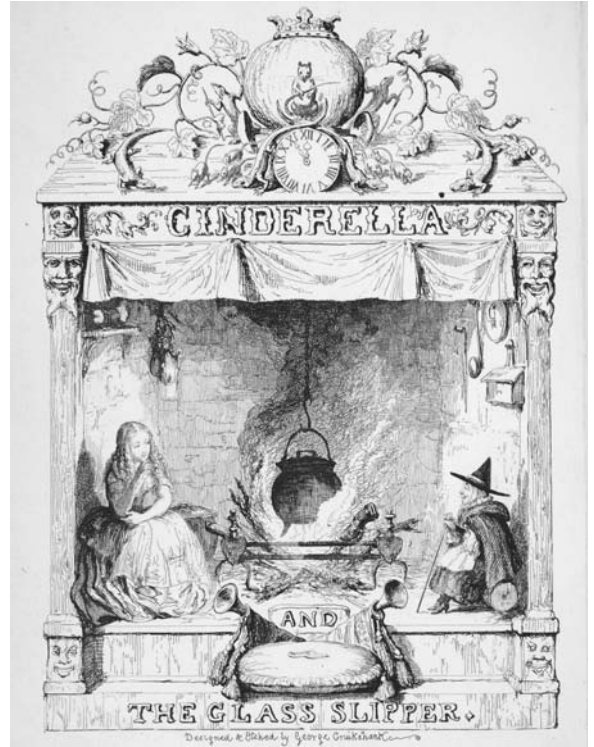
of blown glass, matter and immateriality simultaneously.¹⁵ The conservatory consolidated this alliance of reproduction and glass in the nineteenth century: 'a bell was rung for Richards to repair to this glass chamber, and there walk to and fro with her young charge.'¹⁶ Polly, Dombey's wet-nurse, renamed or reclassified as 'Richards' by Dombey's arbitrary taxonomical authority, nevertheless exercises a polymorphous vitality in the household. Novels ubiquitously (it is well recorded) chronicle a crisis of feminine sexuality associated with the conservatory, whether it is Wilkie Collins's spick and span conservatories waiting to trap men into marriage in *Armadale*, Braddon's exotics in *Vixen*, Maggie's erotic temptations in *The Mill on the Floss*. It is no accident that Mrs Cadwallader draws Sir James aside to the conservatory to warn him about Dorothea's marriage.¹⁷

Reproduction and feminine sexuality in these Cinderella stories is far less perilous, and celebrated through their illustrations. These attempt to displace the magic glass of the slipper as sign of reproduction from the ground to the air, through the plenitude of glass decoration, candelabra, and chandeliers. (Mirrors, appearing in every illustrated text, perform the same work.) Of course they reinforce the nature of glass as feminized luxury artefact, but they cannot avoid plenitude, transforming production into reproduction. In the Cinderella version of 1876 a swagged, Brighton pavilion-style ballroom is flanked by four huge glass candelabra with pineapple centres, whose four curved arms display the hanging and swinging faceted pendants developed in the latter part of the eighteenth century.¹⁸ Among the spectators three black turbaned men look on, exotic figures in alliance with exotic fruit and the racing accomplished by hothouse glass. These prints convey the exuberance and fertility of glass in a counter-movement to the realm of death, which, of course, is always bound up with reproduction. In 1850 a winged figure thrusts its arms into the shoes, with obvious intent, as if they are extensions of its body, ready to fly, its aerial and corporeal nature coexisting and fused with glass. The 1870 edition illustrates a mirror flanked by candelabra displaying a drum of tapering spear drops whose frame is circled with cross-cut prisms, indicative of the hundreds of new pendant designs made in the nineteenth century, but indicative also of the capacity of light to be reproduced to infinity by prismatic lustres.¹⁹ The ballroom scene shows the ultimate in glasswork luxury, a chandelier in the lapidary cut style developed by Osler in the 1860s.²⁰

Only Cruikshank retains one glass slipper, arranged on a cushion, at the base of his frontispiece, as if recognizing that it is the founding element of the story. Cinderella in rags occupies the centre of the engraving, while the entwined rats, mice, lizards, and pumpkin twist energetically in a zoomorph-like configuration at the top of the page. This prominent interlacing of animal and vegetable forms echoes the persistent figure of the



Figure 48 Four images of glass in Cinderella stories: (a) *The Amusing History of Cinderella; or, the little glass slipper*, 1850, small end piece, fairy with slippers; (b) George Cruikshank, *Cinderella and the Glass Slipper*, 1854, 'Cinderella in the Chimney Corner'; (c) *Cinderella or the Little Glass Slipper*, 1870, illustration of ballroom scene, with chandelier; (d) *Cinderella, or, the little glass slipper*, 1876, illustration of the ballroom scene with candelabra



metamorphosed body and co-opts Cinderella into the grotesque imaginary, where the elastic glass slippers, as matter, breath, and artefact, also belong. The positive, fertile meanings of the grotesque are uppermost in these stories. The ancient grotto, source of this genre, could become a womb where semi-human forms, rockwork, water, and vegetation coexisted. (Its generative power replies to the passive *Sleeping Beauty*.)

We can see these stories, then, working on manufacture, amalgam of animate life and thing, and reproduction. To move from these Cinderella texts to others, the grotto's presence in the glass chandelier became a remythologizing project, a transformation scene in glass. Cut crystal, and its analogy with rock (as well as with jewels), with the 'natural' facets of quartz and the surfaces of minerals polished by water and wind, brought the grotto into the light of the dwelling, suspending its carved, artificial stalactites in brilliant, scintillating lustres above the heads of occupants. 'By the end of the first quarter of the nineteenth century most houses of any pretension would possess a chandelier.'²¹ '[W]e saw—ah! It was beautiful—a splendid place carpeted with crimson, and crimson-covered chairs and tables, and a pure white ceiling bordered by gold, a shower of glass-drops hanging in silver chains from the centre, and shimmering with little soft tapers.'²² Heathcliff, the 'grotesque' outsider, recognizes the beauty 'shimmering' in the domestic chandelier. Another outsider and Cinderella figure, Charlotte Brontë's Lucy, is stunned by the grandeur of a public chandelier. 'Pendant from the dome, flamed a mass that dazzled me—a mass, I thought, of rock-crystal, sparkling with facets, streaming with drops, ablaze with stars, and gorgeously tinged with dews of gems dissolved, or fragments of rainbows shivered. It was only the chandelier, reader, but for me it seemed the work of eastern genii.'²³ Glass creates the individuation of each drop of water at the same time as it is mimetic of the generalized, incessantly pouring, aquatic fluidity of the waterfall—'shower of glass-drops', 'streaming with drops', 'dews of gems dissolved'—that make for visual paradox. Water, light, and artifice come together. The spectrum is created and recreated in its refractions. Glass creates at one and the same time the massive unity of rock crystal and an infinitely divided combination of manufactured matter and light.

By the mid-century the delicate branching and undulating stems and arms of the eighteenth-century chandelier had modulated to a circular frame structure (developed in the Regency), sometimes lit from within, in which a column, flared at the base, was constructed from 'a solid core of vertical chains', its graded drops tapering to the base in as many as thirty chains or more.²⁴ Arms projected from the base loaded with further drops and finials. The *Illustrated London News* shows these traditional frame chandeliers (supplied by Osler) hanging overhead in the first Mansion House publicity and fund-raising meeting for the 1851 Exhibition.²⁵ But

this structure was freely varied and extended in Victoria's reign. The central column terminated in innumerable extensions and ever-widening circular frames. Chains hung and looped from point to point of the structure. The hanging, straight-sided pendants of the eighteenth century proliferated in different forms and shapes—tapering, steeple-shaped prisms, icicles, stars, fleurs-de-lis, spires, pears, ovals, large flat lustres incised with diamonds and cross-cut. The terms for some of these drops indicate their complexity—waisted icicle, octagonal flatback 8 cut, octagonal flatback 16 cut, hexagonal flatback, round double point button. Before gas arrived in the 1840s drip pans were elaborated. In 1850 Apsley Pellatt, whose shell-encrusted waterfall chandelier was engraved for the *Illustrated Exhibitor* in 1852, supplied nine gas-lit chandeliers comprised of 35,000 drops to the Brighton pavilion. The *Journal of Design* celebrated these as the consummate achievement of British chandelier production. A mass of crystal had been created, entirely free of visible metal supports (this was a specifically Victorian technology), the refractions of colourless glass left to perform their self-multiplication with miraculous autonomy.²⁶ The largest chandeliers could extend to 30 feet—Victoria restored a mirror glass chandelier of this size in 1842. Almost every major glass manufacturer of decorative glass exhibited chandeliers or large candelabra in 1851.²⁷ One of Pellatt's was 24 feet, nearly the size of the fountain. He exhibited eleven chandeliers. Osler candelabra could be 16 feet high. Osler, who with the long-lasting firm of Perry and Co. was the most prominent manufacturer of chandeliers, further developed the waterfall chandelier, and in the 1860s, experimented with more solid lapidary cut structures. In her *Household Words* factory visit, Harriet Martineau described the laborious process of creating moulded lustres, and fusing the drop to its attachment (men made them, women polished them).²⁸ Just as Grotesque flora travelled inward from the colonial exotic, so these amazing glass products travelled outward, to India in particular.

Chandeliers belonged to a generative moment of glass culture, where the need to create and multiply glass droplets and their interaction with light was paramount. Osler's famous glass fountain was effectively an inverted chandelier, morphologically analogous to the many chandeliers that hung in the 1851 Exhibition. Their simulation of water, effecting the magical transformation of sand into the very element that brought about its being by erosion and dissolution, gave them a mythical reference, an association with birth and with death. The frequent shell motif suggests this. Table centrepieces and flower stands, forms unique to this period, smaller variants of the chandelier's complexity, emerged in the 1850s. Sometimes mounted on a plateau of mirrored glass, their central, flaring vases were surrounded by additional bowls, hanging chains, and festoons of glass drops, producing a cornucopia of crystal. They were sometimes termed cornucopia.²⁹ They could be

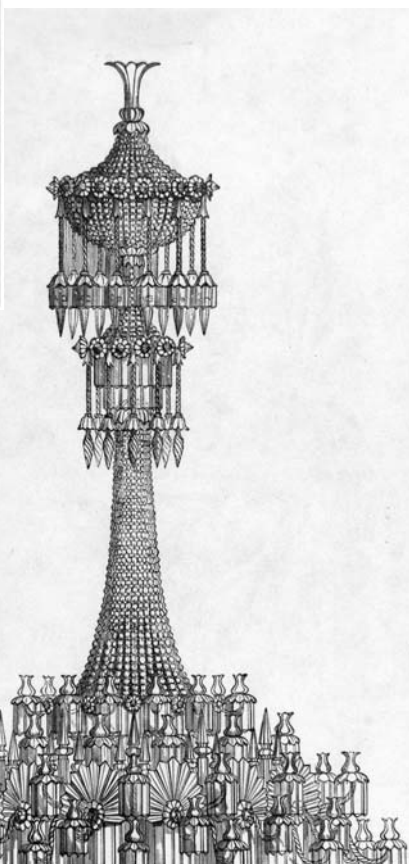
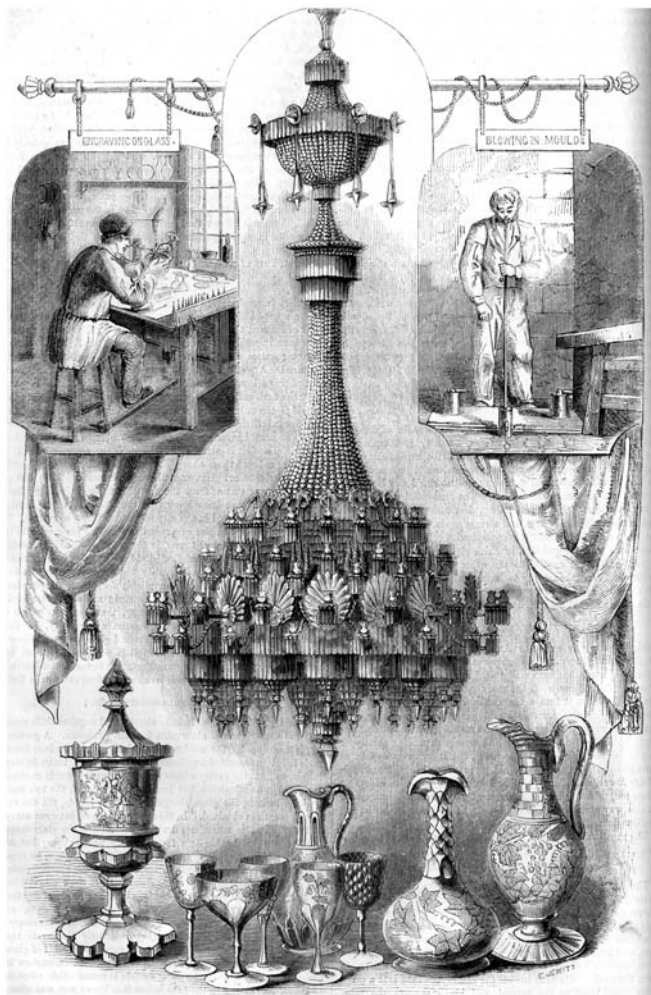
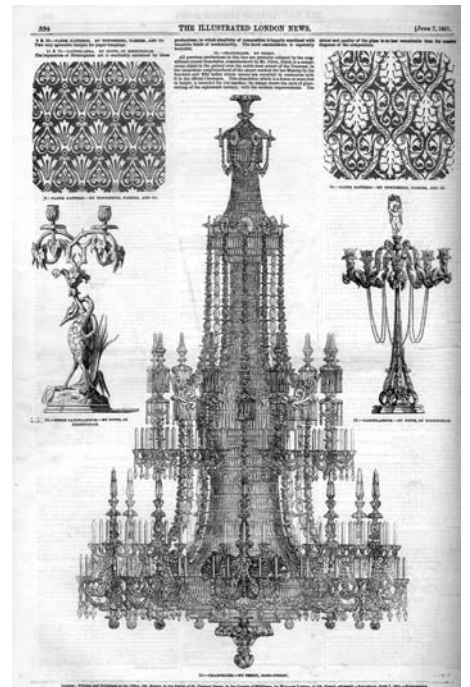
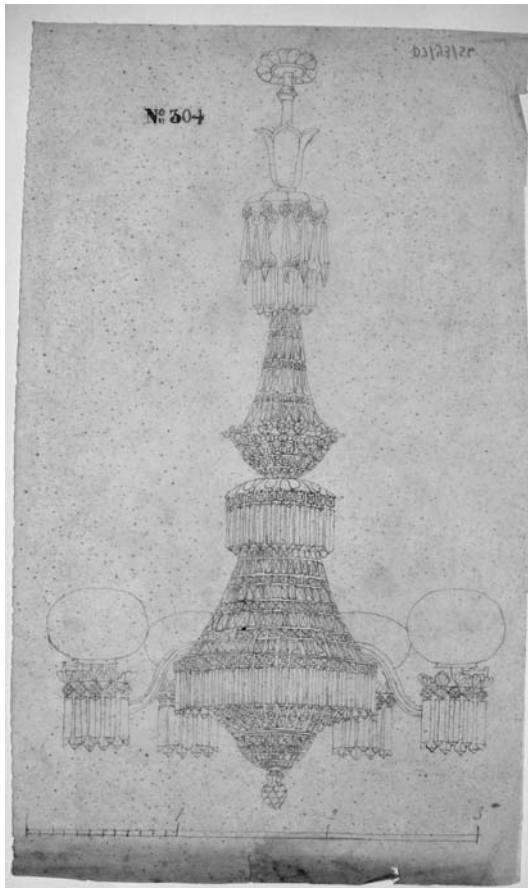
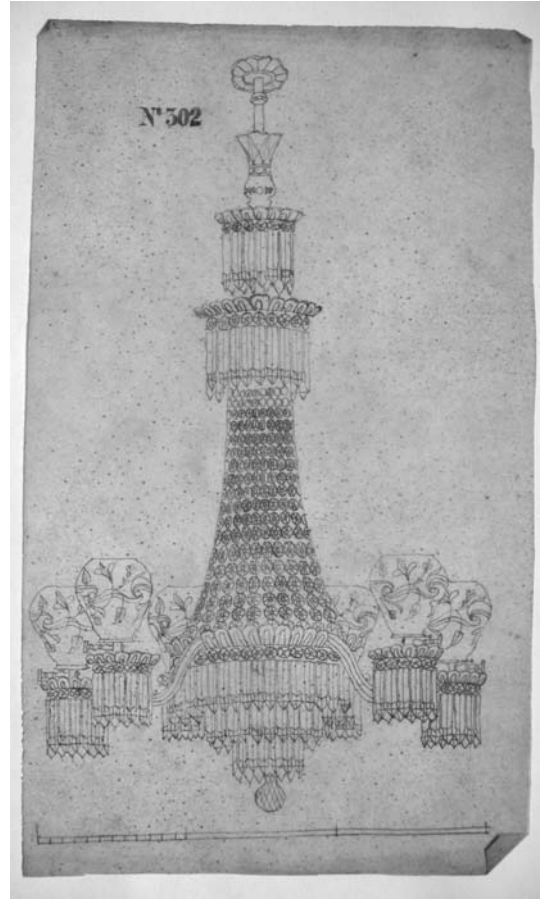
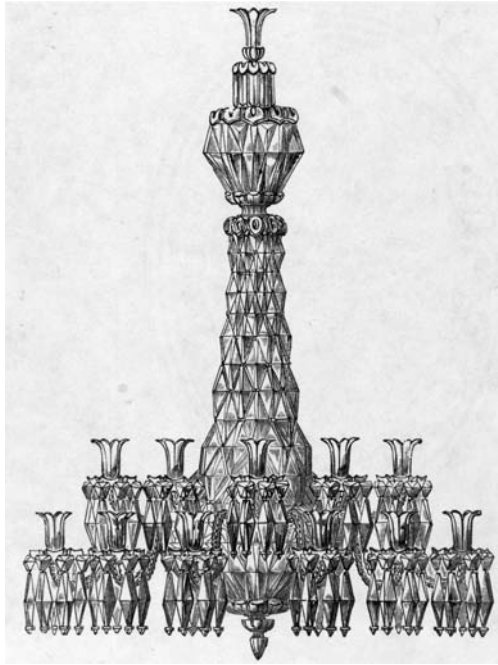


Figure 49 Four sets of chandeliers: (a) *Illustrated Exhibitor and Magazine of Art*, 1852: 'Grand cut glass chandelier, and groups of objects, manufactured at Messrs Pellatt and Co.'s Glassworks'; (b) Two chandeliers from the *Art Journal*, 1851; (c) Gas chandelier designs found among the pattern books of Messrs Richardson, Stourbridge, c. 1860. These designs were inked on to tracing paper, as was often the custom in the creation of patterns. Hence the faintness of the images; (d) A Perry chandelier, *Illustrated London News*.



composites—flower stands, hanging baskets, and candelabra.³⁰ Mrs Beeton recommended that elaborate oval and circular tazzas, ‘elegantly-shaped glass dishes on stems’, another variant of the fountain or inverted chandelier fused with the flower, be placed at intervals down the formal dining table to express the ‘poetry in the dessert’.³¹ The chandelier’s waterfall, a metaphor in glass, is at the furthest remove from the furnaces that created it. But its incandescence acknowledges the fire that formed it. Cinderella’s cinders take on a new meaning in the nineteenth century. Cruikshank’s frontispiece resignifies the ashes of the fireplace, the residue of the furnace, making an association between glass, work, cinders, and their transformation.

These aquatic, grotto-derived forms celebrate a positive reading of the Grottesque genre. They have their aqueous and floral parallel in glass vessels engraved or etched with water lilies and the etched glass with natural floral and animal forms that developed in the 1850s, particularly at Richardson’s in the Stourbridge area.³² The manufactured object and botanical life fuse. Ruskin would only accept worked glass vessels if their transparency and ductility pursued what he thought of as the feudal workman’s expression of freedom in distorted foliate and animal design. ‘The more wild, extravagant and grotesque in their gracefulness the better’.³³ Joseph Leicester praised the zoomorphic celtic engraving of Joseph O’Fallon—‘Like poems moulded into glass’. (O’Fallon also produced glass grotesques of tadpoles and frogs adopting human activities.)³⁴

In these foliate forms in particular we see the impulse to remythologize vegetative life, and sometimes to merge the body with plants and flowers, that emerged in Loudon’s taxonomical projects and even in Paxton’s ‘fairy’ girl-lily. Theories of ornament and design being explored by both art historians and anthropologists over the century also play into this longing of the Grottesque imaginary. Christopher Dresser, writing on the principles of design, regarded the foliated volutes of the Grottesque as a legitimate aesthetic category.³⁵ For Owen Jones in *The Grammar of Ornament*, the syntax of design is the undulating line, the curve, the arabesque. These flowing lines derive from the conventional and geometrical, *not* representational, forms of flower and leaf. The intrusion of flowers is anathema to him. But their arabesques are nevertheless organic: they ‘grow out of each other in natural undulations’.³⁶ Jones, despite his theory of abstraction, as Caroline Arcsott has shown, initiated a debate on the grammar of ornament that continued to the end of the century.³⁷ The status of the lotus or water lily (with which it was frequently conflated) in design was central to this debate.³⁸ Whether the human body or the lotus inspired the originary figures of decoration was a disputed issue to the century’s end. The lily meanwhile became a secular emblem, a popular image for rebirth over the century. ‘It is held sacred in many parts of India and China and Japan. The Bhuddist priests consider it

the emblem of the world issuing from the waters', the *Illustrated Exhibitor* explained. 'The emblem of sanctity amongst the priests of an extinct religion, four thousand years ago, it is now no longer known in countries where once it was held sacred, and *has sought refuge* [emphasis added] in the gardens and conservatories of the far-off lands of the west of which the votaries of Isis never dreamt.'³⁹ Reversing the process of expropriation, and mythologizing the lily under glass, it makes the conservatory a refuge for the exotic.

Cinderella and the Grotesque under Glass

Cinderella's myth of reproductive glass, we have seen, invokes the genre of the Grotesque in its transgression of categories, recognized in the vitalism of Cruikshank's interlaced vegetation and animal life. The lyrical Grotesque of grotto, cascade, and water lily, associated with Ruskin's belief in the liberated energies of the workman even under duress, is one aspect of the Grotesque moment. On the other hand, there is an aspect of deliberate violation which relates more to the 'disturbed dream' that Ruskin characterized as the violent Grotesque of modernity.⁴⁰ The violent Grotesque was inscribed on the body through the division of labour. Indeed, the Grotesque could not be dissociated from many accounts of art at this time. Owen Jones and others believed that art began by being indelibly inscribed on bodies as tattoo. In the tattoo the principles of the highest art are apparent. The volutes and curves of face and body painting in primitive tribes, invoking terror or beauty, constituted the earliest aesthetic sense. (This is why he liked to think of its patterns as abstraction rather than representation.) The 'highest ambition is still to create, to *stamp* on this earth the *impress* of an individual mind' [my italics].⁴¹ Here the incised body and its ornament became one being, and the aesthetic created a double body through a contradictory principle of violation and integration. Despite Jones's respect for the primitive aesthetic of the savage, the racing endemic to the period is at work. Nevertheless, the double body implied here provides a form of negotiation.

This double body is the constitutive element of the Grotesque. It marks the violation of categories between species of animate life, and between animate life and things negotiated in the Cinderella story. Shelagh Wilson has brilliantly identified its markers in Victorian design. Different species of animate life are interlaced in the artefact, human, animal, and vegetable twisted together, a composite of flora and fauna and human body: or animate and inanimate become an amalgam. Most obviously manifested in the decorated *manufactured* object, a 'form of bodily presence . . . transgressed the proper formal boundaries of the object'.⁴² Simultaneously a humanly worked artefact and a product of the vegetable, mineral, or animal



Figure 50 Amber glass vase with silver enamelled lilies

world, the Grotesque engages with the repercussions of that violation of categories across biological life and inorganic matter. The energies of a taxonomical anarchy that literally incorporates the body, confounding it with the materials it works upon, account for a disturbed exhilaration. Wilson reads this as a pre-Darwinian typological anxiety about the breakdown of the boundaries and borders of natural history, and sees these hybrid crossings as a realm of the undead artefact. The compulsion to make one material look like another that we have seen at work earlier, the torsions and broken lines that distort form, the mixture of styles that characterize Victorian objects, all these come under the rubric of the Grotesque. A radical throwing of relations with things into question comes about.

But Wilson also sees the Grotesque as an aesthetically and politically demanding agency (she traces its origins to radical readings of the grotto). The miscegenated language of mixed categories is intended to create an ambivalent space, caught between a series of contradictions. The skin of a killer tiger will be made into a domestic chair: savagery and domesticity, horror and amusement, converge and collide. The Grotesque is a way of bringing conflicting and complex emotions 'into the actual *encounter* with objects' and of dealing with contradiction.⁴³ The amalgam of thing and being becomes both comic and agonistic, farce and trauma, but it is also a space for an energizing encounter with contradiction. An Exhibition example would be *Tait's* reading of the Amazon attacked by a tiger. Yet another form of this restless, miscegenated metamorphosis under glass is observed in the *London Illustrated News* of 5 July 1851, 'A Lady's Glance at the Great Exhibition', which takes us back to *Cinderella*. She notices the abundance of silks, ribbons, furs, lace, feathers, artificial flowers, for decorating the female form. Artificial flowers, made from the tusks of the elephant, stone, jewels, wax, coral pearls, even coal, the 'scarlet plumage' of the ibis, the wings of the beetle or firefly, even human hair, as if trying to make up for some loss, try to turn themselves into something else, attempting to release the power of metaphor from the choking materials. Agamben is partly right that ambivalent meaning emerges from these artefacts, but it does not emerge unnoticed.

Ruskin's characterization of the Grotesque as a distorted form of the sublime intuits the sensory overload, the 'check to the vital forces' that made Kant describe the sublime as 'no sport, but in dead earnest in the affairs of the imagination'.⁴⁴ Kant turned to the sublime as a way of restarting thought after the trauma of sublime immeasurability. It redressed the purely sensory attributes of the beautiful. In the Exhibition of 1851 this 'check' is everywhere. Owen Jones abominated the bastard design of the Exhibition: 'there was everywhere to be observed an entire

absence of any common principle in the application of Art to manufactures,—whilst from one end to the other of the vast structure there could be found but a fruitless struggle after novelty'.⁴⁵ Yet the incised double body as ornament, compounded of anamorphosis and anthropomorphism, is the dominant form of objects under glass in 1851. 'If I pour water from a ewer . . . must I seize a river god by the waist?' 'Can I not have a time-piece but a naked woman must sprawl upon it?'⁴⁶ 'Voltaire's' (and *Blackwood's*) critique of the surreal taxonomy of objects, we have seen in the previous chapter, resists the combination of the human form with *things*. The human heads crushed into decoration violate species being. Grottesque's ambivalent space was a form of Victorian surrealism. A hybrid pot-man, or clock-female emerges—flesh and blood cleaves to clay or metal, technology galvanizes skin and bone, mechanical reproduction fuses with organic life. The double body of the object and the composite living form produces a representational confusion by transforming and making strange the physical proportions of the bodies it moulds, casts, carves, or engraves. Realist bodies, unreal proportion. Animals, flowers, human bodies, transmigrate into one another's species and writhe round one another, demanding the critique that the Grottesque initiates.

Just as 'Voltaire' recognizes that poverty had made working men 'reflective', so the provocations of the Grottesque bring about that 'encounter' with objects and their meanings. Cruikshank, certainly, understood the making strange of manufactured things and our relation to them that is at the core of the Grottesque under glass in 1851. He understood its excess, and the dislocation between things and us that was both its cause and effect and the farcical hybridity that was its idiom. What do we mean by 'things', the product of labour and a social order at specific historical moments? '[T]his waxen Thing which is coloured, flavoured, hard and cold in different ways' can become a heap of sensory detail, Heidegger warned, unless things are perceived 'interspatially (what Merleau-Ponty was to call 'intercorporeal' experience).⁴⁷ Against Descartes (or his reading of Descartes) he argued that the senses could not cognize an entity. The Cartesian account of things presupposes a worldless self and by extension a worldless object. The restoration of things defined not through separation, as technology defines them, but through mutually interactive relations, is his ideal. Cruikshank's final engravings of the Exhibition envisage the consequences of worldless objects and require a reimagining of things.

He made twin engravings for Henry Mayhew's story of Mr and Mrs Sandboys and their visit to the Great Exhibition. The second is less well known. The first shows a globe filled with crowds converging on the Crystal Palace. Its satiric cartography places the Crystal Palace hubristically at the top of the globe, assumed to be its scopic centre, and remaps the

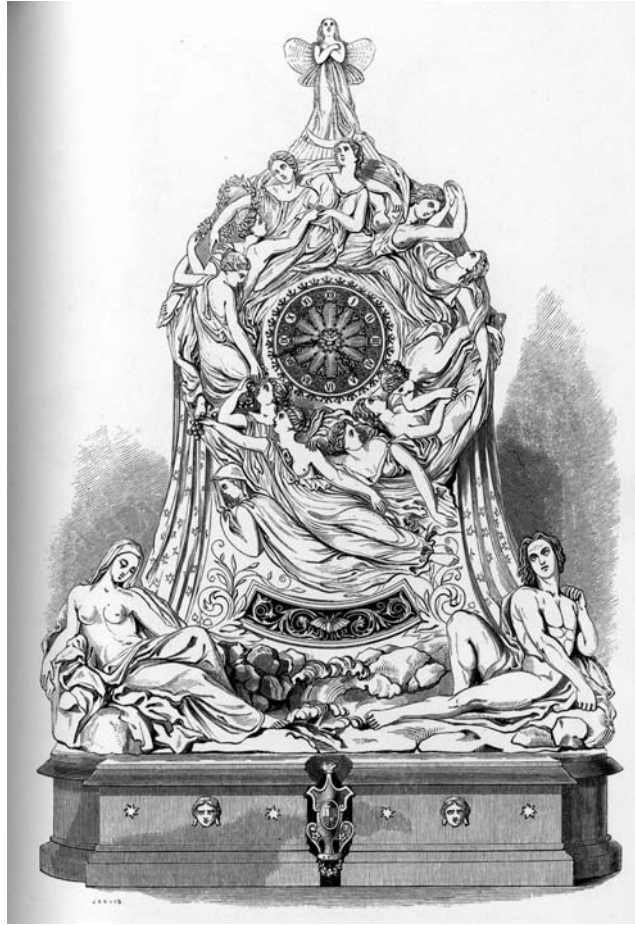


Figure 51
The Hours. 'Clock-
case in Electro-
Bronze. Designed by
John Elkington,
Mason & Co.,
Birmingham and
London', from vol. iv
of the *Official
Catalogue*

world in terms of British colonial possessions. The second illustration shows the globe imploding with things. It is titled *The Dispersion of the Works of all Nations from the Great Exhibition of 1851*.⁴⁸ Things whirl outwards from the central point of the Crystal Palace, whose glass fountain remains the only stable point of reference, orbiting on their own: Robert Lucas Chance's lighthouse, five equestrian statues (including the Amazon attacked by a tigress), four chandeliers, three disembodied boots, carpets and rugs, pots, vases, a steam engine, H. Ploucquet's stuffed animals, prepared for the Royal Museum of Natural History, Stuttgart, automata, a cannon, swords, knights in armour, the colossal Bavarian lion, a classical female torso, two clocks, an organ, the Saffron Walden stuffed elephant lent to bear the Indian palanquin, cellos, hats, parasols, fans, feathers, Mr Murphy's Great (Dublin) Bell, bellows, rakes, spades, a tigerskin from Nicholay's, clothes, drapery, are spewed into the universe. Though the first impression is of a shower of humanly made *things*, *objects*, *artefacts*, we are aware that these things are animate. A cauldron walks with its 'legs'.

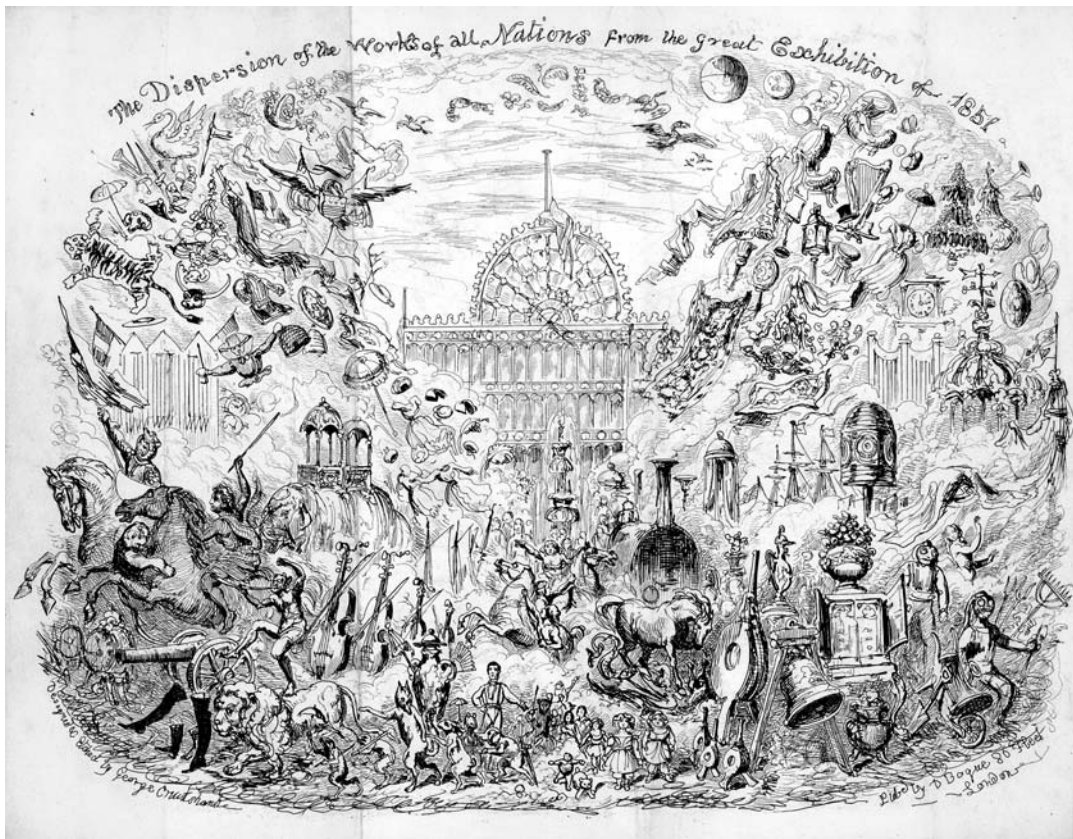


Figure 52
George Cruikshank's
'The Dispersion of the
Works of All Nations
from the Great
Exhibition of 1851'

A behatted vase has tucked a fan under one handle or 'arm' and a parasol under the other. The stuffed animals, the foxes, the elephant, are ambulant, as is the monumental masonry of the lion. Driven into displacement, undead, their status is undecidable: the tigerskin oscillates between beast and soft furniture, the dyed feather between ornithological residue and sumptuary ornament. So many of these artefacts are coverings—clothes, millinery, parasols, rugs. The stuffed body of the dead, the covered body of the living, the cast body of the statue, the carved body of wood or marble, begin to ask questions about the substantiveness, the materiality, of things. Things and their vexed relation to the human body as well as to Exhibition space, once released from their skin of glass, are Cruikshank's theme. The almost invisible membrane of the conservatory, or the protective 'shade', as the glass domes specifically manufactured to cover objects were termed, have disappeared, but the pressure of their absent forms still exists.

Cruikshank's delineation of 'Dispersion' is at once exhilarated and disturbed, a pleasure coupled with anxiety, and for this very reason it is revealing. Cruikshank recognized that the only category of Exhibition taxonomy that mattered was that of the manufactured object. Raw

materials (category one) are nowhere to be seen. He recognized that new technologies coexisted with pre-mechanized labour, different histories forced together by the synchronic drive of the exhibition, as swords and cannon, hand-made and machine-made artefacts, swirl together in their comic inferno. He saw that the sensoria and space–time change with technology, and recognized the Exhibition’s huge demonstration of power, national and mechanical. He saw, too, that the classical distinction between art, with its aura, and artefact, without it, was dissolved. And he realized that central to his quasi-technologized world was the hybrid, miscegenated object. But what Cruikshank’s satiric exuberance marks above all is one of the most important aspects of modern exhibition display under glass. Things in ‘The Dispersion’ are homeless. Once released from the Exhibition taxonomies these objects have nowhere to go; they become redundant objects reduced to a kind of diaspora of the artefact. This dispersal discloses a further necessity of exhibition space—the modern exhibition *always means things out of place*. Things are always meant to be somewhere else. The very form of the exhibition implies that things function in some ideal space designated and waiting for them—somewhere else. That somewhere else is not the empty homogeneous space of the museum, a family relation of the exhibition.⁴⁹ But where, since they have once been co-opted into exhibition space and then released from it, *do they now belong?* Thus the modern exhibition’s project is the making strange of the thing, and in 1851, Cruikshank saw, this meant reimagining relations with things.

Things in the modern exhibition are not reducible to the space they are in. Mourning is the other side of triumphalism, Derrida has said, and the anxiety of things is never far from the surface of exhibition rhetoric.⁵⁰ Exhibits are not reducible to commodity, to products, to possessions. The exhibition drives a wedge between the concept of commodity and thing so that we do not know quite what either is. It establishes a lesion between the artefact and the idea of consumption. The ‘Things’ of 1851 were not priced. (The controversy over pricing objects in the Exhibition attempted to recreate the category of goods for sale.)⁵¹ Overwrought and offered as unique items of display, their uniqueness lacks the principle of comparability and equivalence that sets exchange and analysis in motion. The corollary of this lack of metaphorical possibility underlying exchange is not a confirmation but a radical disruption of the meaning of exchange value, need, and luxury. Things take on a strange status, anomalies.⁵² Not the fetish, but the loss of metaphor itself was the problem.

Glass culture’s alliance with the Grotesque reappears in the display of glass under glass. It is through glass that the contradictions of Exhibition things are mediated.



Glass under Glass

Glassworld Fictions

Here's goblet-glass, to take in with your wine
The very sun its grapes were ripened under!
Drink light and juice together.¹

‘Purest crystal’ is one of the commonest descriptive phrases of the Illustrated Catalogue of the 1851 Exhibition.² Elizabeth Barrett Browning understood this will to transcendent transparency, writing of Exhibition glass so pure that it was possible to drink in light as well as wine, resulting in the *consumption* of purity. This pellucid, crystal diction appears inside and outside the Exhibition, and until late in the century. We ‘require that every article of glass which we use shall be absolutely free from flaws or blemishes of every kind’.³ Earlier in the century purity meant the play of light on cut crystal. Apsley Pellatt explained that the ‘object to be obtained in cutting glass is to present such a surface to the rays of light that instead of passing directly through the glass, they may be broken and refracted, so that the “play of light”, as it may be termed, is always on the surface’.⁴ Angular indentation, diamond or prism and flute cutting was the norm: Webb’s pattern books list other complex cut patterns; mirrors, flowers, rosettes, fringes, pillars, scallops, stars.⁵ Later, in reaction to the scintillating extremity of deep cutting (represented by Richardson’s coruscating pineapple decanter in 1851), purity meant glass’s own ‘beautiful and imperishable gleam’, as Joseph Leicester put it in 1878. Glass can ‘radiate a lustre richer than any the jugglery of iron and stone wheels can confer’.⁶ ‘Water itself is not more clear and transparent,’ the *Art Journal* wrote, in 1875.⁷ Even before the Arts and Crafts movement criticized cut glass as mere ‘tormented’ ‘lumps’, the ‘delicate curvature’ of uncut glass had its advocates.⁸ Both Joseph Leicester and T. J. Wilkinson in the 1860s deprecated the spread of elaborate imitation Venetian glass.⁹ But brilliant deep cutting continued until the end of the century, with another surge in the 1870s, and many new techniques and forms of glass production emerged—engraving, acid etching, the creation of rock crystal glass, intaglio engraving, cameo glass, ice glass—in addition to the Venetian and Bohemian ‘cased’ glass



(layered coloured glass cut to reveal the inner shell) practised since the 1830s.¹⁰

Whatever the changing definition of ‘purity’, most nineteenth-century writers agree that glass vessels possess an aura and aesthetic life not erased by industrial process or their status as commodity—if anything the lost aura was replaced by another, as the ‘purest’ form of consumption, the purest form of worked article. ‘[T]his beautiful material’, the 1851 Catalogue predicted, would lead to the universal use of glass. The *Journal of Design*, quoting Richard Redgrave, a distinguished glass designer, urged women in particular to remember the ‘crystal clearness’ that glass could achieve, the real basis of its utility, and to avoid heterogeneous style and decoration.¹¹ Certainly table glass and ornaments spread rapidly in the century, as both sets and single items of glassware became purchasable after 1850. Catalogues advertised cheap as well as expensive ranges, and rituals of glass usage developed among high bourgeois households.¹²

The compelling force of decorative glass, and the fascination it exerted, arose because it both suggested and avoided the invisible nature of

Figure 53
Photograph of a group
of Richardson cut
glass vessels, 1851–78

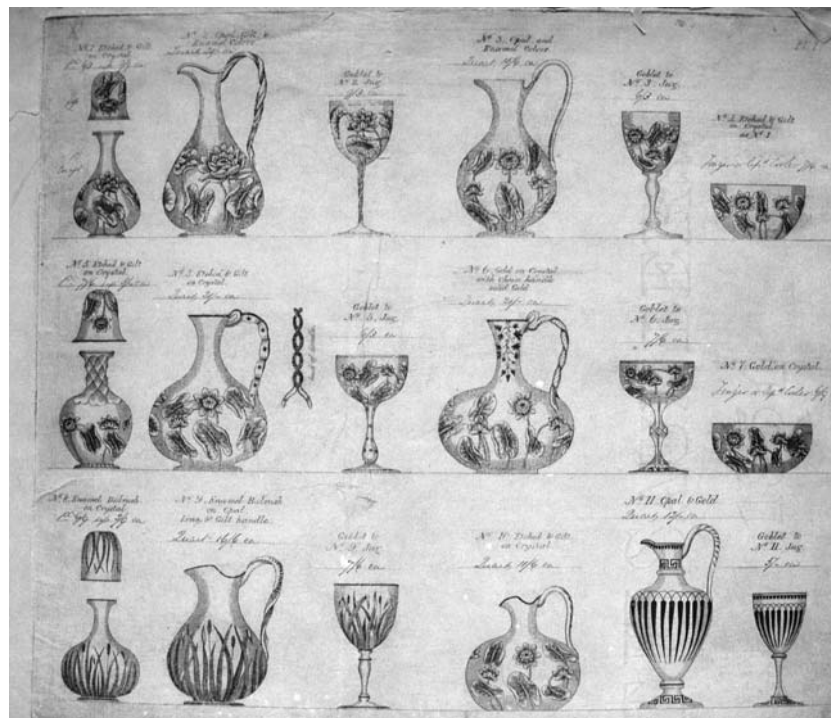
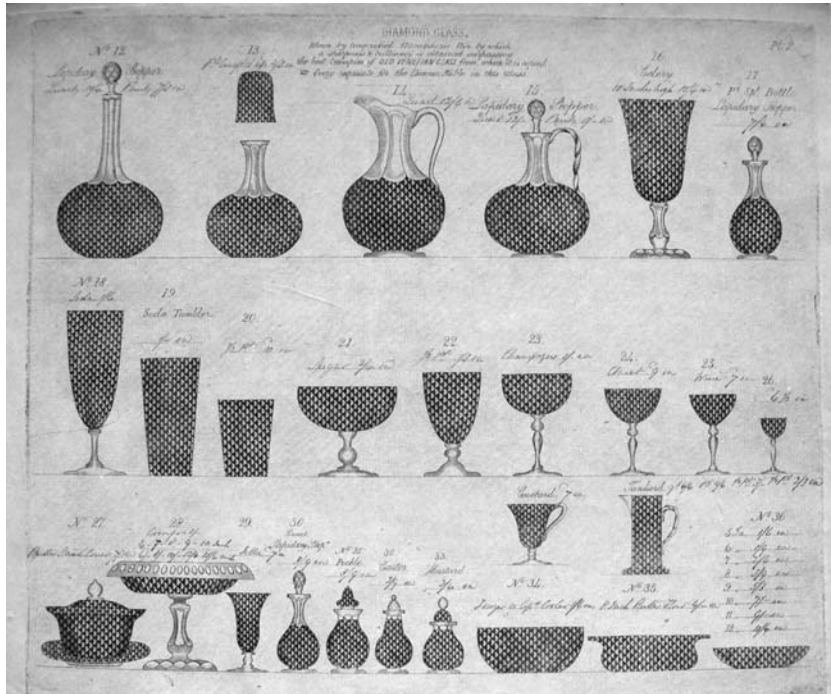


Figure 54 Two loose Richardson pattern sheets for table glass, gilt on crystal, diamond glass, Flint table glass

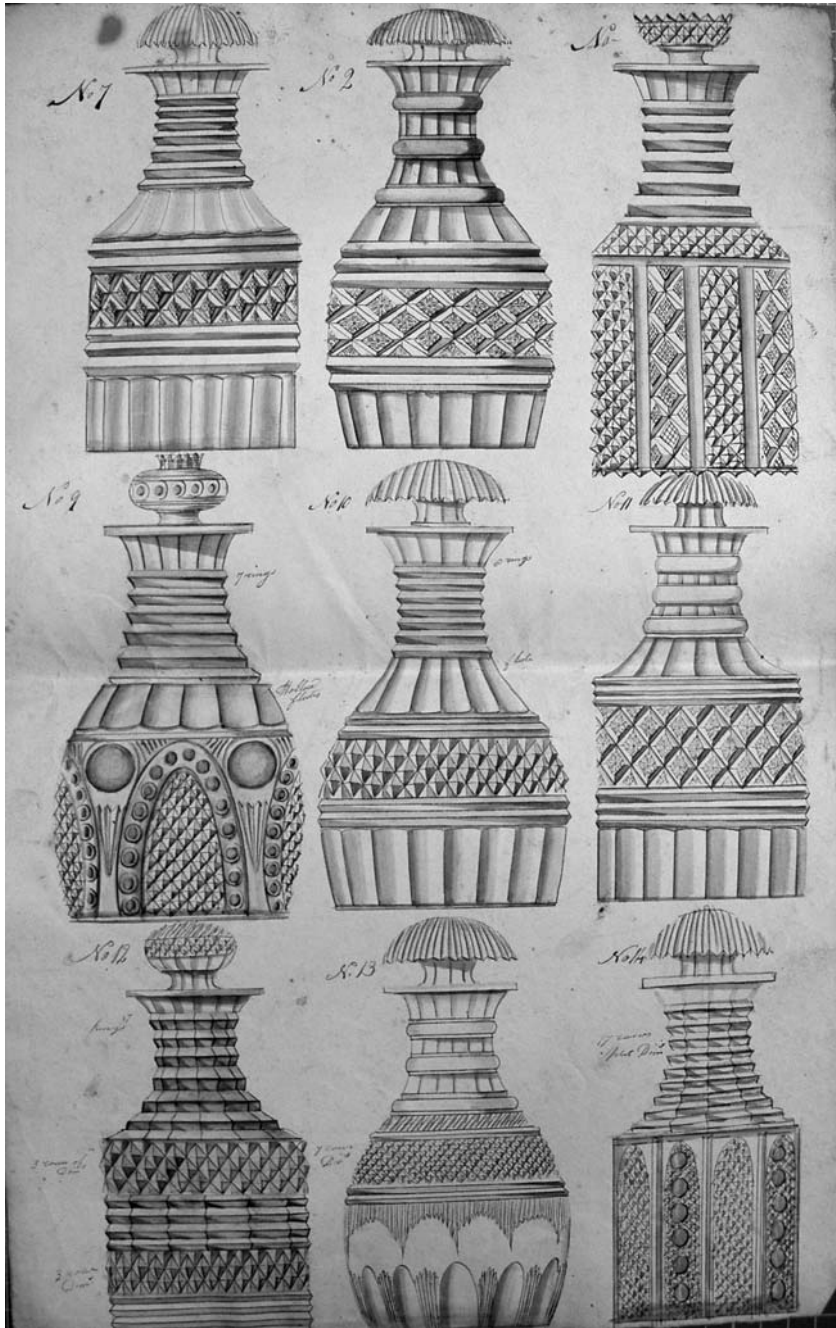


Figure 55 Cut glass decanters from Richardson

mediation in complex, 'modern', nineteenth-century experience—a many times mediated world created by and creating new technologies and artefacts that, we have seen, changed the relation between self and things. It possessed a subtle anthropomorphism, despite the 'purity' of crystal, so that its nearness to the body was a constant aspect of glass. '[T]he metal is positively alive,' William Morris said.¹³

For Ruskin the purity of glass meant the distorted body. Its simultaneous evidence and avoidance of mediation infuriated him. He never failed to use glass as the epitome of every abuse of modern industry and its negative Grotesque. In *Stones of Venice* he notoriously portrayed the cutting up of the workman's body in the division of labour in a terrible image, the cutting up of glass beads, 'rods . . . chopped up into fragments by the human hand . . . The men who chop up the rods sit at their work all day, their hands vibrating with an exquisitely timed palsy, and the beads dropping beneath their vibration like hail.'¹⁴ It is the workmen who are divided, not the labour. (Add to this abuse the disgrace of sales of glass beads to Africa for the purchase of slaves, noted by Robert Hunt in his *Hand-Book* to the Exhibition.)¹⁵ The cut glass container, scored and incised, spoke the human body. It recalled the tattoo, Owen Jones's originary moment of art as both invasion and fusion with an alien element. It spoke the divided body. But it also *was* the double body of the Exhibition's dominant Grotesque idiom, man and glass fused. 'Waist', 'lip', 'mouth', 'foot', 'leg', the terms that describe glass vessels make them metonymies of the human body. 'All cut glass is barbarous,' Ruskin said. Its 'exquisitely clear' accuracy, its deep cut lead crystal, creating the restless surfaces of vessels in the Exhibition, scintillating with deeply cut, sharply carved angular facets, undulating in wheel-cut or engraved design, layered with casing, mask the surface of the object. The deep incision and cutting of glass surfaces for which English steam-aided cutting was well known, its defensive glitter and scintillation, abused the body of the worker: the 'animation' of the workman, as Ruskin termed it, was 'unhumanised' and consumed in 'perfect polishings', so that, in a famous phrase, he was 'racked into the exactness of a line', the glasscutter's body tortured to achieve geometrical exactitude.¹⁶

Yet the immanence of the body in pain and the pressure of anamorphosis does not alter and perhaps intensifies the ontological or 'spiritual character' that Ruskin denied nineteenth-century glasswork. 'You can see the men in the glass,' a glassworker said, meaning that individual style was recognizable, but we can generalize this statement.¹⁷ Blown glass is always a matter of body and breath, matter and immateriality. The glass vessel was not simply the transparent spectre of an opaque ceramic. It was the spectre of breath, shaped not externally by the hands, but from within, by air from

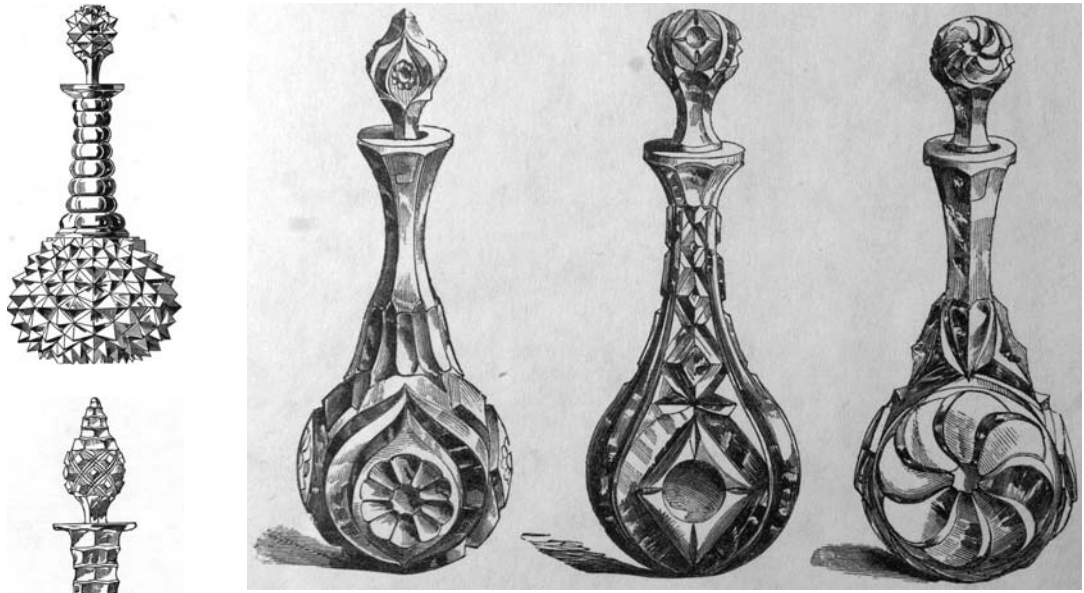


Figure 56 Glass items from the *Art Journal Catalogue*: three Lloyd and Summerfield decanters; two Richardson decanters; Green's Neptune jug; and a group of engraved vessels



Figure 57 (a) Jug and goblets in blue Flint glass, enamelled, cut, engraved, and gilt, C. Bacchus & Sons, Birmingham, from the *Official Catalogue*, vol. iv supplement

(b) Venetian Glass C. Bacchus & Sons, Birmingham, from the *Official Catalogue*, vol. iv supplement



the glass blower's lungs. Cut glass required blown blanks as a basis. It is shaped by the negative space internal to it, whereas the ceramic object creates space round itself: the light returns from the surface of the opaque vessel, exhibiting volume; light passes through the glass vessel, throwing fugitive radiances, further reflections of transparency, to the opposite wall or inner curve of the vessel, so that we intuit the other side of the glass even when we cannot see it. In the same way we can intuit the very instant glass's hollowed-out viscous state congealed to the curve of breath, the instant it yields to gravity—glass is always about arresting motion formed to a transparent shell, not about creating solidity from the turning matter of clay moving on the wheel. It creates a space within a space. Christina Rossetti, to return to her insight once again, understood the glass vessel as 'flexibility in motion'—'inert glass moulded from within caught the semblance of such an alien grace'.¹⁸

Glass, implicitly posing corporeal and ontological questions and precipitating category problems, possessed inherently the distortions and species derangement that belongs to the Grotesque. It asks for the 'encounter' that presents contradictions to the onlooker. Glass culture here endorses that alliance with the Grotesque developed in the previous chapter through glass's association with fertility and its endemic taxonomic anxiety. Three readings of glass in the Exhibition, two moments of disquiet, where the artefact becomes dysfunctional, and one where glass represents the pleasure principle of Grotesque experience, exemplify the complexity of glass culture and lead to its two great texts, Charlotte Brontë's *Villette* and Dickens's *Bleak House*. Because in all three cases glass arrests the observer, creating a jolt or caesura in perception, invoking categories beyond the economic and disrupting economic meaning, glass is the limit case of the exhibit in 1851. It demands a reimagining of 'things'.

Reading Glass Episode 1

First, economic disruption, and the spectralization of value. The great Koh-i-noor diamond lost its aura in display under a glass canopy, under the bleaching, shadowless natural light of the exhibition space. It might as well have been glass, people complained. As Brewster in the *North British Review* observed: diamonds 'lose all their charm when exhibited in a palace of crystal . . . The great Koh-i-noor or Mountain of Light, the Duna-i-noor or Sea of Light, and the fine blue diamond of Mr Hope, have less effect, as now exhibited by daylight, than a piece of glass of the same size and tint would have . . . all the colours are recombined into white light.'¹⁹

Figure 58
Tiered flower stand by
Richardson



The 'worth' of the diamonds changes catastrophically, transformed to a phantom existence, because of its affinity with common glass in the bleached light. This uncertain status was made more awkward because there *was* a glass Koh-i-noor, manufactured by Apsley Pellat, in the North Gallery immediately above the 'real' thing, creating a farcical comedy of value.

A curious feature in this collection was what the manufacturer called the Koh-i-Noor, consisting of several lumps of the purest flint glass, cut diamond-wise, and quite rivaling in brilliancy the two-million original down stairs. We are certain that if the largest of these specimens had been placed on the velvet cushion, surrounded by an iron railing, and attended by a reverential policeman, it would have received a much larger meed of public wonder and approbation than the real eastern gem . . . It has the advantage of the gem in entire absence of colour, and produced the prismatic changes with nearly equal effect.²⁰

Perhaps the Koh-i-noor itself was ‘nothing but a piece of glass’, James Tennant said, and Eastlake thought it could be sold for ten shillings without difficulty: the *Illustrated*’s lady reporter found it ugly and disappointing.²¹ Glass replicas of the diamond were sold on the Strand. The diamond’s symbolic meaning became uncanny. For when it is displaced by a new symbol, glass, the syntax of equivalents that creates value breaks down. The *Westminster Review* reminded its audience that *The Times* had called the Koh-i-noor ‘a large piece of carbon’. It would prefer *imitation* jewels of glass: ‘To our mind a chessboard in the gallery, in cut glass, made to imitate brilliants and rubies, is far more magnificent than all the precious stones exhibited.’ And glass itself was best when imitating the organic shapes of flowers, pretending to belong to the natural world: ‘For the pleasure of sight, we would not change a drinking-glass resembling a blue convolvulus for the Koh-i-noor itself.’²² Glass here becomes the spectral double of diamonds. Or it is asked to become the duplicate of natural forms, seemingly escaping from luxury, but declaring the natural through artifice.

But how valuable, then, was glass? Adams, the *Westminster* writer, may have had in mind the display of Bacchus and Sons (Birmingham). Volume 4 of the Official Catalogue (Supplement) shows their elaborate blue flint glass goblets and a complex group of ‘Venetian’ glass, whose stems twist and writhe in double and quadruple loops in vitreous imitation of the tropic stems of the convolvulus while the cup of the glass is engraved with flower and leaf designs.²³ In fact, the creation of ‘Venetian’ glass is, as the Catalogue supplement explains, no simple matter but a work of extraordinary intricacy and difficulty. The twisted ‘filigree’ stems of the goblets required the collaboration of two workmen.²⁴ The Bacchus glasses appear to be both engraved and gilded, both of which processes required exacting skills. The engraver employed a lapidary’s lathe, worked by the foot, to produce intaglio cuttings by the abrasion of small copper discs. In the case of minute designs and incision the proportionately small discs could hardly be seen by the naked eye.²⁵

The intrusion of glass destroys the dream longing or ‘thought’ around the diamonds that matter itself might be transmuted to pure light, a sea of light, a mountain of light, released for contemplative delight, free of attachment to privilege and power, free of a history of labour, free of violent extrinsic meanings. Obtained by the East India Company on condition that it be presented to the Queen, this diamond could not have been seen without the knowledge of the plundered resources of India. Hunt’s handbook, the ‘official’ ‘unofficial’ guide to the Official Catalogue brought out by Spicer and Clowes, publisher of the Official Catalogue, traces the history of murder, expropriation, and illicit

possession of the diamond for all to see in explicit detail—he also gives a detailed account of the way diamonds *are* valued, as if to secure them from deconstruction.²⁶ One dreamwork longing is to eliminate this memory, but the ironies introduced by glass inhibit this.

Reading Glass Episode 2

Second, psychological and sensory deformation or synaesthetic psychosis. The sight of the colour and shape of Bohemian glass disrupts seeing and hearing, which become pathological.

These far-famed Bohemian crystals offer a horrible mélange of detestable tints which are enough to give one the headache. Never did a pack of famished dogs howl in a more distracting manner than these unlucky glasses: one may hear them cry; they abhor and abuse each other... Without positively asserting that we breathe what we touch, we see what we smell, and hear what we see, we may yet say that there exists a similar connexion between the senses. I heard the din of the Bohemian exhibition. I still see in my mind's eye two large green vases, the clarions of this insufferable orchestra; they resemble two rounded pyramids, extremely elongated, remarkably fragile... immediately behind, two large, fat, dropsical, unruly flacons are singing a duet out of time. They are followed by a perfect army of melancholy candelabra, mutinous candlesticks, stupid wine-glasses, lazy cups, flat plates, empty sugar-basins, and ambitious fruit-dishes. It is a perfect bedlam. But those two vases—Austria ought never to be pardoned for them.²⁷

In this second form of glass disruption, we consider glasses that produce 'bedlam'. This time the breakdown is the syntax of the sensoria, creating the psychological or perhaps neurological form of Grotesque distortions. The plasticity of glass guarantees it no intrinsic nature. But colour here has become anarchic and noisy as the visual permeates the separate sense of hearing and is superseded by it. These glasses are mad. They speak the language of violence. The artefact has taken on animation and refuses to be ordered within a scopic field: the glasses howl like a pack of hounds, and quarrel aggressively among their own kind; they 'abhor and abuse one another'. They deny the potential for an undistorted sensuous life, the dreamwork desire at work in this description. Instead they take on the psychic life of *ressentiment* associated with a German populace in the grip of an authoritarian state, the Austrian empire, and the transition from peasant to industrial society: they are melancholy, mutinous, stupid, lazy, flat, empty, ambitious. Anti-Austrian feeling (and probably hostility to Prince Albert) co-opts extrinsic political signification to 'colour' the meaning of Bohemian glass. Glass repels the very interchange that puts humanly



Figure 59
Bohemian glass, Rice
Harris & Son, from
the *Official Catalogue*,
vol. iv supplement

made things in a relationship with the observer. Aural where they should be tactile or visual, these artefacts have become antisocial. They turn against the projection of human values onto the world and destroy the potential for reciprocity. The writer treats these vases like an inferior race, picking up the racing endemic to the conservatory. They have become like alien beings, ripe, but for the inertia bred of repression, for the revolution England avoided in 1848.

Bohemian glass perhaps exemplifies more than any other the capacity of glass to have no 'nature' of its own. It resists the most obvious characteristic of glass, its transparency. There were two kinds of Bohemian glass in the Exhibition, Hyalith glass, black with gold designs, often imitating chinoiserie, and Lithyalin glass, imitating semi-precious stones, cut with heavy intaglio so that the deep incisions produced bulging carbuncles, medallions, and protruding ribs.²⁸ This glass displayed multiple kinds of skill: it was 'cased' with different layers of multi-coloured glass, painted, cut, engraved, enamelled and gilded. Bohemian vases frequently rose distended from a narrow and highly ornate base. The effect of encrustation rendered by their multiple workmanship does produce a cacophony of conflicting forms, colours, and styles. These glasses cannot but speak an unstable language. Nevertheless, 'Bohemian' glass was universal in the

Exhibition, its encrustation enthusiastically imitated by British manufacturers quite early in the century.²⁹

Reading Glass Episode 3

*Case Study of a Mirror: CL. XXII., 323.—Grand Boudoir Glass, Bronzed Frame. W.Potts, Birmingham*³⁰

Described as ‘A Grand Boudoir Glass’ under Section 22, General Hardware, the mirror was clearly monumental (though the Catalogue does not state its dimensions). The bravura virtuosity of its technology was celebrated: illustrated in the Supplement of the Official Catalogue of the Exhibition it was also singled out for reproduction and comment by the populist *The Crystal Palace and its Contents. An Illustrated Cyclopaedia of the Great Exhibition of 1851*. ‘We believe this toilet-glass is one of the largest pieces of ornamental casting in bronze of this *genre* executed in England. Its design and workmanship reflect the highest credit on its spirited manufacturer’.³¹ It was also illustrated in *Tallis’s History and Description of the Crystal Palace*.³²

The mirror brings three unlikely figures together: its maker, William Potts of Birmingham, a flamboyant manufacturer of ornamental designs that included the technologies of gas fittings (fashionable and profitable) and ventilation; the intended recipient of the mirror, the Duchess of Sutherland, close to the throne and with influential connections to the organizers of the Exhibition, one of the richest patrician figures in the land, with the cultural capital of socialite philanthropy as well as of aristocratic power; and lastly the reviewer in *Reynolds’s Weekly Newspaper*, edited by the ex-Chartist, G. W. M. Reynolds, who singled out the mirror for extensive comment. *Reynolds’s Weekly Newspaper*, a radical paper with a huge working-class and artisanal readership of 100,000, was vitriolic in its hatred of the Exhibition, savagely protectionist, and resolute in its attack on the Exhibition for being mounted on the backs of starving workers: ‘So the people are to be mulcted . . . for that most tremendous humbug of modern times, the Great Exhibition of 1851.’³³ Potts, who among other exhibits displayed an ornamental gas bracket in which a helmeted head supported a globe, typical of ‘Voltaire’s’ strictures, was frequently commended by Henry Cole’s *Journal of Design* for ‘fertility of imagination’, ‘originality and dash’, though his ‘exuberant fancies’ were ‘all too florid’.³⁴ Yet it praised him for the explicitly ‘grotesque’ element of his work. Pott’s commitment to the Exhibition would have represented the counter-revolutionary movement of the Exhibition to *Reynolds’s Weekly Newspaper*. Similarly, the Duchess of

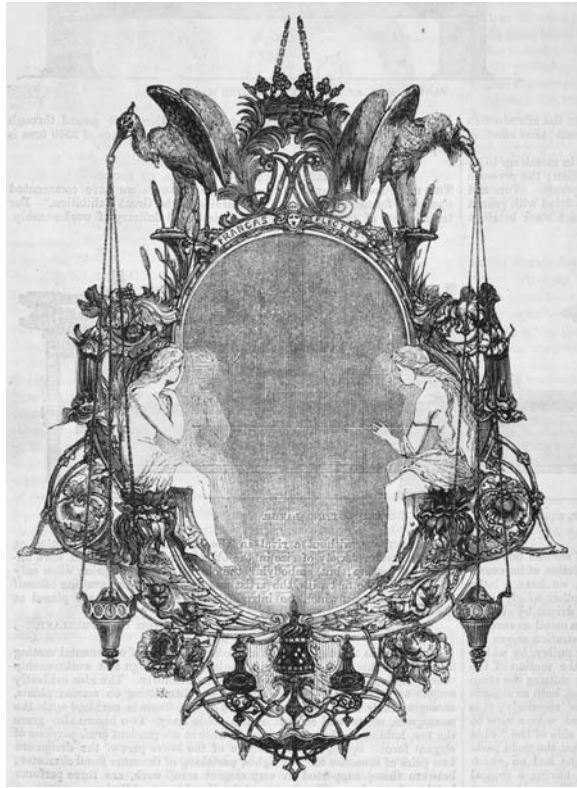


Figure 60
 'Toilet Glass. Potts of
 Birmingham', *The
 Crystal Palace and its
 Contents. An
 Illustrated Cyclopaedia
 of the Great Exhibition
 1851*

Sutherland, Whig grandee and Mistress of the robes, with the double authority of aristocratic power and commitment to liberal causes—she later entertained Garibaldi and led an anti-slavery campaign, entertaining Harriet Beecher Stowe 'like a sister', as one unctuous biography described it—represented the antithesis of *Reynolds's* values.³⁵

The mirror's iconography suggests the 'encounter' that belongs to Grotesque experience:³⁶ two white porcelain nymphs, seated on either side of the huge, dark bronze frame, paired with one another and with their reflections, peer inwards in a state of reverie. Each Naiad or nymph is cushioned sideways on a lotus, water lily, or *nymphaeas*—here the botanical taxonomy puns on the doubles that are the mirror's prerogative fusing nymph and *nymphaeas*. These flowers recall the famous Victoria Regia lily, the motif of Exhibition ornament. The porcelain figures are lapped in minimal drapery and in the wreathed, interlaced scroll of the border. The reflections, duskily hatched in by the unknown engraver at each side of the huge empty surface of the glass—four figures, now, not two—reveal the bodies of the nymphs, unseen, and but for the mirror unseeable, by the spectator. Here, privileged by this mimesis of the act of reflection,

the spectator sees the outer and inner surfaces of the body, sees round the bodies of the nymphs, sees the nymphs seeing. Inserted into the secret privacy of gazing reflection and what becomes quadruple acts of looking between the four nymphs, the onlooker is as much aware of the limits of gazing as its power. For this is a strangely social and non Narcissistic glasscape. Our gaze is mediated by the nymphs, theirs by us, as we intervene between body and reflection. We see 'more' of their reflected bodies than their exposed bodies hide—a breast, an ankle, two knees, at right, a breast, a leg, a foot at left. There is a fusion of reflected and reflecting body that produces Grotesque double bodies.

The wateriness of glass and the glassiness of water enable two meanings, of frame and border, to occur. If the bronze assumes a frame, a photograph, transportable and repeatable, is the idiom. If a border, a grotto, a surface *into which you can enter*. The un-nerving swinging of the left nymph's leg over the space of the 'water-mirror' suggests this.

One would expect an entirely hostile attack from the *Reynolds's* reporter. But his account of the mirror is lyrical, and emancipatory, an *encounter* with the Grotesque that makes a poetics from it in a truly reflective act.

Potts has an equally striking display of metal-worked productions. A bronze mirror for a boudoir, intended for the Duchess of Sutherland, will attract notice from its richness of design and its elaborate finish. The character of the design may be divined by the following sketch: Suppose the frame of a mirror modelled after aquatic objects, such as the lotus, with fowl congenial to the watery element, and so arranged that they convey to the mind an outline of the performance in question; again, suppose two Naiads, sculptured in porcelain, seated on aquatic foliage on each side of the mirror, whose beautiful forms are reflected from its surface, while in the act of trimming their locks after a bath. Just above these nymphs are two herons, sculptured boldly out, supporting in their beaks pastille burners, and around the rim of the mirror are represented plants, flowers, and fruits, in all their peculiar characteristics. The toilette bottles rest, on a metal scroll, while their contents are presumed to run through the mouth of a mask into a shell below. The frame, foliage, and figures are metal, of a dark bronze hue; the Naiads are white porcelain, and form a beautiful contrast to the colour of the metal, and the clear reflective surface of the mirror, while their elegant forms, in all the graceful and innocent *abandon* of nature, impart a charming interest to the general conception of the work. There is also a dignity and boldness in the design and execution, which strike at once the mind of the spectator, and excite the impression that the spirit of art, in its highest condition, is but yet in its infancy as applied to the manufacturing industry of the country.³⁷

The reporter sees the mirror as a grotto, and notes the fluent and undulating mobility of the Grotesque. The asymmetrical 'outline' of the mirror figures the twining tendrils of aquatic plants, and takes on something of

their shape, the lotus. He is pleased by the combination of plants, birds, and half-human bodies and by the interplay of different materials, bronze, porcelain, glass, and above all by the free sexuality of the nymphs—their *abandon*. He adds things, presupposing the nymphs have bathed in the mirror. He has passed imaginatively through and into the mirror-scape. It is the result of seeing the mirror surface as something liquid, an *element* to belong to, and the idyll of a social world where the hard surface has melted. He misremembers things, displacing the female mask from top to bottom and democratizing it among the lily roots, figuring it as a conduit or channel that irrigates and fertilizes. This artefact asks for intercorporeality, an image in the mirror that is not a phantom but a rejoinder. He envisages a state that is not one of pure commodity exchange, or of one solipsistic gaze for another. He reads the mirror as a world that could be different, against its oppressive possibilities, a world without slaves.

He ignores the ducal coronet at the apex of the mirror. He does not translate the Latin motto that runs on an admonitory scroll at the top of the glass, with its NON isolated at the centre of the frame.

The motto is not the Sutherland motto, as the sycophantic *Illustrated Cyclopaedia* claimed, which is ‘Sans Puer’. There are two versions of this cryptic motto. Thus a number of possible readings of the mirror were put into circulation. The first is the ‘authoritative’ Official Catalogue: FRAGAS NON FLETES. The motto across the *Illustrated Cyclopaedia’s* illustration of the mirror reads: FRANGAS NON FLECTES. (Tallis’s mirror, steel engraved from a daguerrotype, does not reproduce the motto at all.) The *Illustrated Cyclopaedia’s* Latin is actually the most convincing. Depending how one chooses to construe the ‘NON’ it means ‘You may break but you will not bend me’. The ‘authoritative’ Official Catalogue’s Latin is eccentric and looks to be a corruption of the words inscribed by the *Cyclopaedia*. All readings, however, suggest breakage. There is death in Arcadia.

The mirror speaks a form of social contract. But the motto it utters depends on who ‘owns’ it.³⁸ The ‘contract’ differs according to the different positions of the trio involved—Potts, Sutherland, the *Reynolds’s* reporter.

If the Duchess owns the motto she asserts through it the unbending continuance of her class privilege. If Potts owns the motto he is asserting the prerogatives of a new class. In fact, aristocratic privilege and the new forces of production are being asked to ‘bend’ to one another, one of the messages of the Exhibition itself, projecting a fantasy of industrial energy united with meritocratic aristocracy. If the *Reynolds’s* reporter owns the motto a very different reading emerges. For a *Reynolds’s* reader the motto could both warn and threaten: the mirror must not be broken, the nymphs (figuring aristocracy) are not to be violated, by revolutionary action. It warns of an intransigence in the powerful. *Fra[n]gas*, with its associations



THE HAUNTED LADY, OR "THE GHOST" IN THE LOOKING-GLASS.

MADAME LA MODISTE. "WE WOULD NOT HAVE DISAPPOINTED YOUR LADYSHIP, AT ANY SACRIFICE, AND THE ROBE IS FINISHED J. MERVEILLE"

Figure 61
 'The Haunted Lady,
 or, The Ghost in the
 Looking Glass',
Punch, 1863

of noise, shattering and breakage, offers violence. (*Reynolds's* had reported with relish disturbances at the opening of the Exhibition: 'loud shouts from the surrounding multiitude');³⁹ 'Window-breaking mobs will not bend me' is a radical's gloss on the patrician motto. The reporter could not have been ignorant of the Sutherland family's virtual genocide during the clearance of the Scottish Highlands up to 1821. Even before Marx, in 1853, drew attention to the destruction of the Gaelic community, the Sutherland family's inflexibly savage clearance of the Scottish Highlands was well known. 'The history of the wealth of the Sutherland family is the history of ruin and expropriation.'⁴⁰ The figuring of aristocracy as fragile nymph open to violation is an inappropriate allegory. '*Non Fra[n]gas*': the corrupt reading of the motto takes on a curious appropriateness as it recognizes an element of mourning.

The faintly hatched but darker reflections of the nymphs, shadowy, slightly sooty doubles of the white nymphs, remind one of the Duchess's later campaigns against slavery and Marx's furious response to the vicarious patrician liberalism that accepted and furthered patrician violence at home

while condemning it abroad. A *Punch* cartoon by John Tenniel, of 1863, five years before the Duchess's death, was to figure an elegant woman before a looking glass, confronted not with her reflection but the ghost of the seamstress who stitched her clothes. It was called 'The Haunted Lady; or the Ghost in the Looking Glass', and the glass here *is* a looking glass, taking on agency by looking back at the viewer.⁴¹

Villette: Glass Encounters—Charlotte Brontë's Exhibition Novel

In the drawing room there is a ghost in the mirror: 'A gilded mirror filled up the space between two windows . . . In this mirror I saw myself laid, not in a bed, but on a sofa. I looked spectral.'⁴² Reinforcing the spectrality of the vision, the syntax slips sufficiently for us to see Lucy momentarily 'laid' in the mirror itself, in the reflected room rather than inhabiting the actual 'walls, windows, and ceiling'. This recognition scene occurs at the centre of the novel, when Lucy has been rescued by the Brettons after her collapse following her confession to a catholic priest. It is also a transformation scene. A second mirror episode, in the Bretton bedroom, creates the poetics of remembrance. History congeals in this object: 'ten years ago shone reflected in that mirror'. In a moment of rediscovery Lucy is compelled to 'hail' and 'recognize' the revenant past in a boudoir mirror: 'the carved, shining-black, foliated frame of that glass; the smooth, milky-green of the china vessels on the stand; the very stand too, with its top of gray marble, splintered at one corner' (p. 212). Brontë transposes the Sutherland mirror, with its combination of the dark and the milky, into the novel. ('Foliated' is Ruskin's structural essential for the true Grottesque of gothic art.)

The great bedroom mirror makes two further appearances. On its second appearance it figures in the lyrical, submarine space of retreat and reverie that the Bretton bedroom becomes for Lucy. An underworld grotto, 'like a cave in the sea', it is here that she takes possession of her unconscious. The interior is mythologized as a place of 'foam and deep water', the cornice scrolled with shells, the mouldings like dolphins, the red satin pin cushion, her own gift to Mrs Bretton years before, like coral—'even that dark-shining glass might have mirrored a mermaid' (p. 227). Here are the traces, perhaps, of those long-haired nymphs mirrored in Potts's glass, supernatural beings further transformed from Naiads to the hybrid mermaids. The mirror no longer reflects an alienated 'spectral' self but figures a magical encounter with plenitude and experience remade. This healing oceanic 'lullaby' recognizes the regressive comfort and protection of the self-consciously dressed and feminized room,

a white 'toilette table dressed, like a lady for a ball, in a white robe over a pink skirt'. Yet it is also the matrix of the imagination, transforming the habitat of a middle-class bedroom and the 'exhibits' of the domestic interior from the 'ghosts' of 'solid arm-chairs, looking-glasses, and wash-stands' (p. 211) into oneiric objects. When we move to the spaces of the underground, Gaston Bachelard says in *The Poetics of Space*, poetry is the genre of the subterranean experience, and, in the protective spaces of the house, the dream works creatively. But at the third appearance of the mirror, after Pauline has re-entered the text, the passionate experience is deleted, with that self-castigating vigilance over fantasy on the part of both Brontë and her protagonist that so frequently closes down Lucy's life. '[S]omething dressing itself' unexpectedly appears before 'the great looking-glass' lit on each side by a 'tall waxlight' in 'my own little sea-green room' (there are candelabra on the Duchess's Exhibition mirror). It is 'an airy, fairy thing—small, slight, white—a winter spirit' (p. 343). Here the white nymphs of the Exhibition mirror block and displace the onlooker's vision. Lucy is deprived of her own reflection. Indeed, the white porcelain nymphs are replaced by two white, blanched female figures whose desires must conflict: the 'winter spirit' and Lucy *Snow* form a pair, but a pair in opposition. The 'intruder' is Paulina, the woman who earlier displaced the 14-year-old Lucy as a child, and who, in this decisive moment of exclusion, is now to deprive her of any claims on Dr John's/Graham's love and the high bourgeois world of the Brettons. She can no longer image herself through them and their things, their mirrors.

From then on, the brief reconciliation with things is over. Her name, Lucy or light, puns on the common nineteenth-century usage of 'lights' for windows, just as her second name signals the nature of glass as frozen liquid. She becomes a window on glass culture. Through her an intransigent gap between dream and history opens up, no less intransigent because it is seen *through* glass culture itself. Through her the reprise of the Crystal Palace that occurs in the hallucinatory sequences of spectacle that run across the thirty-eighth and thirty-ninth chapters is submitted both to an imaginative and critical ideological reading. Glass modernity, the conservatory principle, and the gathering of things in the domestic interior, of which the Exhibition is both consummation and catalyst, are interconnected, and receive one of their deepest analyses.

First, Exhibition spectacle: Charlotte Brontë went five times to the Great Exhibition during her visit to London in 1851—the second visit was three hours long. She had seen the Duchess of Sutherland, and was impressed by her, when she attended a public lecture by Thackeray the day before her first Exhibition trip. (As a high Tory she loved a duchess.)⁴³ She was divided about the Great Exhibition. 'Yesterday we went to the Crystal

Palace . . . The interior is like a mighty Vanity Fair. The brightest colours blaze on all sides; and ware of all kinds, from diamonds to spinning jennies and printing presses, are there to be seen. It was very fine, gorgeous, animated, bewildering.’ It was ‘bewildering . . . a mixture of genii palace and mighty bazaar’.⁴⁴ On her second visit, ‘I was more struck with it on this occasion . . . its grandeur does not consist in *one* thing, but in the unique assemblage of *all* things. Whatever human industry has created, you find there.’ Magic only could have gathered this wealth, ‘with such a blaze and contrast of colours and marvellous power of effect’.⁴⁵ She transposes this blaze of colour, and its exotic signifiers, to the metropolitan festival that takes place in Villette’s park. The drugged and hallucinating Lucy searches for a stone basin, with its disk of water reflecting the moon, in the quiet city park. She finds instead a festival of urban spectacle:⁴⁶

In a land of enchantment, a garden most gorgeous, a plain sprinkled with coloured meteors, a forest with sparks of purple and ruby and golden fire gemming the foliage; a region, not of trees and shadow, but of strangest architectural wealth—of altar and of temple, of pyramid, obelisk and sphynx; incredible to say, the wonders and symbols of Egypt teemed throughout the park of Villette. (p. 566)

Here is *the construction* of glamour through timber, paint, and paste-board. But the insight into spectacle goes deeper. Supported by the State and Church, and a memorial to the successful defeat of a democratic uprising (the ‘struggling in the streets’ (p. 566) and rearing of barricades whose defeat it commemorates is reminiscent of the 1848 revolutions thought to be transcended by the Exhibition) this is, like the Crystal Palace, a pleasure garden. With its brilliant lights and shadow-free environment, it is by night what the Crystal Palace was by day. Indeed, its a-temporal environment, abolishing time and making European and colonial spaces synchronous, follows the restructuring of space in the Exhibition. What Charlotte Brontë does here is to produce the Exhibition without the mediation of glass: she quotes it rather than literalizing its presence; here is not the actual spectacle behind glass as much as its epiphenomena—*images* of exotic display. The Egyptian and North African references in the novel return. The scene recapitulates Lucy’s visit to the art gallery where she sees the Cleopatra, and Dr John’s ‘Mulatto’, his description of the actress, Vashti. The allusion is not only to the plundering of exotic goods but to the plundering of *representations* of the exotic, the indiscriminate othering of Africa in images. This scene is the context of over-determined colonial reference. Lucy overhears plans to send Paul Emanuel to the West Indies, the destination of exported African slaves. *Villette*, we need to remember, was published the year after

Harriet Beecher Stowe's *Uncle Tom's Cabin*, at the height of the American anti-slavery movement.

If the experience of spectacle in the Exhibition's great conservatory is left naked, stripped of the mediation of glass, the presence of glass is displaced and appears repeatedly elsewhere in the novel. From the 'clear wide windows' of Bretton, with which the novel opens, to the five large dormitory windows of Madame Beck's establishment, from the 'sky-light glare' of a foreign hotel whose 'wide windows' lit up dirty marble, to the glass doors of the classroom (*repeatedly* described, like some invisible boundary) opening out on to the carré or courtyard, where the large classroom windows appear to glass in the sides the school courtyard as part of an interior square, glass is abundant in private and public buildings. The school itself, where the convergence of the *conservatoire* and conservatory enables a family resemblance between the two, combines the aspects of nursery and forcing house that was the mark of the nineteenth-century conservatory carried forward into the Exhibition. It continually quotes the conservatory. It sometimes functions as nursery—Madame teaches in the 'berceau', garden arbour, or cradle, as the two meanings of this word indicate, in the summer. But more often the school introduces Lucy to the painful modern alienations of glass. Glass is frequently non-transitive. It is constantly exclusionary in its refusal to enable seeing or reflection, blocking vision: in an existential moment of extreme alienation, Lucy sees the stars reflected in the frost of the classroom windows—a frost partially created by the condensed breath of the noisy crowd of girls within—dead matter reflecting dead matter, Loudon's debris. Or glass registers the deflections of the gaze through a mirror, accidental reflections of the body in glass, situations where you do not know who sees you or whom you see. Madame Beck picks out a grey hair in the mirror, seen by Lucy, Dr John sees Lucy's stare deflected in a mirror. Lucy is appalled by her image in public glass at the concert.

The school harbours the negative grotesque. Cinderella-like vermin inhabit the attic: a spider accompanies Lucy down the stair rail as she runs downstairs before the concert. There is an earlier 'exhibition', a freak show, before the final spectacle. This is the spectacle of the 'cretin' whose demands tip the isolated Lucy over into psychological illness and trauma. Monstrosity is concealed at the heart of the school's careful monitoring of appearances. This female monster is described in the harshest of eugenic language, with no attempt to resort to the benign vocabularies that would have been available to Charlotte Brontë.⁴⁷ She is subject to fits of passivity and violence, half-human, half-beast. She is another example of the double body, a conflation of human and animal, hovering at the borders of natural history, disturbing and disrupting those categories, that we have seen

elsewhere, in the Exhibition space. Lucy ('double' of the wet in?) is unable to feel other than disgust and hatred for her, just as she loathes the Beck pupils and their flagrant sexuality, assigning the crudest national and religious characteristics to them. (Her epithets for them resemble Jane Loudon's account of hothouse flowers, another of Lucy's loathings.)⁴⁸

If the school is more forcing house than nursery, the Bretton drawing room is also a place of concealed violence, despite appearances. The introduction of the Bretton interior occurs at the windowless centre of the novel—all its windows are shrouded and protected from the outside. It is the still 'container' in a novel that is structured round the to and fro of outings, trips, walks, visits, entertainment, leisure events. A hyperactive scopical life—the look, the glance, the glimpse, the covert stare, the secret survey, the casual gaze, a libido of the eye, is at work in this promenading public world and an accompanying dialectic between the window and the mirror. The Bretton household, on the other hand, produces an enclosed and alienated gaze. Lucy's awakening begins with what is simultaneously a lyric to the drawing room and a making strange of its contents:

At first I knew nothing I looked on: a wall was not a wall—a lamp not a lamp. I should have understood what we call a ghost, as well as I did the commonest object; which is another way of intimating that all my eye rested on struck it as spectral. (p. 207)

The two insistent tropes of the nineteenth-century interior, the lamp's enclosing circle of light that reduces the world to a small cosmos of radiance gathering consciousness into a circle of safety, and the wall's protective covering, an extension of the subject's body, cannot be realized. Neither words nor things function cognitively. It is a state of perception without recognition. Things here are not antecedent to the names and concepts that register their being. They are belated. 'We want things to come before ideas . . . before the word. Whereas they seem to persist in coming after.'⁴⁹ Suddenly the constituent fabric of domestic experience, a wall, a lamp, is unnameable. This wordless condition, in which things are not reducible to semantics, does not possess the fullness of immediate experience but precisely its opposite. It is phantasmal, 'spectral'. Even when the archive of memory begins to map the objects in the room and a sequence of semantic recovery permits recognition, bourgeois solidity becomes its opposite. Marx's *tormenting phantoms* of imagination appear. The more familiar the objects of another history become the more hypersensitive and trance-like the mesmerized recall and itemizing: 'two oval miniatures over the mantelpiece [family portraits? relations?] . . . two china vases, some relics of a diminutive tea service, as smooth as enamel and as thin as egg-shell, and a white centre-ornament, a classic group in alabaster,

preserved under glass. *Of all these things I could have told the peculiarities, numbered the flaws and cracks, like any clairvoyante* (emphasis added) (p. 209).

It is possible that the ghostly aura and pallor of things derives from her friend Harriet Martineau's account of mesmerism. Both writers dematerialize their environments.⁵⁰

First, the outlines of all objects were blurred; then a bust, standing on a pedestal in a strong light, melted quite away; then the opposite bust, then the table with its gay cover. . . . The busts reappeared, ghost-like, in the dim atmosphere, like faint shadows, except that their outlines, and the parts in the highest relief, burned with the same phosphoric light. The features of one, an Isis, with bent head, seemed to be illumined by a fire on the floor, though this bust had its back to the windows. Wherever I glanced, all objects were dressed in this beautiful light.⁵¹

The paranormal language of both writers, hystericizing the aesthetic artefacts of the interior, is a way of proposing not only that the solidity of the interior is spectral, but that the objects themselves may be the hysterical symptom of a dysfunctional system rather than of the writers themselves. The ghost in the novel here is less the nun or 'none' than the phantoms of corporeal objects that crowd the La Terrasse living room, signalling lack. Martineau's classical Isis, traditionally associated with motherhood and mourning, is recapitulated by the 'classic group in alabaster, preserved under glass', sequestered in a transparent prison or 'shade' as glass domes were termed. The vestal objects on the mantelpiece, hollowed-out containers 'thin as egg-shell'—porcelain again—are feminine symbols frozen into aesthetic form. The spectralization of value is at work here, de-realizing things, whitening out the feminine body.

La Terrasse, the Bretton home, is a place for preserving things, a kind of domestic exhibition of displaced artefacts, a middle-class winter garden that on many levels suggests nurture. Here, the artificially worked household decor of wallpaper, covering, and upholstery stands in for the living, but just as artificially confected botanical flora of the conservatory. The wallpaper of 'forget-me-nots . . . amongst myriad gold leaves and tendrils', the 'autumn-tinged foliage' bordering the round table's cover, the group 'of brilliant flowers on a dark ground' that cover the small ebony-framed chair (p. 208), the undulating design of the carpet—even the blue damask upholstery would have undulating self-patterns incorporated in its fabric—represent plenitude. Its therapeutic nurture fuses with a dream of plenty.⁵²

On the other hand, La Terrasse is also, supremely, the place of the trace that Benjamin identified as the suspect environment of nineteenth-century consciousness. Two other elements counteract glass culture's nurture.

Luxury that ransacks resources is also the interior's coded meaning. Marble (Italy), ebony (Africa), alabaster (Germany or Italy), porcelain (France), damask and arabesques (Damascus and the east) (the submarine bedroom adds dimity, chintz, muslin, gold beads, crimson satin, lace, white silk)—'the unique assemblage of *all* things'. Secondly, there is restlessness in the scrolling and curvature of the Bretton 'grammar' of ornament. The room subverts many of Owen Jones's 'rules' of ornament, in particular the need for repose.⁵³ The style is more than touched by the understanding of decorum in Cole's *Journal of Design*. Nevertheless, there is excess. The gilded mirror, the 'endless garland' of wallpaper flowers, 'mazed and bewildered', the scroll couch, the arabesques on the carpet, the damask coverings, suggest the convoluted designs, the volutes and spirals, of a scene of display, pattern, and texture whose subtext is a perverse double body. With their dwelling upon covered surfaces, embroidered, printed, upholstered, padded (Mrs Bretton's personal blue damask chair is 'deep-cushioned' (p. 227)), they intimate something hidden behind or below the surface. It may not be a coincidence that the seats of Thackeray's lecture room, where the Duchess of Sutherland appeared, were upholstered in blue damask, a fact particularly noted in Charlotte Brontë's letters. The Bretton possessions suggest a concealed erotics. This, with its overtones of arousal and libido, is a more compromised and sinister Grotesque than that of the bedroom grotto. Concealed, it does not avail itself of the *confrontation* essential to Grotesque distortion. (There is more than a hint that Dr John knows the prostitutes of Vilette.)⁵⁴

This environment is complex: hand-worked aesthetic gifts of love coexist with luxury possessions. The hand screens in the drawing room designed with fussy schoolgirl exactitude to imitate engraving in pencil drawing (screens in more ways than one), the red satin pin cushion in the bedroom—'I had made it myself' (p. 212)—the initials L.L.B., offering the only clue to Lucy's affiliations (Louisa Lucy Bretton), complicate and override the suspect interior with an expressive history. The 're-joinder', rather than the phantom in the mirror, might be a possibility. Nevertheless, in these traces of her life, their maker was forgotten.

Lucy's survival depends on resisting being made a mere trace in the bourgeois mirror. Her response to the incandescent glass of a chandelier, quoted in the last chapter, occurs in the same episode that provides her with a destructive image of herself in a public mirror. Lucy/luce is intuitively drawn to the 'shivered' drops of glass. On analogy with Ruskin's bead-makers she is threatened with psychic fragmentation, a self split and divided up. But her dry recall—'It was only the chandelier'—is redressed by her grotto-esque language. In her reading, glass is 'crossed' with rock

crystal and water, a hybrid of fluid rock and carved water, a downward fountain. Here is an active *encounter* with the grotesque.

Frangas non flectes could well be her motto.

Dickens's *Bleak House*, Glass Culture and Exhibition Travesties

they will come out of it at last, with that feeling of boredom and lassitude . . .⁵⁵

I find I am 'used up' by the Exhibition. I don't say 'there is nothing in it'—there's too much. I have only been twice; so many things bewildered me. I have a natural horror of sights, and the fusion of so many sights in one has not decreased it.⁵⁶

['E]very noise is merged, this moonlight night, into a distant ringing hum, as if the city were a vast glass, vibrating.⁵⁷ Though the novel was serialized from March 1852 to September 1853, there is not a single direct reference to the Exhibition in *Bleak House*. Yet there is a systematic reversal and dreamwork travesty of it, as in the sinister shade or glass dome that contains the whole of London, vibrating as if ready to shatter. Dickens had unsatisfactory dealings with the Exhibition organizers that predisposed him to hostility, but the depth of antipathy in *Bleak House*, his anti-Exhibition novel, comes from a more searching analysis of glass culture than offended *amour-propre*.⁵⁸

The ideal of a transparent world imagined by philosophical radicals grated against his more pragmatic radicalism and deflected attention from existing horrors. Where the *Westminster* imagined a society where bricks would no longer be made by hand, superseded by glass, Dickens made a violent and abusive Brickmaker central to his plot. Not transparency as a medium, but an opaque, humanly made atmosphere, fog, created by pollution, dominates as trope and literal presence. Quasi-matter as glass is quasi-liquid, its obfuscations are socially produced and pun on the artificial climate of the Crystal Palace's huge greenhouse. On two occasions *Household Words* pursued a deconstructive ecology into the Exhibition by suggesting that glass and sewage were intrinsically connected. R. H. Horne, in July 1850, noticed that public competitions for the design of the Exhibition building and the London sewers were taking place at the same time.⁵⁹ W. H. Wills elaborated this cloacal theme in January 1851, by insisting that drainage and ventilation were the main desiderata for the 'tremendous pile of transparency' that was simply an enormous glass case. The condensation of 'scotch mists' from breathing, heated bodies required conduits for these waste products. 'Into these grooves the condensed breath of "all Nations" will fall and be conveyed into the transverse gutters; thence through the columns into the jurisdiction of their honours the Commissioners of Sewers', into the sewers themselves, an ironic levelling

process.⁶⁰ The universal fog of *Bleak House* is intensified scotch mist, sardonically replicating the union of breath and matter that went to the making of glass. The proliferation of mud, filth, effluvia, and rotting waste, most appallingly exhibited by the decaying burial ground of Tom-all-Alone's (the anti-conservatory of the novel) and its mephitic vapours, is the corollary of this atmosphere.

It may be that Dickens's febrile associative power made him connect the Court of Chancery not only with the lottery of the law but with Chance, the makers of the Exhibition glass, as *Punch* punned on Peel, the Exhibition's advocate, by fusing the conservatory with his name in the composite, 'Orange Peelery'. Certainly he picked up the syntax of his earlier article on the Exhibition, his xenophobic attack on high 'Tory' Chinese paralysis, when he turned to the 'foggy glory' of the Lord High Chancellor.

'Well may the three Chinese divinities of the Past, the Present, and the Future be represented with the same heavy face. Well may the dull, immoveable, respectable triad sit side by side, in a glory of yellow jaundice.'⁶¹

Well may the court be dim, with wasting candles here and there; well may the fog hang heavy in it, as if it would never get out; well may the stained glass windows lose their colour, and admit no light of day into the place; well may the uninitiated from the streets, who peep in through the glass panes in the door, be deterred from entrance. (p. 15)

Dickens recycled the racist 'jaundice' of Chinese skin into the case of Jarndyce and Jarndyce, and, with far greater imaginative intensity, made Chancery a principle of exclusion, as its glass door becomes a barrier and the lantern admits no light, marking off the two worlds of privileged and dispossessed that *Reynolds's* saw consolidated by the Exhibition. This is in complete contradiction to *Punch's* eulogy in mock Irish to 'The Palace made o' windows!'⁶² Yet the epiphenomena of glass is everywhere.

The pollution of fog comes about through smoke, and fires burn everywhere in this novel, from the brick furnaces near St Albans to the Bagnet and Smallweed hearths, the Lord High Chancellor's private chambers, to the Dedlocks' aristocratic chimney corner, from which Lady Dedlock screens herself. Fires and windows are oddly linked, and these in turn link Esther and Lady Dedlock. '[C]andles were reflected in the black panes' of Esther's window in *Bleak House* (p. 114) just as later a 'bright miniature fire blazed in each of the tiles of the fireplace'. At twilight in the Dedlock breakfast-room 'The fire glows brightly on the panelled wall, and palely on the window-glass, where, through the cold reflection of the blaze, the colder landscape shudders in the wind, and a grey mist creeps along: the only traveller besides the waste of clouds' (p. 194). Esther's journey in search of Lady Dedlock recapitulates these reflected fires. 'Night was setting in, and

its bleakness was enhanced by the contrast of the pictured fire glowing and gleaming in the window-pane. As I looked among the stems of the trees.' (p. 883). Multiple reflections of the fire in the window, return the image of the fire to the transparent pane, as if its origin in the processes of the furnace and its final form coexist as a self-reflexive entity in the heart of the domestic interior. This is an indirect reminder of the complexity of industrial work, and the fallacy of Exhibition taxonomy that created the hierarchy of raw materials and manufactured articles.

There is also a window poetics at work whose full implications were seized upon much later by Virginia Woolf in *To the Lighthouse*, when the Ramsay family dines, while the sea is seen through their reflected images. An outer world seen through images of an interior world. The image screens that world and mediates it. The full desolation of the external world and the full possibilities of warmth only become apparent because outer and inner scenes occur at the same time in the moment of vision, 'the cold reflection of the blaze, the colder landscape'. In *Bleak House* mediated reality and images through which it is seen are held in precarious tension. Many characters see through glass, darkly, as images obfuscate. Lady Dedlock and Esther have a vision—literally—or perhaps Esther has a vision on her behalf, of the co-present existence of nurture and exposure. The flame-lit window pane appears at moments of crisis for both women. The window holds contradictions perilously together. For both there is no consolation in the winter garden (and it really *is* a winter garden) outside. Perhaps only they understand the full meaning of protection and exposure.

Windows are dispersed through the text as if the Palace made of windows has itself dispersed. They function as 'eyes' at Nemo's death, but mostly as imperfect sites of vision—windows 'with their eyes stoned out' (p. 120) (alluding to the social unrest of glass-breaking in one economical phrase)—representing obfuscation, barriers, and blockage or conduits of disease. The dirt-encrusted windows of Krook and Jellyby are the urban norm (a kitchen 'winder' gives onto Tom-All-Along's). The brilliantly lit windows of Chesney Wold seen from outside or from within the long drawing room function as agents of exclusion.

This novel sports with upside-down Exhibition images. Not the seat of a 'democracy' of spectatorship, Chesney Wold is the real conservatory, preserving privilege and traditional landed wealth, even though it is an inefficient hothouse. (There's only one reference to a conservatory.) Its miles of pipes do not heat it, it traps light but cannot control its distortions—in the summer sunset the portrait of 'A dense Justice in a corner is beguiled into a wink' (p. 641). Resolutely reversing Exhibition priorities, portraits and pictures, controversially excluded from the

Exhibition, abound in the text, not sculpture, which was admitted into the Exhibition as a manufactured object (the Dedlock ancestors, the portrait of Lady Dedlock, portraits of the Snagsbys, the Swosser, Dingle, and Bayham Badger contingent). Where the Exhibition valorized machines, copying by hand is the means of transmission and reproduction, and just as the plot turns on the recognition of the Dedlock portrait by Guppy (the Dedlock's inefficient 'conservatory' cannot *actually* keep out the vulgar) so it turns on the recognition of Nemo's copying.

Exhibition motifs occur at the most unexpected moments. Phil, Captain George's assistant, has clearly suffered mutilation in the Birmingham gunsmiths' workshops which supplied the Exhibition so liberally. Things, and things out of place, proliferate: a curtain fastened with a fork, a pie dish serving as wash bowl, potatoes in the coal scuttle (Jellyby). Krook's accumulated detritus—bones, bottles, old iron, 'Waste Paper bought', 'Ladies and Gentleman's wardrobes bought' (p. 67) are classified but anomalous. Bleak House itself harbours old mangles and three-cornered tables, and contains, deftly gesturing to East India Company plunder as well as to those many objects on display that turned into something else, a Hindoo chair that was sofa box and bed, and a bedstead like a bamboo skeleton and a 'great bird cage' combined (p. 86).

Dickens exposes the Exhibition's political self-deceptions, its assumption that Chartism, 1848, and working-class activism, have been defeated by the mere act of enabling mass spectatorship and an admission of the dignity of labour. Sir Leicester Dedlock, with Wellingtonian affinities, associates Mrs Rouncewell's son from the industrial north, Watt, with a vague, archaic notion of political action, simply conceived as a mob hardly relevant to him: 'one of a body of some odd thousand conspirators, swarthy and grim, who were in the habit of turning out by torchlight, two or three nights in the week, for unlawful purposes' (p. 107). The pricing controversy prior to the Exhibition (many, including Charles Babbage, wanted the commercial aspect of the Exhibition frankly acknowledged by pricing objects) ended in the absence of price tags. The resulting occlusion of cost, exchange, and thus the ethics of property, as ownership was aestheticized, is fiercely parodied in Harold Skimpole. 'I covet nothing . . . Possession is nothing to me.' His claims slide into the dubious 'possession' of leisure class colonial fantasy—'I can lie down in the grass—in fine weather—and float along an African river, embracing all the natives I meet' (p. 91).



Both *Villette* and *Bleak House* address the contradictions of glass culture. Brontë uses glass culture against itself to explore these, but she does celebrate aspects of it. Part of her imagination is enthralled by it. Dickens

prises apart the alliance of glass culture and the Grotesque in order to make a critique of the fallacies of glass culture as he saw them through the Grotesque itself (true to the Grotesque's questioning of boundaries between animal and human, dogs, horses, and poultry, more sensate than human beings, have consciousnesses in this novel). Both *Villette* and *Bleak House* intuit an increasingly mediated, optical, specular culture. They see two results. One is bewilderment, a word both Dickens and Charlotte Brontë used. A 'horror of sights' emerges from sensory overload.⁶³ When Ruskin described the Grotesque as a distorted form of the sublime, he was thinking of that breakdown of thought that Kant understood as a preliminary to the remaking of reason, an epistemology I have glanced at earlier. The particulars, intense but finite, that constitute beauty, become, in sublime and grotesque experience, a perceptual overload that defeats thought and stuns the mind with the incommensurable—a modern phenomenon. Not to be able to think—the condition that Dickens is describing, is a condition of enslavement, 'lassitude'. Kant made room for reason by grasping the limits of mind itself. The Grotesque, offspring of glass culture, makes room for thought by seizing contradictions and confronting them. The implicit question in both texts is whether the Grotesque imagination is sufficiently creative to make room for thought and deal with contradiction.

The second consequence of optical culture is the ambiguous status of the image, for Dickens in particular. The reflected fires in the window glass, images of light made by light, and capable of infinite multiplication, are the very type of the optical images mediated by the glass lens, carried by matter but not *of* it, that constituted the vigorous 'shows' of popular entertainment. In his later novels the free-standing light image became a fascination. The narrator's voice in *Our Mutual Friend* meditates on the reflections of the Thames and humanly made mirrors—'if all the images it has in its time reflected could pass across its surface again'—expressing a common nineteenth-century reading of the image existing forever, multiplied to infinity.⁶⁴

So far I have explored the perceptual, aesthetic, and political questions that emerged from the physical fabric of glass culture and its artefacts, following these with the myths and fictions generated from a new glass infrastructure. The final section turns to the lens and its implications both as a popular and 'philosophical' medium.



PART III

LENS-MADE IMAGES

Optical Toys and Philosophical Instruments



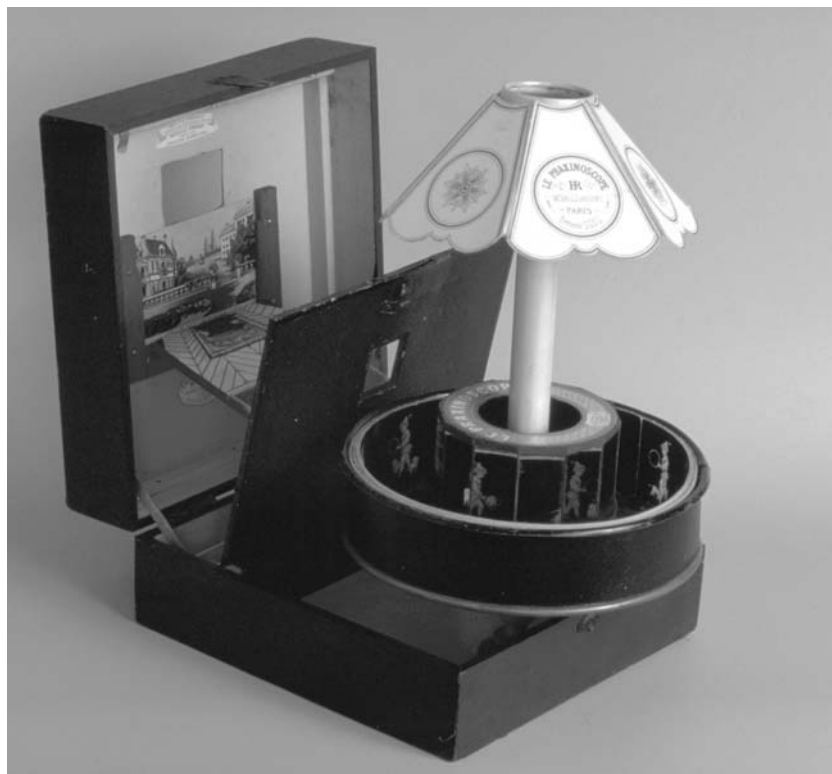
The Lens, Light, and the Virtual World

Introduction

The physical fabric of glass culture interposed a transparent film between the observer and the environment, generating debates that arose from its transformation of materials, things and artefacts. With the lens not things, but *images*, were at issue. This was the era of the aperture, and the multiplication and sophistication of lens-based devices, from the magic lantern to the telescope. The convex or concave lens, and the convex or concave mirror, aided by the plane mirror, together created another dimension of glass culture. Interposed between object and the eye, the lens remade matter as an 'ideal' entity, in the 'air', and so changed the image that it appeared independent of an origin, a replication without correspondence. The tactile, material trace has dissolved, leaving a specular trace. The lens user worked purely on images at a remove from matter. As a result the lens released the latent speculative problems of glass culture. At the same time the demand on the eye produced an unprecedented, hyperactive sensory awareness.

'A lens in optics is a portion of a refracting substance such as glass, which is bounded by curved surfaces,' John Tyndall wrote.¹ Controlling the real and the virtual image, as physics termed them, through convergent and divergent rays, the lens made light mobile, enabling light to accomplish its own transformations by making non mimetic images out of itself. Its simulacra were at the juncture of the visible and invisible, the seen and the unseen, body and mind, through the process of bending light: 'all that any lens or mirror can do is to impress a curvature on the wave-fronts of the [light] waves,' Silvanus Thompson wrote, demonstrating the undulatory theory of light with convex and concave mirrors in a ripple tank.² Light-made images needed the screen. Screen practice created the potential

Figure 62
A praxinoscope



for moving pictures, technological and psychic, but though for many critics ludic devices belong legitimately to a teleology of ‘pre-cinema’, the media of glass culture perform other optical work as well.³ This work is the concern here.

Three interconnected themes run through the following chapters, whether they are explored in treatises intended for an informed public or periodicals directed to artisans, whether they arise from ludic devices or the instruments of high research: the status of the image, the nature of mediation (or the bringing about of a changed state), and the problem of knowledge and perceptual certainty. Questions that circulated in the earlier part of this book, in particular the questions of time–space, spectacle, taxonomy, and anamorphosis, reappear, but they are twined through the philosophical aspects of glass culture.

Nineteenth-century modernisms met the lens’s challenge, which created a radically ungrounded world, with an extraordinary, exhilarated scepticism. This occurred as intensely in the sphere of astronomy (perhaps more intensely) as in the more familiar evolutionary ideas exposed by the microscope. Some of the figures appearing earlier in the book reappear in these debates. The lens’s ungrounded world begins this final section. Putting in parallel phenomena in popular and scientific spheres, the magic

lantern's 'dissolving view' and the 'nebulae', cosmic dissolving views, explored (and sometimes 'resolved' by the telescope), the argument of the first two chapters centres on the moment of transition that brings about change, a topic of deep fascination to both contexts. The atopic conditions of the microscope and stereoscope, and the time-bound nature of the camera in subsequent chapters, follow from this.

'A Kaleidoscope Gifted with Consciousness'⁴

To be 'a kaleidoscope gifted with consciousness', generating brilliantly coloured multiple images, images of images, and fragmented perspectives to infinity, is how Baudelaire thought of the ludic freedoms he sought to define as 'modernity'. The kaleidoscope image, effected by angled mirrors, sometimes enhanced by a lens, created one of the earliest specifically nineteenth-century optical crazes for popular media. David Brewster claimed in 1819 that two hundred thousand were sold after the first demonstration of his kaleidoscope.⁵ The sub-visible and extraterrestrial technologies of microscopy and astronomy shared the same image-generating optics with spectacle. For Richard Proctor the physics of light (the scattering of rays in all directions from a luminous body) makes images uncanny to infinity. 'Events have happened on our earth and have been forgotten, which, nevertheless, are at this very instant of my writing visible from some one or other of the orbs which people space... and there is no event... visible from standpoints without the earth, which has not been thus rendered visible over and over again as the light-messages conveying its history have passed beyond star after star (in all directions from the side of the earth on which such events took place); no such event which will not be thus rendered visible over and over again hereafter as the light-messages travel onwards into the star depths for years, for centuries, for millions and millions of ages, until time shall be no more.'⁶ *The image is forever*, guaranteed by the immortality of light.

A telescope gifted with consciousness. But, as the double negatives intimate, anxiety rather than Baudelaire's insouciance is the keynote. For Proctor astronomy imposed the necessity of living with two contradictory explanations of the same phenomena: telescope imaging persuades us that the universe, for instance, is old and new according to particular standpoints; a block of granite or a diamond is changing more rapidly than a star that can be displaced by its own motion.⁷ A dialectical world of opposites became inevitable. Baudelaire recognized that an insatiable appetite for images created a split modern 'I' in search of the 'non-I' of virtuality, the sensory in conflict with the immaterial.⁸

The lens as toy and research instrument raised the problem of knowledge. Though hedonist optical toys exercised a kind of plagiaristic haunting of the philosophical instruments of high research from which they were derived, their inventors (Charles Wheatstone, David Brewster, and Joseph Plateau for instance), saw them as part of a continuum of experiment with images, with the visible, and with seeing as an object of investigation.⁹ Jonathan Crary, however, the most impressive recent researcher of technologies of spectacle, assumes that these are subjugated knowledges, part of a disciplinary panoptical culture that educated the subject into optical obedience to an atomized and mechanized self both for work and pleasure in a capital-driven commodity culture.¹⁰ But this presupposes that optical toys can be used in one way only. On the contrary, they also created ways of *negotiating* the image.

Though it recognizes the coercions of the image, the reading of optical devices here starts from the same assumptions as those of the most innovative nineteenth-century optical theorist, Hermann von Helmholtz, whose thinking on optics recurs in this last section, and links each chapter. Formulating a reading of visual perception through optics, and particularly the optical toy, he claimed for non-verbal, visual, and sensory perception the highest form of intellectual and philosophical enquiry. In fact, for him sense data are capable of producing a form of non-verbal critique. In a phenomenological move he argued that the sensoria, particularly the eye, can work cognitively with non-verbal propositions and universals. It is in this way we know ‘a man, a road, a fruit, a perfume’.¹¹ Sensory forms of knowing in our society are relegated in the hierarchy that privileges *wissen*, abstract verbal logics, against the praxis of *kennen*, knowing ‘how to’ through the body, muscles, nerves, sensoria. Helmholtz’s inference, audacious for its time, is that the capacity for experiment, learning, and *research* is universal from birth. The relation between sense data and the world can be made with an exquisite accuracy of conceptual induction that makes it possible to say that fixing of a point in space could ‘become the *major* premiss of a syllogism’ (p. 199). William Herschel, the foundational astronomer-theorist for the nineteenth century, spoke of ‘Seeing’ through the telescope as a form of knowing ‘how to’, ‘an art that must be learnt’, as subtle as playing a Handel organ fugue. ‘[M]any a night have I been practicing to see.’¹²

Three different forms of ‘practising to know’ represented by both playful and ‘philosophical’ uses of the lens are addressed here. They belong together as groups by virtue of the kinds of question they ask, without regard to a hierarchy of high and low. In accord with Helmholtz’s somatic knowledge, they fall into three groups.¹³ The first, the magic lantern and its effects—the phantasmagoria, the ‘dissolving view’—its related genres, the diorama and to some extent the panorama, the telescope, the spectroscope—are devices for

managing and transforming primordial light and radiance, often forming images convergent with matter but not *of* it, and moving them from one surface to another. What constitutes an ‘Appearance’ or ‘view’ is the dominant enquiry here. At stake in the microscope, the kaleidoscope, the stereoscope, peepshow, and polyoptic pictures is the definition of Anamorphosis, figure and ground, and the distortion of species being. The object of vision either exists in atopic space or hyper-really tied to scale and perspective, swinging between two types of ‘distortion’ created by the absence of spatial markers on one hand and overdetermined distinctness on the other. The third group, comprehending photography and devices for creating movement such as the praxinoscope, phenakistiscope, and thaumatrope, depends on a dialectic of motion and fixity, either setting a body in motion or transfixing it. The dynamic of Repetition is the central concern here. All optical toys repeat the ‘repeatability’ of scientific experiment. They engage in what Martin Meisel has characterized as serial repetition or anaphora, but anaphora is this group’s particular concern.¹⁴ These three groups frenetically hybridized over the century—attempts were made to project three-dimensional stereoscope images via a magic lantern, or to project the changing patterns of the kaleidoscope. Despite overlapping concerns, however, the grouping is distinctive.¹⁵

The radiant image replicated through technology, visual aberrancy, mechanized repetition, these go deep into the cultural imaginary because they intimate the transformation, through glass culture, of light, space, and time in nineteenth-century experience. Through the mediation of the lens nineteenth-century modernism encountered new pleasures and new crises.

The poets understood this optical work, and its somatic knowledge. The theme of image dissemination, to take two brief examples, is germane to poetry of this time. Christina Rossetti’s light-saturated poetry adroitly turns astronomical insights in ‘Passing and Glassing’ (1881), where we are all recipients and donors of reflected light. The earth is a ‘looking glass’ for thought itself that actively looks back at the perceiver, and, as a planetary body in motion, ‘passing’, ambiguously passes on its images or ensures their passing away. Hardy’s mordant God complains of being a mere obsolete projection, ‘One thin as a phasm on a lantern slide’ (the word ‘phantasm’ has been thinned) sustained by gimcrack material mechanisms, ‘Shown forth in the dark upon some thin sheet’, ‘vivified’ by a showman. The metre as it were stumbles in the dark, opening up a metaphysical dimension of uncertainty that queries that materiality in the act of asserting it. The ‘thin phasm’ and ‘thin sheet’ do not quite match as mediating devices (‘A Plaint to Man’, 1909). ‘I am half sick of shadows’, the utterance of Tennyson’s ‘The Lady of Shalott’, on the status of the image, is a

keynote line. I have constellated poems as commentaries, rather than illustrations, on optical themes, throughout this final part of the book.¹⁶

Terrestrial and Extra-terrestrial Dissolving Views: Lantern Dissolves and the Nebulae

The 'dissolving view': 'a gradual but almost imperceptible change comes over the scene; this is what is termed *dissolving*. . . The original picture fades insensibly from the sight, and another as stealthily takes its place.'¹⁷ '[O]ne subject is melting into another, and there are but half indications of forms.'¹⁸ '[S]liding plates . . . effect . . . the gradual change of tint on the mountains and water.'¹⁹ This is light in flux. The technique of superimposing an emergent image on the erasure of a prior image, melting one into the other, was brought to perfection in the magic lantern and its cognate spectacle, the diorama. It was common to domestic lanterns, large-scale Polytechnic Institution Lantern projection, and Regent's Park Diorama dissolves alike.²⁰ Using light to make images out of light itself in present time, it was a uniquely nineteenth-century technology. Hovering between appearance and non-appearance, dissolving views opened up a series of questions about imaging and the image, and transition. These questions were curiously duplicated by the Nebulae, the cosmic dissolving views that came to be at the heart of intense controversy among astronomers and in the culture at large. So far analogous to the dissolving view did they appear that De Quincey identified the Nebula of Orion, a test case for astronomy, with the lantern projections of the phantasmagoria. Existing in 'eternities of death', 'the horror of the regal phantasma which it has perfected to eyes of flesh', his 'ghostly ugliness', his 'phantom's attitude', his 'meagre shadow'. The 'uncovering' of Orion by astronomy,²¹ acts like one of the familiar optical ploys of the phantasmagoria, the stripping of the body to a skeleton.

How were dissolves made? There were two forms. The phantasmagoria were an early form of the dissolving view and used the same magic lantern apparatus, but differently. A 'box to hold the lamp, a concave mirror, and a convex lens to concentrate the light on the slide, and a second convex lens to throw the light on the screen', were the image-making constituents for each, Marion, the author of a popular work on optics, explained.²² Either two lanterns were used or a lantern with double lens. 'There are therefore two sets of lenses identical in every particular, placed side by side, in the same line, the foci being adjusted for the same spot, so that the images refracted from each may superpose each other without difficulty' (p. 231). The first lantern is shut off while the second simultaneously opens its beam

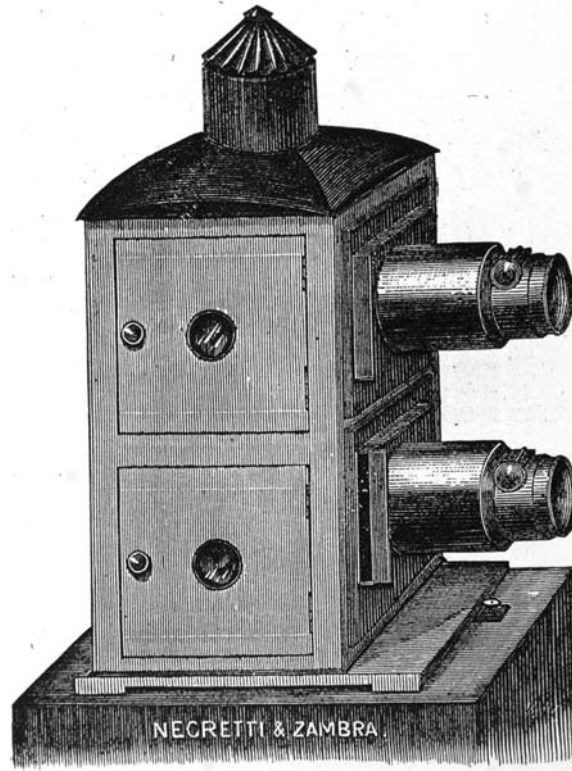
of light. In the early days a hand passed over the lens produced the dissolve. (In a Diorama the raising and lowering of multiple screens produced the same effect.) There were innumerable ways of creating a dissolve. But, unlike later dissolving views the phantasmagoria were projected from behind a backlit screen by a rolling apparatus that could enlarge or reduce the image by approaching or retreating from the screen, seeming to make the image break out of the screen surface into the space of the onlookers, in their autonomy cut loose from the screen, distending and shrinking, disobeying the laws of perspective. 'If, therefore, at a given instant the first lantern is shut off, the spectators see the winding sheet torn, as it were, suddenly from the spectre before them. The first lantern being turned on once more, the skeleton is instantly re-clothed in its hideous garb' (p. 231). In their violent disorientation, their invasion of space, their fusion of eros and death in the stripping down to the image's bare bone, they were the first genre of spectacle to break out of the confines of the camera obscura, the first genre to experiment with the surfaces of the flesh and the screen image, provoking questions about transformation both through their content and form of projection. Developed during the post-revolutionary period in France and spectrally re-enacting its trauma, in England this invasive return of the dead was also perceived as a violation. Harriet Martineau's horror (seeing is gendered) at the unframed image of Minerva left her grasping the back of her chair—'I did not like the darkness to begin with . . . and when Minerva appeared, in a red dress, at first extremely small and then approaching until her owl seemed coming directly upon me, it was so like my nightmare dreams that I shrieked aloud.'²³ A bird flying into one's face, 'coming directly upon me', the assault of a scarlet woman representing knowledge, a mother-image turned Medusa: the phantasmagoria produced the first ungrounded images.

Later dissolves, however, the main subject of this discussion, were projected onto a front-lit screen. Transition was their essence. The front-lit screen of the magic lantern exploited the lens so that it displaced sudden apparition with the graduated image, sensory immediacy with sensory contemplation, invasive proximity with distance, the instantaneous with slow transformation.²⁴ It established the *screen* as an intrinsic part of lens-made spectacle, no longer to be broken through as a barrier to the image but instead its mediating form in collaboration with the lens. Dissolving views were based on insistent binary reversals and peripeteia, so every image possessed a latent duality—day to night, summer to winter, calm to storm, one state of luminosity displaced by another. Transition between two states was central to the image: 'I think it is not going too far to say that more moonrise effects have been painted than all the other subjects put together.'²⁵ The *Illustrated London News*, influenced by the dissolving



Figure 63 Clark's Miniature Diorama with three 'dissolving view' skies and Tintern Abbey image

Figure 64
A Double Magic
Lantern, Negretti &
Zambra
advertisement



view, published an engraving of the Crystal Palace by moonlight in 1851. Dean & Son's *Cinderella* of 1876 advertised transparent pictures, which, held up to the light, produce 'two entirely different effects' and 'Cause mountains calm to issue ashes dire'. So important was the changeable luminosity of the view and its gradations of light in process that John Clark's miniature portable diorama of 1826 reproduced its effects by arranging a voile or fine muslin rolling screen that could be let down in front of two other screens behind it—a landscape and a skyscape. While different combinations of skyscape and landscape were slotted in place the lowered voile screen veiled their change, achieving the 'atmospheric tints', that 'glow', 'palpitate', 'transport', and 'transfuse' light and shade, that Clark aimed for, and described in his manual instructing the user how to create his own scenes and transparent diorama effects.²⁶ His work shows how the indeterminacy of the view was intended to arouse the episteme-phililia of the longing, libidinal eye, 'practising to see' (to enhance this effect his own scenes, his 'Tintern Abbey', for instance, layered perspective and de-centred the landscape by introducing arches, apertures, and peepholes at different angles to one another that lure the eye but deny it comprehensive vision). Just as important, his work shows how the 'view' was an ensemble of moving screens, light and image (or lenses, mirrors, and the

screen in the case of the magic lantern)—the ‘picture’ could not be located at any one point. It did not exist as an entity.

One compulsive image crossed magic lantern and dioramic scenes, the eruption of Vesuvius, a deep, insistent obsession of the era and a persistent element of the culture’s image store. It fused the violence of the phantasmagoria with the transitional effects of the dissolve. Indeed, the volcano not only represents but *is* a dissolving view. It is the embodiment of peripeteia or reversal, moving from calm to violence, and its violent spasms of energy became a calorific sublime. This is the text of a poster of 1846 advertising the ‘Eruption’ of Vesuvius—the word is used repeatedly as a compulsive advertising ploy, but the repetition surely registers a deeper compulsion—at the Royal Surrey Gardens on 3, 4, 5, and 6 August.

View of Naples,
Eruption of Vesuvius!
and Destruction of Herculaneum and Pompei
In the year 79 (by Danson)
In reviving that magnificent Exhibition,
THE ERUPTION OF VESUVIUS!
The Proprietor has not confined himself to copy the previous Spectacle,
THIS PICTURE IS MORE THAN TWICE THE SIZE OF THE FORMER!
And represents as accurately as can possibly be done, the
GREAT ERUPTION IN THE YEAR 79, WHEN THE
DESTRUCTION OF HERCULANEUM AND POMPEI TOOK PLACE
The practical observation and experience of Mr. Danson, assisted by Messrs.
ADAMS, TURNER, ROBERTS, T. DANSON, &c., has enabled
him to produce effects never before attempted.

Preceding Vesuvius is another light-associated display that was once intrinsically linked symbolically to Louis XIV in the pyrotechnical displays of the *Ancien Régime*.²⁷ The king, as the ‘sun’ of the court and state, would performatively produce his power by dressing as Phoebus. Here, in this populist tableau for the 1840s, Signor Farinelli assumes the role of Phoebus. Whereas Louis XIV performed his sun role as the centre round which all revolved in the Galilean universe, this is a vertical descent, and implicit commentary on the volcanic upheaval to follow—an attempt to contain the power to be displayed in advance—here the sun cedes power to a feminine principle, quenched by ‘the Bosom of the lake’,

As a climax and preceding [*sic*] the Volcanic Display a most Novel and Astounding Exhibition will be introduced, representing
the
DESCENT OF PHOEBUS, IN THE CHARIOT OF THE SUN,

to effect which a
CHINESE PAGODA SEVENTY FEET IN HEIGHT
(The Design taken from the Emperor's Garden in Pekin) has been Erected from
which altitude
Signor Farinelli, REPRESENTING THE GOD OF DAY, IN THE CHARIOT
OF LIGHT,
Will descend on to the Bosom of the Lake, where a Naiad's Car will rise to
receive him and bear him to his Crystal Home.

The entire ensemble is then re-described.

THE PYROTECHNIC DISPLAY BY MR SOUTHEY has seating especially favourable for 'an unusually
EXCELLENT VIEW OF THE ERUPTION & DESCENT IN THE CAR.

Then again.

Feeding of the carnivore at half - past 5 . . . Descent in the Car, at half - past 9,
And, the Eruption follows immediately.
ADMISSION . . . ONE SHILLING.

And again. On 10, 11, 12, and 13 August there was to be

A GRAND NEAPOLITAN CARNIVAL
And a constant round of Amusements will succeed each other—concluding
with
THE ERUPTION OF VESUVIUS!

The final day of the carnival was to have an extra display of fireworks to honour the birthday of 'Her Majesty the Queen Dowager'. In *Glances Back*, George R. Sims remembered 'Vesuvius in constant eruption' at the Surrey Gardens.²⁸

We shall return to Vesuvius. Here, as the quintessential dissolve, the catastrophic overflow of the volcano, epitomizing light and matter in flux, serves to enable further exploration of the dissolve form, as well as to connect the dissolve and the flux of the nebulae. The dissolve typifies a form of image that, on Deleuze's definition, is absolutely antipathetic to cinematic technique. It reproduces movement through a synthesized series of *poses*—perhaps 'tableau' might be an appropriate term for this privileged moment. Vesuvius by moonlight, in eruption, volcanic wreckage in daylight. This for Deleuze belongs to an archaic dialectic, immobile section plus add-on movement, hostile to the analytic movement of cinema. 'Movement through an order of exposures [*poses*] projected in such a way that they pass into one another, or are 'transformed', is foreign to cinema.'²⁹ The 'privileged moment' of earlier art forms for him belonged to an archaic genre. The magic lantern and dioramic resting points, Vesuvius calm, Vesuvius violent, would form such privileged moments.

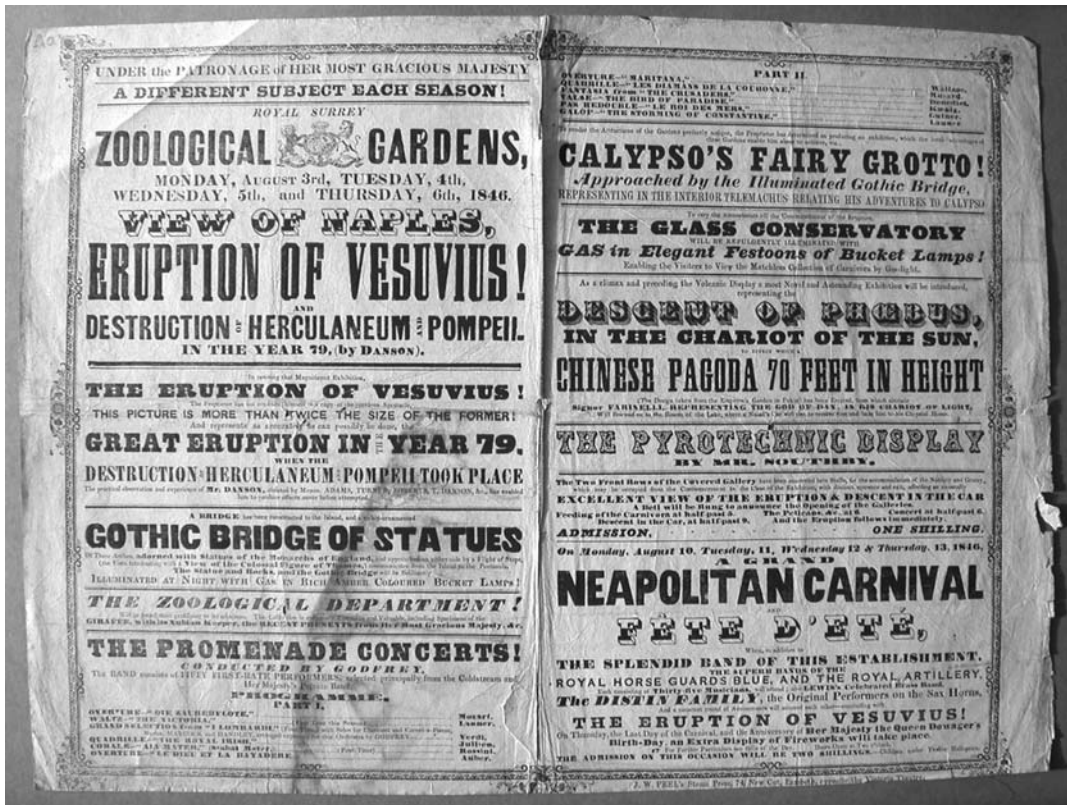


Figure 65
Surrey Gardens
Poster advertising
the eruption of
Vesuvius

On the other hand, a succession of discrete instants, with a series of caesura, however rapid, concentrated into twenty-four images per second, is the foundational movement of cinema and the break that constitutes modernism. He argued, claiming Bergson for the metaphysics of film and the truly dynamic 'movement image', that the temporality of modernity and cinema was constituted analytically from equidistant 'sections' of time, and that the caesura between these was elided.

On these terms the dissolving view is *not* the precursor of cinema. It is not necessary to commit the dissolving view to a teleology of pre-cinema to see that its own modernities initiated a series of questions by precisely inverting cinematic structures. The infinitely divisible temporal section will always be constituted by caesura, however elided. It is this pause, the caesura itself rather than the temporal 'section', that the dissolving view brings into visibility, reversing the priority of the privileged moment to transition. Not only is the privileged moment distanced, ironized, even deconstructed: the pause as process is explored. The dissolving view is both after-image and pre-image, transforming the 'now' into both the 'then' and the 'and then'. With its superimposed images, of the present with the past,

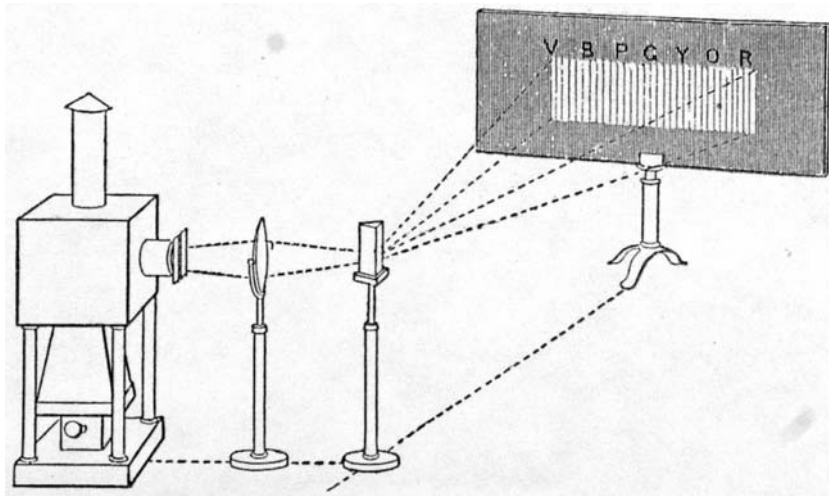


Figure 66
Diagram of the splitting of light

or the past with the present, it is in a position to speculate on the phenomenology of flux.

Deleuze claims that cinema follows the analytical separation of space and time, which, he says, enabled modern astronomy to form in the seventeenth century. He explains the relation through a time lag in technology, as cinema realized the possibilities of this disarticulation. And yet for nineteenth-century astronomy that analytical separation had already taken place. The effects of this separation were contemporary with the dissolving view. Here it manifested itself not as a succession of discrete cuts but a presentation of process as change which reversed the priorities of succession. It was partly as a result of this analytical separation of space and time that nineteenth-century astronomy became preoccupied to the point of obsession with those larger ‘dissolving views’ in the astral universe, the Nebulae. They were test cases of process. They reproduced on a stellar scale the shifting, inchoate light of the dissolving view and generated analogous questions about transition. These entities, indeterminate, dissolving vapour, a galactic haze, or so it seemed, were, until the 1860s, entirely mysterious, ‘a modification of matter wholly distinct from stars—a thin and filmy substance diffused through stellar intervals, and spreading over regions so immense, that its magnitude or the space that it fills is absolutely inconceivable’; a ‘filmy or Nebulous fluid shining of itself’ (John Pringle Nichol);³⁰ a ‘diffused mass of nebulous matter’ (Robert Chambers);³¹ ‘luminous cloud or vapour’, ‘gaseous masses’ (William Whewell);³² ‘Star-clouds and Star-mist’; ‘vast wildernesses of matter presenting no characteristics such as we had become accustomed to’ (Richard Proctor).³³

The lens of the lantern gathered light to create dissolving views, the lens of the telescope gathered light to interrogate dissolving views in space. But the telescope encountered the same problem of defining change. As attempts to ‘resolve’ the Nebulae into stars were made by the penetrative technologies of the lens and the mirror, and as reflecting and refracting telescopes developed in strength, it became apparent that, as Agnes Clerke wrote in her *Popular History of Astronomy During the Nineteenth Century*, ‘change on a tremendous scale’ was going on in a process of cosmic dissolution. ‘In all directions groups were seen to be formed or forming; tides or streams of suns to be setting.’³⁴ The volcano was as much a compulsive concern to astronomy as it was to the imaginary of spectacle, for it possessed a disturbing and deeply disputed relation to nebulous matter.

The depth of these preoccupations and their hold on glass culture can be understood by turning to two ‘primal scenes’ of the lens that became the founding narratives for optics and astronomy in popular manuals and treatises for a general audience. The first, Newton’s splitting of light through a prism, aligns the dissolve with the dispersal of light. The second, the telescope’s agency in discovering the speed of light, aligns the nebulae with the displacements of parallax. Both narratives rework seventeenth-century scientific history for an ungrounded nineteenth-century experience.

Primal Scenes of Optics and Astronomy

There it was—the patch of rainbow light on the pavement transmitted through a lamp in the shape of a star.

George Eliot, *The Lifted Veil*³⁵

A slit in a shutter and a darkened room, a beam of light, a lens, prism or aperture, a screen, rainbow colour. Newton was ‘expecting to see the image of the sun, after refraction, still round. To his astonishment, it was drawn out to an image with a length five times its breadth,’ John Tyndall wrote.³⁶ Red, orange, yellow, green, blue, indigo, violet. This composite was constituted by different coloured images of the slit, in fact, placed side by side as the prism separated out the elements of light.³⁷ A primal moment in the remaking of light, the classic Newtonian origins of the spectrum (which means, of course, ‘appearance’), the dispersion, or splitting of light, forms a foundational movement of intellectual drama, the earliest lens-screen experiment.

This primal scene is repeatedly rehearsed. A crack or a pinhole in a door or shutter of the *domestic room* reappears at these primary expository moments. To take some examples across the nineteenth century.

To make the experiment in the most striking and satisfactory manner, procure a triangular prism of good flint-glass, and having darkened a room, admit a sunbeam through a small round hole in the window shutter. (John Herschel, 1831)³⁸

When the prism is very perfect and the sunbeam small, so that the spectrum may be received on a sheet of white paper in its utmost state of purity, it presents the appearance of a riband shaded with all the prismatic colours, having its breadth irregularly striped or subdivided by an indefinite number of dark, and sometimes black lines . . . The best method is to receive the spectrum on the object-glass of a telescope . . . This experiment may also be made, but in an imperfect manner, by viewing a narrow slit between two nearly closed window-shutters through a very excellent glass prism held close to the eye, with its refracting angle parallel to the line of light. (Mary Somerville, 1858)³⁹

A small round hole is made in the window-shutter of a room, facing the sun, and the pencil of light proceeding from it is allowed to fall upon the surface of a three-sided prism . . . and is thrown upon the wall. (Marion, 1870)⁴⁰

You see we have been using a beam [that] . . . falls in a round spot against the wall. Newton used sunlight streaming through a hole in a shutter. (Thompson, 1897)⁴¹

Other experiments used lens and screen.⁴² Other scientists, notably James Clerk Maxwell, worked on colour.⁴³ But Newton was paramount for three reasons. First, through Newton the *household shutter*, the darkened *domestic* room, can be made to bring the prismatic radiance of the spectrum and the splitting of light into the core space of the modern subject. The spectrum heralds the structure of the magic lantern (itself inherited from the camera obscura), which replicates it. Lens, screen, and rainbow image penetrate deep into the self. A darkened interiority signals a transformation of the optical unconscious. Both Benjamin and Adorno saw the interior privacy of the bourgeois subject as the mark of possessive individualism, and Terry Castle has affirmed that the phantasmagoria became internalized, and paradoxically created an inner world that was the only reality.⁴⁴ Psyche and soma adjust to a mediated world. Yet the self is not only the object of a mediated world: it is here posited as a *mediating subject*. The eye becomes isolated among the sensoria, hyper-alert to cognitive and sensory demands that *pass through* a prior medium (the senses are routed through the eye), but it also becomes an actant as interpreter in the scene of dispersion. The Newtonian scene stresses the eye's mediating function and appeals to cultural myths that repudiate passivity.

Second, dispersion gave a new complexity to the move from a unitary beam to a fragmented, multiple entity. Colour waves, deflected from their courses by refraction in different proportions in relation to their speed, model a universe whose constituents move at different rates, reaching

locations at different times. Light 'disunited' is 'so many streams flowing together until an unexpected deviation in their course caused them to separate', Marion explained.⁴⁵ Colour is the result of different rates of vibration of waves in the spectrum. 'The red being lowest' (and the slowest in its pulsations), 'is called the least refrangible of them all; or, in other words, it is bent less out of its course than its companions' (p. 85). By the same token, violet 'at the top', is the most refrangible and vibrates at the greatest speed.

Finally, add to the ungroundedness of dispersion the reading of colour indirectly and by displacement initiated by the spectroscope. The indefinite number of 'dark' lines (discovered by Fraunhofer in 1817) that Mary Somerville described in the solar spectrum crossing the 'riband' of prismatic hues finally led, in the 1860s, to the remote or indirect analysis of the chemical composition of bodies that extended to the solar universe. The black lines register a blank, or a furrow. They are indicators of the absorption of substances and not their emission, cutting off the light in that part of the spectrum. Radiation from a carbonic acid flame will intercept carbonic acid, the yellow constituent of sodium vapour cuts off the yellow and leaves a dark band in its place. They are the fingerprints of chemistry. The spectrum and line configuration varied with different gases and metals. In other words, analysis of the spectrum produced by different bodies showed unique patterns of colour and line formation, and colour could be 'read' for the clues it provided to a material condition. Yellow signals sodium, green, copper, red and blue bands, zinc.⁴⁶ Light and bodies, colour and matter, became integral to one another, but remotely, by displacement, and through an 'ideal' image.

Deflection and displacement govern the primal scene of astronomy. 'Light requires time for its propagation. Two spectators at different distances from a luminous object suddenly disclosed, will not begin to see it at the same mathematical instant of time' (John Herschel).⁴⁷ We occupy different space-time relationships. It was recognized that *parallax* (a change in the observer's position that produces a displacement in what is observed) is now a constitutive part of our experience and *organized* by it. That is, even when the process is rule-bound and seeming evidence of design, we are in non-convergent relations with others and with the world. The analytic separation of space and time on which such observations depend was at the core of accounts of the speed of light, where the calibration of different rates of movement between objects travelling at different locations, and their changing relations, yielded the speed of light to Olaf Roemer in the seventeenth century. The velocity of light is an 'astonishing' fact, Mary Somerville, and others, commented: the earth, moving at the rate of nineteen miles a second, would take two months to

travel the distance ‘which a ray of light would dart over in eight minutes’. ‘A cannon ball would require seventeen years at least to reach the sun’, John Herschel said.⁴⁸ But Roemer’s data also established the constantly changing and variable relationship between observer and observed. It uncovered an unstable misalignment as well as speed. The nineteenth century—including even a placid reader of law-bound instability such as Mary Somerville—tells Roemer’s story of parallax to dramatize not only speed but disynchrony and virtuality.

Olaf Roemer calculated the time of the moon’s revolution by watching it move round the front of the planet Jupiter, plunge into Jupiter’s shadow, and re-emerge, correctly reasoning that the period between the two successive lightings up of the moon gave the time of revolution (42 hours, 28 minutes, 35 seconds). When the moon, as Tyndall put it, was an ‘unpunctual’ 15 minutes late, six months on, however, Roemer reasoned that the difference resulted from the alteration of his own position as observer at the furthest point of the *earth’s* orbit away from Jupiter, and that the light required fifteen minutes to travel from his first to his present place of observation. He thus possessed the data he needed to calculate the astounding speed of light for the first time.⁴⁹

Jupiter’s moon only ‘appeared’ to be ‘unpunctual’; ‘the moment when he [Roemer] remarked the disappearance of the satellite was not always coincident with the instant when it *really* [my italics] took place.’⁵⁰ The ‘same instant of absolute time’ is marked ‘to all the inhabitants of the earth’ when the beginning or end of the eclipse of Jupiter’s moon takes place, Mary Somerville wrote.⁵¹ But it is not the same time to inhabitants at different parts of the earth. Thus, quoting Bacon, she remarks that there is ‘a true time and an apparent time’. And by the same logic of parallax there is a ‘true place and an apparent place’ as well as time (p. 32). Moreover, as a result of the time taken by light to travel to the earth, our own positions as observers on the moving earth itself are continually altering and as it were ‘falsifying’ sense data. Thus the senses are always in ‘error’, as Somerville remarked. Or, as it was put, light itself is ‘aberrant’. We ‘refer Jupiter to a place in which he is not . . . In consequence of the aberration of light, the heavenly bodies seem to be in places in which they are not’ (p. 31). We see Jupiter by means of rays that left him 15 minutes before, but during that 15 minutes our own positions have changed by reason of the earth’s motion in its orbit. ‘Hence the stars, the sun, and planets, all appear removed from their true place in the direction in which the earth is moving,’ Herschel wrote.⁵² Tyndall illustrated the ‘astounding’ velocity of light and its ‘deflection’ by the earth’s motion by rapid movement through a rain shower falling vertically that will ‘appear to meet us’.⁵³ Later he invoked the speed of modern technology, a rapidly moving train against which

vertical rain drops appear to fall slantwise. 'The moment the train begins to move the rain-drops begin to slant, and the quicker the motion of the train the greater is the obliquity.'⁵⁴

The speed of light connects the seer with the abyss of time, for the spectator looking out through the telescope's lens into the universe sees the ancient light of the stars, not as they are now but as they were aeons ago when the light we see began its journey to the earth. The spectator looks deep into the past of prehistory, but the lens of the telescope ensured that it is a past mediated through aberration. The popular dissemination of a spatio-temporal sublime in the nineteenth century carried with it something new—the notions of *appearance* and *aberration*, tied to a perception of *ungroundedness*. A perceiver in motion whose perception is always after the event of a cosmic system in motion is in a condition where visual correlations are always apparent. Thus the transformation of a stable Newtonian order into a Herschelian universe of flux 'founded' on ungroundness was a principle of nineteenth-century astronomy, as William Herschel's son recognized. 'Could a spectator exist unsustained by the earth, or any solid support, he would see around him at one view the whole contents of space—the visible contents of the universe: and, in the absence of any means of judging their distances from him, would refer them, *in the directions in which they were seen from his station* [emphasis added], to the concave surface of an imaginary sphere . . . he would have no warrant for this opinion, any more than for the idea that all were equidistant from him.' John Herschel began his *Outlines of Astronomy* with an account of the 'illusion' created by atmospheric refraction (the atmosphere's 'lens' creating the prolongation of the sun and moon above the horizon, the dilation of the sun and moon at the horizon), and parallax motion.⁵⁵ Almost all astronomy's conclusions, he said, 'stand in open and striking contradiction' to 'what appears to everyone'. Once Tobias Mayer had divined the perspective nature of the solar system (confirmed by William Herschel) by comparing its bodies to trees to the eye, 'separating in front and closing up behind', we exist in a universe plotted by shifting relations. 'It is a matter of daily experience that two objects situated at different distances, seem to a beholder in motion to move relatively to each other.'⁵⁶

'There it was—the patch of rainbow light on the pavement transmitted through a lamp in the shape of a star.' George Eliot brilliantly condenses the connections between stellar space, the spectrum, and the magic lantern's images here. The protagonist of *The Lifted Veil*, has, unbidden, a premonitory image of Prague, as if of a 'dissolving view' from a magic lantern show, a city which he has never seen. He comes upon the 'original' of this transmitted image, visiting Prague for the first time, with a sick sense of recognition. The questions generated by optical experience

associated with the primal scenes of the Newtonian spectrum and the paradoxically normative illusions of astronomical parallax are latent in his exclamation. The dissolutions of the dissolve, and the shifting, indeterminate nature of the nebulae, typify the ungroundedness existing at the core of perception. They generate three questions, the subject of the next chapter. What is colour? What is an image? What is a 'view'?



11

Dissolving and Resolving Views

From Magic Lantern to Telescope

The problems of the dissolving view and the nebulae run parallel. Whether the inchoate matter of the nebulae could be ‘resolved’ into stars, and how the ‘dissolve’ of a view comes about, raised interconnected questions that crossed the effects of the magic lantern and the telescope. They go to the core of glass culture. What is colour? What is an Image? What is a ‘View’, in the context of the lens? These three questions are responses to the ungroundedness precipitated by the ‘primal scenes’ of optics and astronomy discussed in the last chapter, and manifestations of it. They circulate in popular accounts of optics and astronomy. They arise not only from epistemological readings of the lens but from the pressure of sensory experience and the felt complexity of seeing. I pose each of these questions and the series of answers they generated in sequence. How colour makes strange but yet ties us into the world, is the concern of the first question. How the light-image, non-material but hyper-intense in its appeal to the eye, can free itself from the irreality of appearance, is the second problem. Lastly, a ‘view’ is a double-sided thing, intimating the unstable nature of seeing and the thing seen. This is where the intellectual problems of the dissolving view and the nebulae came to a crisis. It was a crisis for nineteenth-century modernism, as different accounts of the meaning of viewing and of the nebulae themselves were violently fought out and highly politicized.

The poets’ responses to colour, the image, and the ‘view’ follow each question and answer cluster. They do not, of course, exactly replicate the ideas, but come at them athwart, indirectly and obliquely, remaking ideas and extending glass culture in unexpected ways. This is a long chapter because the dissolve and the nebulae raise questions underlying all forms of lens-made image. Two shorter chapters, on micro images, follow, and a coda on the non-cinematic image concludes this final part.

What is Colour?

Colour is Appearance. It is Non-intrinsic

It is a function of an object's capacity to absorb some portions of light and reflect others—green leaves are not green in themselves but reflect green, the poppy absorbs green and reflects red. Different reflective capacities transform: the 'yellowish tint' of the magic lantern's artificial light meant that in order to create a 'natural' colour, colouring itself had to be aberrant. Sky must be a *dark* blue, trees and grass a 'bluish green', the reds 'never shaded with blue'. Purple simply becomes a *neutral tint*, the blue and red comprising it disabled.¹

The optic nerve responds to an almost inconceivable series of undulations that pass through the pupil every second, a series 185,000 miles long. 'Colour, in fact, is to light what *pitch* is to sound. The pitch of note depends solely on the number of aerial waves which strike the ear in a second.'²

Ethereal bands of colour spring into meaning as signifiers of invisible chemistries. The sun, a massive incandescent globe of burning matter over 92 million miles from earth registered itself in the ideal and irreducible colours of the spectrum. The spectrum of the sun's photosphere became a standard against which different stellar and planetary compositions reveal themselves, so that a solar-centric universe 'artificially' regulated relative spectra. A kind of transcendent materialism is made possible.

Colour is Dialectical

After-images—green displaced by red, blue by orange, white by black—fascinated the Newtonian theorists of 'official' science, based on the 'law' of complementary colours. David Brewster studied the 'red fatigue' of the eye that calls up green and speaks of training the eye to move from a window to a dark wall, 'where the observer will see a picture of the window, in which the dark bars are white and the white panes dark'.³ Goethe was also fascinated by the spectral after-image of the window, but he, and Schopenhauer after him, absolutely repudiated the positivist Newtonian spectrum and the empiricism of classical optics.⁴ After-images are not the phantom supplements of seeing theorized by lens-based empirical readings but the robustly formative elements of vision. For Goethe the eye in a state of *activity* generated the contrary image. He repudiated the lens (but he would use a prism) and worked with the immediate drama of light and shade and the transparency of common glass to the naked eye—'transparency itself', he remarked, 'is already the first degree of the opposite state', opacity (p. 61). Above all the transparency of the common window was an optical laboratory. 'In the act we call seeing, the retina is at one and the same time in different and even opposite states' (p. 5). The intensity of

darkness and the intensity of brightness can coexist—light and dark ‘seen at the same time produce the same states together which light and dark occasioned in succession’ (p. 6). That which is successive, can coexist with the simultaneous. Red can call out its answering opposite, green, as an alternating after-image, but after-image and prior colour can appear at once: ‘After a little practice the two opposite colours may be perceived at once, by causing the floating image to fall on the junction’ of two black and white planes (p. 18). One colour ‘already pre-supposes’ the other. The after-image, the halo effect, can occur when its prior stimulus is still present to the eye—both impressions remain, ‘even when the external cause is removed’ (p. 7). The after-image, projected forward as a consequence of visual impression, and backwards as a moment of recapitulation, is foundational for Goethe’s argument about the rapport between body and light and the necessary creativity of the sensoria in perception. Schopenhauer’s idealism went further than this: colour is a faculty of the eye alone; the retina is permanently polarized, each extreme seeking the other.⁵ These idealist theories were technically wrong, but they emphasized the *responsive eye*, dealing with opposites.

Proctor (who wrote *The Spectroscope and its Work*, 1877) imagined a cosmic dissolving view of dialectical colour, a dance of alternation between double stars, suns orbiting round suns. (These paired entities attracted attention because it was thought that the parallax of double stars held the clue to the distance of astronomical bodies.) If double stars, compositionally alike, shine through coloured vapour, the arrangement of dark lines in an orange star cuts off the blue part of the spectrum, and a blue star cuts off red and orange. In the systems of double stars, orbiting round each other, there is a quadruple alternation, a double day with both suns above the horizon, consecutive single days when each of the suns is above the horizon alone, and finally true night, when both are below the horizon.⁶ ‘The blue sun would, in fact, rise before the orange sun had set. Thus there would be orange day as before, but towards orange sunset there would be two suns, the orange sun nearing the west, the blue sun passing over the eastern horizon. Then would come orange sunset and blue day; but the blue sun would set before the orange sun rose, and there would be therefore a short night, though no doubt not a dark night, since there would be blue twilight in the west and orange twilight in the east.’

Colour is Transitive

The most minute and ordinary drop of rainwater becomes a lens and explains the rainbow in terms of the transmission of colour: it was the transparent vehicle of dioptric and catoptric drama; ‘A beam of solar light, falling obliquely on the surface of a rain-drop, is refracted on entering the drop; it is in part reflected at the back of the drop, and on emerging from

the drop it is again refracted . . . The rainbow is in fact a spectrum, in which the raindrops play the part of prisms.⁷ C. W. Whall rejoiced in the lyrical transposition of 'faint flushes' of rainbow colour projected from the stained-glass window to the floor: 'pearly white . . . purple bloom and azure haze, and grass-green and golden spots'.⁸ 'Rackwork slide, with Rainbow effect', the Negretti and Zambra slide catalogue reads:⁹ In his preface to his translation of Goethe's theory of colour, Charles Eastlake reminded readers of Aristotle's remark that no painter had achieved a convincing representation of a rainbow—the magic lantern did achieve it. Goethe describes sunset on the Harz mountains as if it were a dissolving view of transitive colour: the sunset gradually displaces the 'shadows tending to violet' 'owing to the yellowish hue of the snow', shadows that 'might now be pronounced to be decidedly blue', and the sinking sun 'began to diffuse a most beautiful red colour over the whole scene around me, the shadow colour changed to green, in lightness to be compared to a sea-green, in beauty to the green of the emerald'. A grey twilight and, 'by degrees', a clear moon and starlight night superseded the scene.¹⁰ The multiple effects of interacting light fascinated him. The light of the moon and the light of a candle making a double shadow can be got to change the colour of each other's shadows, the candle-illuminated moonlight a 'red-yellow', the moon-illuminated candlelight 'the most beautiful blue'.

Colour is Passional

'A beautiful greenish-blue colour, a full and intense tint . . . [not the] bluish' colour of Lyra, but 'between Indigo-blue and . . . Green'. From the Cape Colony John Herschel described the colour of a planetary nebula to his aunt, Caroline Herschel, inventing a vocabulary to register uniqueness with scrupulous delight.¹¹

But it is red that dominates this century.

Turner's paintings are like dissolving views: he has modified his passion for red, but Turner's 'genius' is still that of a sick poet's dreams, this ambivalently serious and satiric account affirms, taken in spite of itself with the 'strange blending' of reds with other colours.

There are glimpses of bright conceptions in them, not indeed distinctly discernible, yet they may be so perhaps to himself. They are like the 'Dissolving Views', which, when one subject is melting into another, and there are but half indications of forms, and a strange blending of blues and yellows and reds, offer something infinitely better, more grand, more imaginative than the distinct purpose of either view presents.¹²

Ruskin defended Turner's passional redness. In a surprise gesture (in 'The Truth of Colour' in *Modern Painters*) he asks his reader to imagine displacing Turner's 1842 painting of Napoleon in exile with 'an opening

Figure 67
J. M. W. Turner's
dissolving view: *The
Exile and the Rock
Limpet*, 1842



in the wall' of the Academy, replacing the painted sunset with the drama of a living tropical sunset, effectively displacing the picture with a dissolving view. Through the picture-sized aperture would have 'been poured the full glory of a tropical sunset, reverberated from the sea; see how you would have shrunk, blinded, from its scarlet and intolerable lightnings! . . . The stormy blood-red of the horizon, the scarlet of the breaking sunlight, the rich crimson browns of the wet and illumined seaweed.'¹³ Actual red light blinds, but *imaging* the blinding red light sets passionate light free. The painting's light in transition occupies the critical caesura of the dissolve. The transitional moment is a critique of the 'privileged moment' of Napoleonic power. Napoleon is deliberately set against sunset light in transition, painted with a mobility that mocks the reduced, static figure. It is air and 'space blended', 'radiant', 'glowing, absorbing light'. Light dissolves the small, isolated figure of defeated power. Its freedom comments on Napoleon's disempowerment, his shadow larger than he.

Vesuvius lantern slides meant the art of managing redness, managing catastrophe projected through a brilliant beam of light, whether made by argand lamps or cylinder-fed hydro-oxygen limelight. Consider a single 'Rackwork' slide of painted, double-layered glass: one layer of glass is painted to represent the blackened crater. The other is delicately brushed with vermilion, crimson, and orange flame, accompanied by billows of grey-black smoke. A protruding handle ratchets a toothed disk which moves the incandescent glass upwards. Indeed, the flame can be made to rise and fall by moving the ratchet back and forth to rotate the disk in order to create the effect of preparatory surges of flaming matter. The double translucency of the plates creates volume in both smoke and lava.¹⁴



Figure 68 Two magic lantern slides showing dissolving views of Napoleon

Another pair of slides portrays 'Vesuvius Empty', a painted slide of many-layered gradated greys and blacks, so that the eye must distinguish between blacknesses, and 'Vesuvius in Flames', a second scene of violently contrasting incandescent reds, where the eye distinguishes between reds.¹⁵ Techniques of producing multiple effects of light and methods of painting flame and lightening on glass are a constant preoccupation of lanternists.¹⁶ A paper and tissue protean view of Vesuvius displays a calm, pallid mountain scene when front-lit, and, when backlit, becomes incarnadine, a fiery sea reflecting the lurid red of the mountain, dark masses replacing pallid forms.¹⁷ The spreading lights doubled in the water replicate the extended repercussions of volcanic energy. There are no victims, but their absent blood is there in the colour reflected back to the mountain.

The century was seeking the apotheosis of redness, an eruption of colour. For Goethe red subsumes all other colours. It is the supreme colour. His passional account of colour begins with a glaring after-vision from a forge fire in the dark turning green in the light, the 'flame-like' corona of poppies in twilight, the green spectra of a red peony, the blue spectra of an orange marigold.¹⁸ The body's reciprocity with light, the eye responding to its affect, constitutes the visible. The 'eye sees no form, in as much as light, shade and colour together constitute that which to our vision distinguishes object from object, and the parts of an object from each other. From these three, light, shade and colour, we constitute the visible world' (p. li). Red burned on the retina by the light of the sun, red deepening in a cardinal's robe, is nevertheless an 'unquiet' and 'restless' colour (p. 313), even though pure red 'from its excellence' was re-named by him 'purpur' (p. 279). Red is the union of opposites, the 'reddish' aspect of yellow and blue, the colours nearest to light and shade respectively. Extremes of pleasure and pain meet in it. 'We are to imagine an absolutely pure red' (p. 313). This is the colour of gravitas and power, the colour of terror. A one-sentence paragraph appears towards the end of his account. 'The red glass exhibits a bright landscape in so dreadful a hue as to inspire sentiments of awe' (p. 315). It is no accident that 'antique' red glass, 'flashed ruby pot metal', was urgently sought by glass painters and manufacturers alike in the revival of ecclesiastical stained glass. James Powell of London, and Chance, aided by Bontemps, succeeded in producing one. His rival Hartley was less successful. The *Journal of Design* sought a pure red dye.¹⁹ Swags of red drapery dominated the 1851 Exhibition, as they did in bazaars, and as they do in St Peter's in the famous twenty-second chapter of *Middlemarch*, when George Eliot has Dorothea see them as a 'disease of the retina', perversely intimating menstruation and physical birth at the time as Easter's transcendental rebirth. The power of red prompted Helmholtz to hazard that the mind posits a purer red than any seen

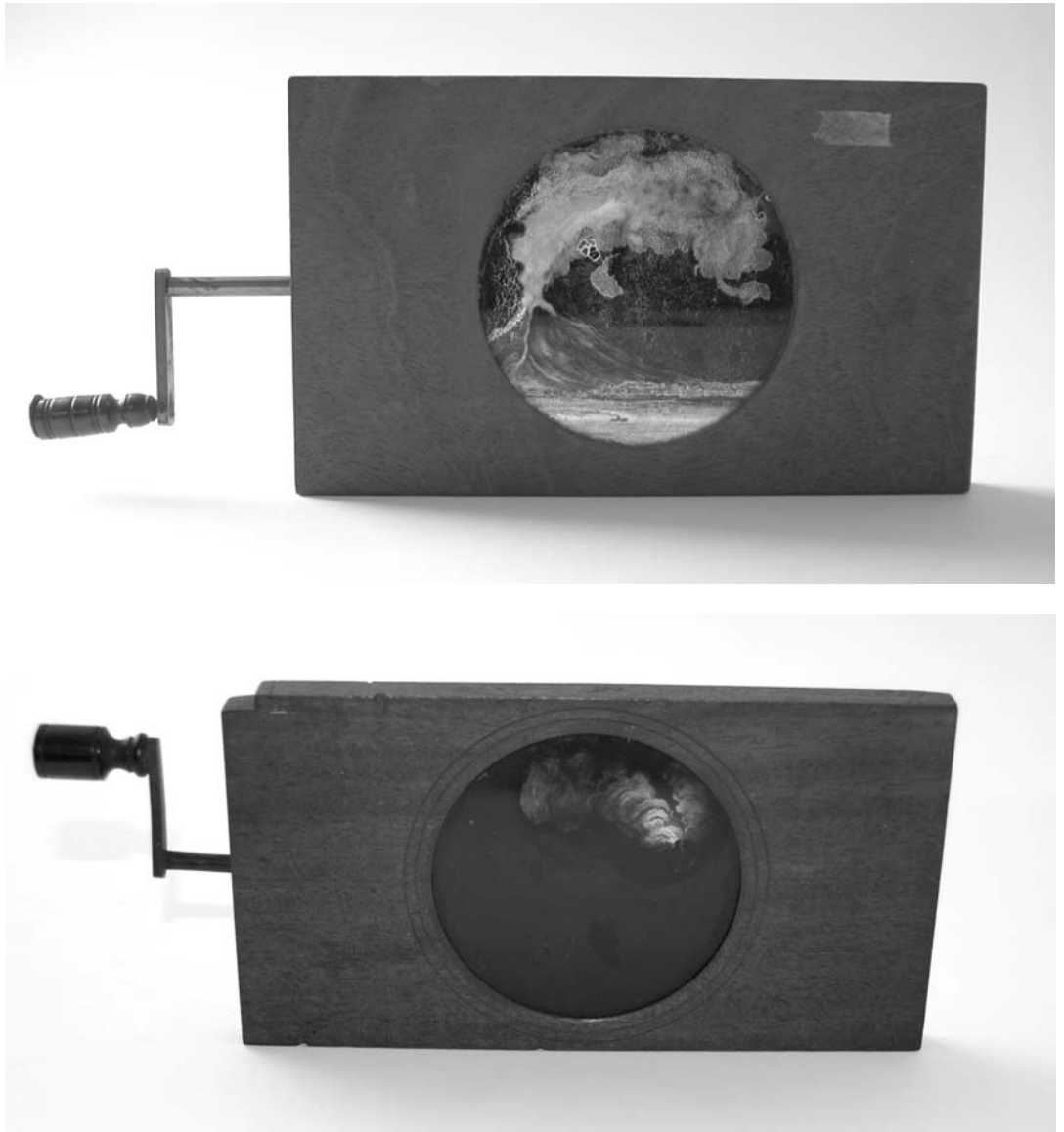


Figure 69 Rackwork dissolving view lantern slide: Vesuvius in eruption and quiescent

red.²⁰ Following him Merleau-Ponty chose red as the colour most exemplifying the intensity of the visible—‘this red under my eyes is not, as is always said, a *quale*, a pellicle of being without thickness... it emerges from a less precise, more general redness’.²¹ Red for him is a concretion of cultural and personal memory emerging from ‘a punctuation in the field of red things’, drawn from ‘the depths of imaginary worlds’, a junction or crossing ‘between exterior and interior horizons ever gaping open’ (p. 132). The ‘gaping’ volcano brings forth redness as death and creation.

Colour: Choric Lyrics

Christina Rossetti celebrates the non-hierarchical plenitude of self-luminous coloured stars—‘Differing all in majesty... Ameythystine, roseate, | Golden, silvery, glowing blue, | Hueless and of every hue’ (‘The Song of the Star’, ll. 44–8). Gerard Manley Hopkins’s spectacular scientific lyricism invokes spectroscopy in ‘That nature is a Heracleatean Fire’: ‘Million-fueled, | nature’s bonfire burns on’. Nature’s bonfire is ‘fuel-led’ and burns on millions of fuels, as unique forms of light individuate every star. But it is red that leads to the intensity of poetry’s chromatism.²² Red partakes of the hyperactive intensity of images painted on glass seen by Goethe—it is the optically advancing colour of the spectrum.

Mountain pinnacles are ‘sunset-flush’d’, the West red with a ‘charmed’ sunset (Tennyson’s ‘The Lotos Eaters’, ll. 17, 19); ‘As the flush of a Morning Sky, | As a Morning Sky colourless’ (Christina Rossetti, ‘Mirrors of Life and Death’); the day of Browning’s *Pippa Passes*, ‘Boils, pure gold, o’er the cloud-cup’s brim | Where spurting and suppressed it lay... forth one wavelet, then another, curled, | Till the whole sunrise, not to be suppressed, | Rose, reddened, and its seething breast | Flickered in bounds, grew gold, then overflowed the world’. Transient colour is not a permanent property of these skies, which quiver with endowed chromatic intensity, always on the point of calling out a change of light. Yet passionate colour signifies: it is how we ‘know a man, a road...’; for Browning the magic lantern’s popular spectacle enables the revolutionary possibilities of projection as Pippa critically projects her identity into ‘Whate’er I please’ of the town’s more privileged groups of citizens. For Felicia Hemans the red sunset projected ‘pouring’ onto Arabella Stuart’s cell wall makes time visible as liquid and intensifies the physiological action of her own blood: her heart ‘throbb’d’ in anticipation of release. ‘Sunset! I tell each moment. From the skies | The last red splendour floats along my wall, | Like a king’s banner! Now it melts, it dies!’ (‘Arabella Stuart’, ll. 77–9). Heraldic power and her own heart’s blood come together through redness, and remind us that the threat of her bloodline to the existing monarchy is the reason for her imprisonment. The market girls in ‘red cloaks’, the

pages ‘in crimson clad’, that enter the Lady of Shalott’s mirror produce a momentary check as, intimating an incipient democracy, they appropriate the colour associated with power in their hierarchical universe.

Colour prompts buried memory and ambivalent guilt for William Morris’s speaker in ‘The Wind’, which figures a ‘sweeping green’ chair-hanging, and an orange with ‘a deep gash in its side’. The green, by association with a woman’s dress, engenders a reluctant, hallucinatory recall, and memory of a series of seemingly inconsequential actions. The speaker covered and uncovered his lover’s supine figure with armfuls of daffodils, but unaccountably there is an interval: ‘I turn’d my back and went away for an hour’. It is an act of disowned deflowering. ‘Blood’, three times reiterated, was ‘on the very quiet breast’ at his return. The orange’s ‘yellow’ blood earlier calls up, not the redness of blood but the yellowness of daffodils, themselves the displaced sign of violation. This colour, rather like the hallucinatory yellow of dandelions and virgin green grass of Freud’s ‘Screen Memories’, both covers and uncovers the deflowering act. Just as Freud’s intense yellow masks the wallflower yellow of the desired woman’s dress, so orange is only adjacent to the red of blood.²³ In Morris’s case the ‘appearance’ of colour moves disingenuously as a shield, less for desire than responsibility. The constitutive gap (for Freud it can be a female sexual space)—‘I went away. . .’—is separated from the casting away of the daffodils and the discovery of blood, as if some other person has intervened in the gap. The obsessive triple rhymes ask a genuine question. Who did this? Himself or a third, himself *as* a third split self?²⁴

Comment

The protean colour emerging from these accounts, mobile, transitive, self-transforming, erotic, preordains the dissolving view. ‘Children like the way colours shimmer in subtle, shifting nuances (as in soap bubbles), or else make definite and explicit changes in intensity, as in . . . pictures produced . . . by magic lanterns’.²⁵ Following Goethe, Benjamin says that colour ‘marks boundaries’, ‘provides the contours’. It is not a layer ‘superimposed on matter’ (p. 50): it ignores form, ‘dead causal reality’, the regime of the law, but celebrates nuance and surface. It is the expression of ‘pure receptivity’ (p. 51), and visionary exactly in the sense of Goethe’s first category of colour—truly phenomenological sight in its purest form as the body’s creative reciprocity with light. The rainbow refers not to chaste abstractions of physics but to ‘life in art’ (p. 51), and it ties us into the world, unlike the alienated fragmentation of the lens-made spectrum as Goethe conceived it, which for Benjamin would parallel the splitting induced by capital. It is as if the dispersion of the spectrum holds out, not fragmentation, but sensory and intellectual wonder. Here the ‘shifting

nuances' of lens-created colour are celebrated. But Ruskin, who saw colour, *because* of its mobility, as a threat to form, believed it to be a source of 'perpetual confusion and indistinctness', 'changeful and uncertain', confusion and blending of tint'. Green reflections of trees tint the path's grey stone, 'every hair's breadth of polished surface gives a little bit of the blue of the sky'.²⁶ Colour was destabilizing. Robert Browning's famous anxiety that his poems occupied a world of divided, alienated colour in comparison with his wife's 'white light' takes on significance here.²⁷ Colour means, but its meaning is unstable, despite the fixed norms of the spectroscope's colour codes, or differential wave-lengths. 'How do I learn to use the word "yellowish"?' Wittgenstein asked, attracted by colour as a test case for language games, because its shared assumptions were so mysterious. Herschel's 'greenish' nebula comes to mind.

What is an Image?

The Image is Appearance, and Notional

Light accomplishes its own transformations. 'When the sun shines through a small hole, and is received on a white screen... the whole circular spot on the screen is, in fact, an *image* or representation of the face of the sun,' John Herschel wrote.²⁸ A pierced orifice admitting a sunbeam stamps 'a round white image of the sun on a wall', Tyndall similarly wrote, for a series of lectures given in 1877. Solar light creates an image of the sun, but out of solar light itself. 'In like manner the light upon every white wall on a cloudless day may be regarded as produced by the superposition of innumerable images of the sun.'²⁹ Less a transformation than a transposition, the *image* requires no substitution, no translation from one material into another—of flesh to paint, for example—and no human labour of transformation. For all the long history of illusionistic language that clings to experiments with light and shadow, the image derived from light is not mimetic. Hence its wonder. John Herschel believed one could 'feel' through light 'the ultimate molecules'.³⁰ The primordial light of the universe and an inverted image of a candle flame cast on a screen belong to the same realm: 'if a pin-hole in a card be held between a candle and a piece of white paper in a dark room, an exact representation of the flame, but inverted, will be seen depicted on the paper, which enlarges as the paper recedes from the hole'; 'every point in the screen is receiving light at once from every point in the object' (p. 342). Likewise John Tyndall. Inverted images through small apertures (a primitive lens) are 'received upon a white screen placed in the dark room'.³¹

But what was light? What was even a 'ray' or 'beam' or 'pencil' of light? Was light matter or not? Even the definition of a ray of light was notional. Writers *named* as an entity what has a notional existence for the convenience of geometry and language.³² 'The smallest portion of light which we can either stop or allow to pass is called a *ray of light*,'³³ 'Mathematically speaking, a ray is an infinitesimal pyramid', its base the illuminated surface at the eye, its point the luminous source;³⁴ 'The lines of light, or *rays* as they are called'.³⁵ So light had to be manipulated in experiments that depended on vision for verification.

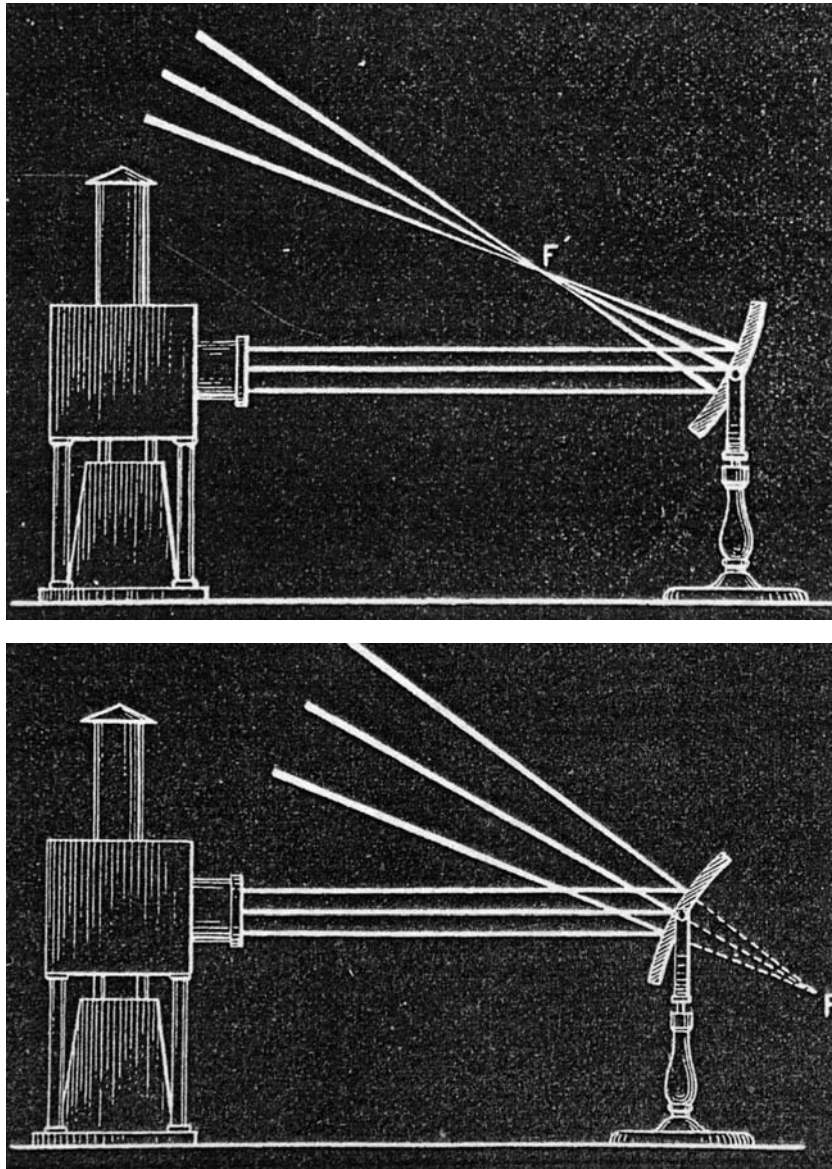
At this stage it was possible to hold different accounts of the unseen agency of light, from its corporeality as particles (David Brewster), as immaterial wave vibrations propelled by the material ether (Mary Somerville), or as wave movements that were nevertheless matter (Tyndall). Clerk Maxwell's electromagnetic theory of light, though formulated by 1864, and theorized by Michael Faraday in 1846, was fully integrated into accounts of light in popular treatises only at the end of the century.³⁶ Tyndall would only term light a 'something' at the start of his *Notes on Light*, and only in his conclusion described it as 'a mode of motion'.³⁷ Light must be understood by its 'effects', he wrote categorically (p. 71). Herschel called light a 'communication' and defined it tautologically as 'a certain state, which we express by saying it is *luminous*'.³⁸ The important element to be borne in mind is that, as Tyndall said, we have to 'picture' an unseen universe.³⁹ In order to grasp its abstract nature analogies had constantly to be found in matter. The flattening, counteractive movement of waves when propagated to overlap, was replicated in experiments with light, where the ensuing blocking effect of 'interference' ('two lights . . . produce darkness', as John Herschel put it) was taken to prove the undulatory theory, as particles would not behave in this fashion.⁴⁰

The Image is Known by the Geometry of Displacement

The lens and the mirror, the virtual and the real, reflection and refraction, these are in constant play in geometrical expositions of the lens and the image. Rays of light were assumed to be the equivalent of geometrical lines, diagrams in the making. Thus reflection, the rebound of light from a surface at the same angle at which it falls, and refraction, the transmission of light slowed down, and thus deflected, by entering a lens (or any medium, such as water, whose density is greater than the air), were always demonstrated through abstract models. A lens collects rays of light. It brings them to a point of intersection, or focus, if it is a convergent lens: if it is not it scatters them. Countless expositions set up linear illustrations of light's action, sometimes humanizing it by realistic picturing, sometimes

Figure 70

Two diagrams from Silvanus Thomson's *Light Visible and Invisible* showing the point of focus in a concave and convex mirror



abstracting it with a mesh of geometrical threadlines, sometimes compromising between the two, as in Thompson's elegant demonstration of virtual and real images, tracking beams of light from convex (virtual image) and concave (real image) mirrors.⁴¹

It is a law of optics, Tyndall said, that the object and the image could change places with one another, but of course, forever alienated, they cannot.⁴² At issue are the peculiar kinds of displacement associated with the real and the virtual image.

A 'real' image: an inverted image of an object formed by a convex lens brought to a focus, Herschel said, can be examined either with a magnifying glass or a microscope, and

received on a plate of glass emiered on one side, [and] the picture may be seen by an eye placed at the other side of the glass, as well as by one in front of it . . . and in this latter situation the emiered glass may even be removed altogether, and the image will still be seen, and even more distinctly, as if a real object stood in the place in all respects similar to the picture . . . the painting remains as if suspended in air.⁴³

Why a 'real' image? This, Brewster explained, is formed by the actual union of rays in a focus. The rays that form the image cross one another and diverge from it 'exactly in the same manner as they would do from a real object of the same size and brightness' placed in the position of the image itself. Such an image is capable of acting as if it could be exchanged for a real object at the intersection of crossed rays and reciprocally producing intersecting rays in its turn. The image of any object formed by the actual union of rays in a focus 'may be regarded as a new object'. And 'by placing another lens behind it, another image of the image' would be formed 'exactly of the same size and in the same place as it would have been' had the new image 'been a real object'.⁴⁴ Though of course, this second image would have been inverted again, and would therefore be erect.

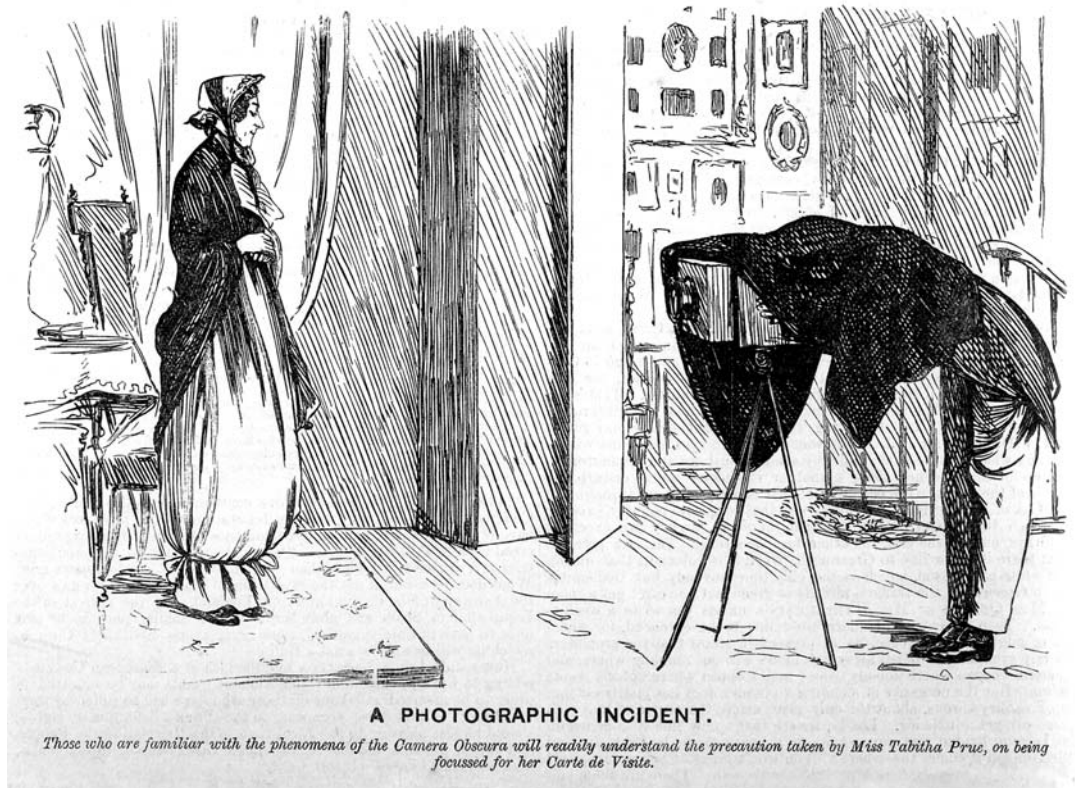
The real image is free-standing, formed in the air, can be seen from either side, can behave exactly as if it is a self-luminous object, but is inverted and spectral. Moreover, the image of the object can be thought of as a *new* object, the image of the *image* as a new object, despite the infinite regression of replication.

The image in a plane mirror arises from another form of defamiliarization, a form of *as if*. 'The rays enter the eye *as if* they came from an object behind the mirror.'⁴⁵ 'Draw a line representing the section of a plane mirror,' Tyndall wrote; 'place a point in front of it. Rays issue from that point, are reflected in the mirror, and strike the pupil of the eye. The pupil is the base of a cone of such rays. Produce the rays backward; they will intersect behind the mirror, and the point will be seen *as if* it existed at the place of intersection' (p. 10). Though its virtuality can be reflected—mirrors can reflect mirrors—the plane mirror image is immobile. It is the mirror that reflects light, not the image. The image does not behave as if it is an autonomous self-luminous object. The 'perfect polish' of the plane mirror's patina, John Herschel thought, created a perfect image. Yet it creates a space of obliquity, where objects are matched but reversed—as Alice calls it, 'the things go the other way'.⁴⁶ The curiously finite inaccessibility and hard-edged remoteness of the mirror image, in which the silver



Figure 71
Two illustrations of reflection and refraction in a popular text: 'The effects of plane mirrors', 'The reversal of real images', F. Marion, *The Wonders of Optics*





sheen of the mirror becomes a barrier, is accounted for by the nature of virtuality. Objects appear *in* the mirror at exactly the same distance as they are *from* it, perfectly duplicated, but in a space absolutely incapable of being entered. This optical bar on entry is a powerful scopic taboo. Foucault, we have seen, thought of the mirror as a heterotopia. Lacan quoted Aragon's lyric spoken by the hapless mirror, its images impersonally determined by light—twentieth-century accounts recapitulating nineteenth-century physics.⁴⁷ The real and the virtual image produce a different kind of desire. The mirror image's silvery, almost lethal completeness and containment, the incandescent radiance of the real image, can call up different forms of longing, the one an inaccessible, the other an alternative world. One freezes, the other mobilizes the image into unceasing self-reproduction untethered from an original.

The Image is Mobile

Images formed 'in the air' can be moved by projection onto a screen.

Images can be moved by adjusting focus. The image can be made larger or smaller at will, simply by overriding the principal focus, and bringing the object closer to or further from the lens—an expanding and contracting

Figure 72
 'A photographic Incident. Those who are familiar with the camera obscura will readily understand the precaution taken by Miss Tabitha Prue, on being focussed for her Carte de Visite', *Punch*, 1863

Figure 73

John Herschel's simplified diagram of a refracting telescope. A is the object glass, B and C the eye-piece and convex lens, E is the Object and ϵ is its image at the point of focus



world becomes available, distending, and miniaturizing, gigantesque or diminished, at will.⁴⁸

It is always possible to alter the apparent magnitude of an object, Brewster argued. We can scrutinize a man's 'very eyelashes' (p. 48). The longer the focal length of a lens the larger the image. If a convex glass with a focus of 25 feet is placed equidistant between the eye and a man 100 feet away, the inverted image of the man will be formed 50 feet behind the lens. 'If this object is looked at by the eye, placed 6 or 8 inches behind it, it will be seen exceedingly distinct, and nearly as well as if the man had been brought nearer by the distance of 100 feet to the distance of 6 inches . . . his apparent magnitude is greatly increased, in the proportion nearly of 6 inches to a hundred feet, or of 200 to 1' (p. 49). Explaining the principles of the refracting telescope Herschel demonstrated how a convex lens of short focus controlled the 'immaterial' image so that 'objects may be seen distinct, and magnified to any extent we please'.⁴⁹

Miniaturization and maximization changed seeing, whether in the domestic room or the realm of spectacle. Convex mirrors are principally household ornaments, 'characterised by their property of forming erect and diminished images of all objects placed before them, and these images appear to be situated behind the mirror'.⁵⁰ The convex mirror brings before the viewing subject all the objects of a reassuringly miniaturized interior—and miniaturization within that miniaturization. On the other hand,

Concave mirrors are distinguished by their property of forming in front of them, and in the air, inverted images of erect objects, placed at some distance beyond their principal focus. If a fine transparent cloud of blue smoke is raised, by means of a chafing-dish, around the focus of a large concave mirror, the image of any highly illuminated object will be depicted, in the middle of it, with great beauty. A skull concealed from the observer is sometimes used, to surprise the ignorant; and when a dish of fruit has been depicted in a similar manner, a spectator, stretching out his hand to seize it, is met with the image of a drawn dagger, which has been quickly substituted for the fruit at the other conjugate focus of the mirror. (p. 265)

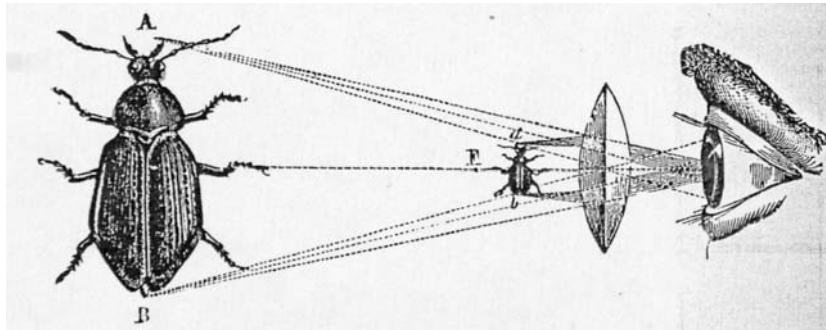
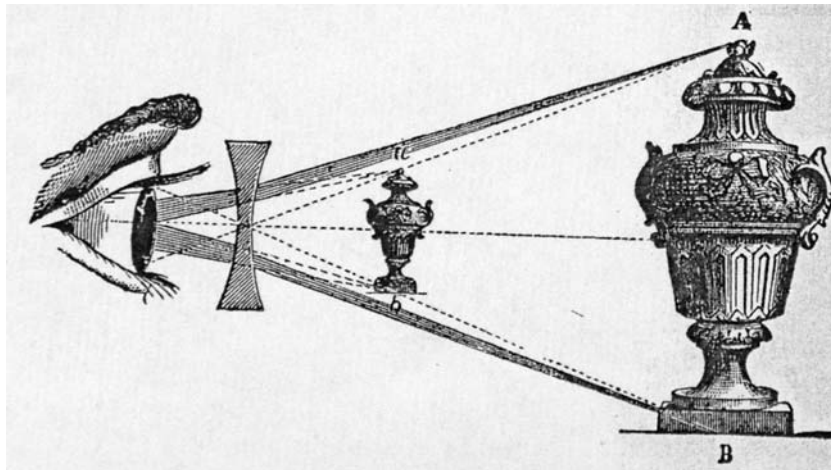


Figure 74
Two diagrams of the
expansion and
contraction of the
image, *The Wonders
of Optics*



The Image: Choric Lyrics

In Charles Dodgson's farcical 'Phantasmagoria' a ghost can punningly fill up a 'vacancy', take a job, and occupy a void, as indeed the modern lantern image does. What it means for a ghost to materialize in modern culture is the question: materialism needs the supernatural in order to fill the void it has created and markets it. Hardy *requires* ghosts for altogether different reasons. His poems are filled with phantasmagoria: they are the repressed of history, revenant figures that belong to the optics of memory. 'Souls of the Slain' (1900) figures a troop of phantasmagoria as the slain from the Boer War, where substanceless memory of the dead becomes a war crime. The phantasmagoric dead are 'night-moths of measureless size', who alight on Portland Bill like migrating birds from South Africa. Backlit by the lighthouse, 'on the ledge by the turreted lantern', they are 'A dim-discerned train', spectra derived from the backlit lanterns of earlier spectacle. True to the unbound images of the phantasmagoria they are 'sprites without mould, | Frameless souls none might hold', 'frameless' because neither history nor the present can contain them. They have returned to seek

recognition as heroes. But *their* misprisions meet what *they* see as aberrant memories in those who have remained behind, mutual refractions oblique to one another. Some die a second death in despair, like the suicide of cultural memory.

Is an image a 'new' object even when it is an image of an image, a reflection of a reflection? Incandescent (he 'flamed', 'sparkled', 'glitter'd', 'burned') Lancelot makes an incendiary assault on the Lady of Shalott's mirror, bringing the trauma of solar light into her dark chamber. Flashing into it 'from the bank and from the river' his *inverted* image suggests the 'real' image that behaves as a self-luminous object and is thus self-renewing. (Mobile, he has the power of moving away from the mirror's field.) The world outside the mirror is an environment of inverted images: 'Little breezes dusk and shiver | Through the wave'. Breezes 'quiver' in the willows and aspens and secondarily through their inverted endlessly propagated images in the water. Water waves, we know, become analogies for light waves. But the violent immediacy of the radiant image seems incapable, in a pun on reflection, of the *meditation* or power of reflection, available to the Lady in her dark chamber of virtual mirror images. 'I am half sick of shadows', she says. She in her turn questions the status of the virtual image and the agency it affords her. Duplications, suggesting duplicity, formally structure the poem from its rhythms to its rhetoric, as if the Lady and Lancelot are caught in a double world. The mirror is slavish, Kierkegaard, Tennyson's contemporary, has a seducer jealously say, of the mirror that reflects his lover. It can grasp an image of the loved one only through distance, by separating the image and its object. (Though nevertheless it provides a perverse justification for the lover's desertion of the physical immediacy of the desired body.) Elsewhere, in another text, *Repetition*, his protagonist enters exactly duplicate rooms, which have 'the effect of seeing one room doubled in a mirror', except that one is lamplit and the other moonlit. He becomes strangely absorbed into virtuality himself as he views through the window the 'shadows' of pedestrians, caught in reflections.⁵¹ Both writers pose the question of virtuality, and connect the unreachable image with desire.

Rigorously, in 'Mirrors of Life and Death', Christina Rossetti follows the logic of the 'shadows' of the 'mystery' of Life and Death, seen as they 'pass', pageant-like, images in the biblical glass of Corinthians that has now become a screen: 'Darkly as in a glass; | Their shadows pass, | And talk with me' (ll. 1-4). The shadows may indeed speak the poem. Paired mirrors reflecting images to infinity must make Life and Death alternately—and repeatedly—substantive and virtual to each other. The fourteenth strophe turns to the anguish of a forest fire: 'this side the flaming fire' is agony, where 'maddened creatures' long for that which might 'assuage desire', and

afford relief. But on what 'side' is 'this side'? 'Fire', 'desire', 'desire', 'fire': the inverted mirror rhymes pair, and signal the possibility of alternation while maintaining the interpretative riddle. Each reading can reflect the other as 'new' substance or shadow but cannot belong to both 'sides' at once.

As a Forest on fire,
Where maddened creatures desire
Wet mud or wings
Beyond all those things
Which could assuage desire
On this side the flaming fire.

Browning catches the image's mobility with Pippa's simple delight in a sunbeam caught in the water poured from her ewer and refracted on to the ceiling—'brilliant bits | Wheeling and counterwheeling . . . grow together on the ceiling!' More sinisterly, the *landscape* moves, a changing phantasmagoria, but the knight does not, in 'Childe Roland to the dark Tower Came'. The knight looks back, the safe road disappears - 'twas gone'. Dante Gabriel Rossetti's 'Rose Mary' strains to keep pace with the lens-made movement of images in a magic stone: 'The road runs by me as I look; | Or it is even as though mine eye | Should watch calm waters filled with sky | While lights and clouds and wings went by.'⁵²

Comment

With colour, the image shares mobility and uncertain status as simulacrum. But, dealing with the unseen, and creating the infinite regression of images of images, it upsets norms of vision. This uncertainty called out a defensive attack on the very notion of illusion. In proportion as the optical world became uncertain, the deconstruction of 'illusion' strengthened. Reason subject to tricks, Kant said, can too often be 'entrapped' into thinking in terms of 'aberrations ever and again calling for correction', whereas they are rational aspects of appearance. The astronomer can never prevent the moon from looming large at the horizon, the sea appearing higher at the horizon than at the shore by virtue of being seen through higher light rays. We *see* like this—we 'represent the objects and the mind, in space and time, as they affect our sense, that is, as they appear'.⁵³ Hence the equanimity of Mary Somerville in referring Jupiter to a place 'where he is not'. Appearance is itself law-bound and deviation works by rules of error, paradoxically normative. Thus John Herschel could assert that astronomers resort to ascertain their exact time, or, which comes to the same thing, to determine the exact amount of error in their clocks, by adjusting to the periodic transits of the fixed stars, which are not in fact

fixed.⁵⁴ Thus Ruskin's condemnation of the *trompe l'oeil* was a moral objection less to the creation of illusion than to a deceiving imitation of appearance—*too* like the real thing—that signalled its intent to deceive. The contemptible pleasure of imitation is that it 'is not what it appears to be', that is, *not* an illusion.⁵⁵ Helmholtz likewise abolished the notion of illusion. Illusions are the result of a visual category mistake, or an imperfect analogy. 'The simple rule for illusions of sight is this: *we always believe that we see such objects as would, under conditions of normal vision, produce the retinal image of which we are actually conscious.*' If more than one interpretation is possible, and we waver between two paradigms, 'a conscious effort of the will' can end uncertainty by bringing the correct interpretation 'vividly' before the mind—a kind of optical pulling of oneself together.⁵⁶

This normalizing of appearance is itself a form of intellectual sleight of hand in which the 'apparent' and the 'true' are passed over one another and thus become reversible. Such is the conceptual after-image of this move that the two terms persist in the mind. Even Kant himself admitted to the apparent/true duality as a 'dialectic' 'inseparable from human reason'.⁵⁷ But such robust attacks on illusion did not do away with the fact that we *do* see problematically. Enigmas will not disappear. Marx, who resolutely kept the two terms in play, keeping phantoms, ghosts, and spectres actively present in his work, recognized that he could demonstrate the illusions of commodity in no other way. He required the contradictions of appearance and truth, materiality and its other.⁵⁸

What is a 'View'?

The 'view' introduces a two-sided problem, the unstable nature of seeing and the thing seen. It is here that the crisis of ungrounded experience is most extreme. The 'view', whether it is the dissolving view or the 'unresolved' telescopic reading of the nebulae, is bound up with the structure of parallax, the experience of multiple change in observer and observed, non-correspondence and misalignment, that became one of the defining problems of nineteenth-century modernism. Latent in readings of colour and the image, their implications emerge unequivocally in the 'view'. To stress the double problem I arrange accounts both of lantern and nebulae round the *Dissolving View* (of the object seen) and the *Dissolving View* (of the subject seeing).

Non-correspondence was foregrounded, because the connection between image and eye that most optical theory presupposed was gradually breaking down. The notion of visual perception as the transposition of a

picture from the retina to the brain was giving place to a semiotics of sight which located the seat of stimulus in the choroid coat or black pigment of the eye. Using the familiar experiment with perforated surface and screen, but forming the light source from two stars brought to a focus rather than a candle (thus bringing optics and astronomy together), Helmholtz demonstrated that 'this light is all derived from the corresponding point in the object, and answers to it in intensity' (p. 136). Likewise the nerve fibre of any individual cone will be excited by 'light proceeding from a corresponding point in the field'.⁵⁹ The light 'of each separate bright point in the field of vision excites a separate impression' (p. 137). It was much more like the registering of chemical reactions to light on light-sensitive paper, as in the photograph, than producing a picture. Millions of separate stimuli are registered as sense data by nerve ends and transmitted to the brain in a form of discontinuous pointillism that requires synthesis, a synthesis that can occur only through the brain's mental act. In fact, the mediated stimuli become signs rather than images.

Helmholtz uses the word 'points' deliberately. A discrete point does not mean outside itself. It can produce no illusions any more than it can be in itself a representation. His theory is a form of physiological Kantianism, a series of phenomenal sense data produced by light that belongs to the world of appearance both before and after it is interpreted. And though it seems to break the relationship between image and interpretation, it ties the seeing subject into the world through the hermeneutics of light and connects her inalienably with the real through its constant *demands* on interpretation.

Perhaps because of the new semiotics, optics displays a fascination with the disappearing object, and the movement of objects from distinctness to indistinctness and back—now it's there, now it isn't, a kind of optical *fort-da*. Shut one eye and concentrate on, say, a pinhead, Brewster directed, and all other objects will be seen indistinctly. 'Let one of these objects thus seen indistinctly be a strip of white paper, or a pen lying upon a green cloth. Then, after a short time, the strip of paper, or the pen, will disappear altogether, as if it were entirely removed, the impression of the green cloth upon the surrounding parts of the eye extending itself over the part of the retina which the image of the pen occupied. In a short time the vanished object will reappear, and again vanish.'⁶⁰ The same thing happens with a black stripe on a white ground. But a candle, such is the persistence of light in the eye, will swell and contract rather than vanishing entirely, becoming a luminous glow. Such vanishing tricks prove that the image on the retina is exact over a small surface—a distinct image will form only when it is directly in the axis of the eye. Try looking between the fingers at a distant object: object or fingers will be distinct and indistinct respectively, but

never distinct at the same moment. The eye cannot see objects at different distances with the same distinctness (p. 252). Or (Tyndall's variant), try looking at print through gauze, and either gauze or print will be distinct but not simultaneously.⁶¹ Demonstrate the blind spot by aligning the eyes with two black wafers on a white ground, closing one eye and looking steadily with the open eye at the corresponding wafer, right to right, say: the left-hand wafer will disappear.⁶²

Ruskin rehearsed these optical experiments with appearance in *Modern Painters*. The eye lives in an 'undecided' landscape, a nature that is never distinct, a 'confusion' of 'spots and strokes'.⁶³ Seeing is a constant adjustment of focus. Far and near can never be seen simultaneously. Your 'friend's face as he is coming up to you' (p. 328) is a series of visual perspectives rapidly coalescing as he approaches. The 'mystery' of distance is that the near and the far can never be seen simultaneously. There is always something in an object, however close, 'which you *cannot* see', just as there is something in a retiring object which you *can* see, but it will not be what you see when it is near.

It is clear that the classical paradigm of the seeing and the seen, subject and object as a stable dyad, cannot be maintained in a context where it is impossible to define a discrete moment of seeing. Thus we can speak, as above, of the 'dissolving *view*' (the object) and the '*dissolving view*' (of the subject).

The Dissolving View of the object: The Magic Lantern

A meteorological sublime persists in the views. Dissolves are reflexively related to the light that itself constituted their being, experimenting with different forms of radiance. The miniature diorama already discussed has six interchangeable skylscapes, ranging from a flushed yellow sky, a storm scene riven with bars of light, and a deep blue night sky and distant moon. Such images, structurally organized by the double rhythm of peripeteia or reversal, form a huge class. A poster advertises the 'Figure of Time withdrawing a Curtain to exhibit the first of a series of Dissolving Views' (preceded by the presentation of humorous objects exhibited through the shadows of the biscenoscope and a demonstration of the gas microscope) —'Sunset', (No. 9) 'The Tower of London', 'Daylight (No. 10), Ditto'— 'Moonlight (No. 11), Ditto, on Fire'.⁶⁴ The Theatre Royal advertised (1827) 'Dissolvent Views', a storm scene with waves in motion and phantom ship, followed by the 'Appearance of a Rainbow'.⁶⁵ Negretti and Zambra's late-century catalogue, on the same page as its Vesuvius slides, offers a 'Landscape.—Three slides, with rain, Storm, Lightning and Rainbow Effects'.⁶⁶ The catalogue also offers an extended sequence where the light trajectory is the same whatever the narrative that carries it. 'The

Emigrant Ship.—Six slides. The Ship leaving Port; at Sea; Full Sail by moonlight; the Storm; Ship struck by Lightning; Ship on Fire; the Raft with Survivors'. Similarly, multiple movement could be produced on fewer slides within the same arc of changing radiances: the three-set 'Rustic Scene' comprised a watermill, in motion with a moving swan, summer changing to winter by moonlight: 'the clouds move, lights appear in the window of the mill, with ripples on the water'. Even one image can produce a latent duality: 'Mount Ararat, with Rainbow effect'.

Not surprisingly, it is Ruskin (exempting the diorama from his condemnation of *trompe l'oeil* because it *was* light, not an imitation of it), who understood transitional light, 'noble passages of light'. He had learned them from Turner. His catalogue of Turner's light effects from morning through to night reads like a sophisticated slide catalogue. His consummate lyrics to Turner's light create the poetics of dissolve.

Observe above everything the varying indication of space and depth in the whole, so that you may look through and through from one cloud to another, feeling not merely how they retire to the horizon, but how they melt back into the recesses of the sky; every interval being filled with absolute air, and all its spaces so melting and fluctuating, and fraught with change as with repose, that as you look, you will fancy that the rays shoot higher and higher into the vault of light, and that the pale streak of horizontal vapour is melting away from the cloud that it crosses.⁶⁷

'Melting': the in-between, the beyond, acting and reacting in a mobile field of vision; figuring transition as well as performing it, figuring the veil as well as materially creating one in the diaphanous surface—this is a transformation scene which is also a dissolution. It is a de-formation and re-formation simultaneously, after-image and prior image, past superimposed on the present, the present on the future. Layers of transparency halfway between appearance and non-appearance, matter and non-matter, the borderline between substance and light; mist, shade, shadows of shade, gleams of light and half-differentiated radiance, this is perceptible *as* the imperceptible. Whether knowingly or not, Ruskin was theorizing the dissolving *view* here, a lightscape of multiple reactions where it is impossible to posit a single view as a single instant. The viewer lives in the moment of contradiction and change, the moment of mediation.

The dissolve's indeterminateness ensures that there are many and contradictory contexts in which it can take on meanings, then and now, from passivity to arousal.⁶⁸ But pursuing whatever reading would mean paying attention to the tensions of the dissolve and its *negotiation*. It holds contradictions within itself, best described as an attempt to produce a synchronic and a successive experience together in a passionate way.

Goethe's 'contrastive' visuality is at work. The after-image appears when its prior stimulus is still present to the eye. It is projected forward as a consequence of visual impression and backwards as a moment of recapitulation. This rhetoric of temporality is the language of parallax. It presupposes a universe in which every element is simultaneously in a state of change. Thus relationships will always occur across two different times and spaces. In the following accounts of volcanic dissolving views a struggle between present participles and past tenses occurs, as the descriptions make an effort to convey both a total diachronic movement and synchronic change among multiple elements in the visual field.

a volcano may be depicted during its tranquillity, with the sun shining on its verdant sides, and surmounted with a gently rising wreath of smoke. Then it may be shown at night, with its crater vomiting flames and red-hot stones, while streams of lava are flowing beneath. By proper mechanism, one lantern may be gradually shut and the other as gradually opened.⁶⁹

In Renoux's 1843 Etna 'the volcano was glimpsed first by moonlight . . . As day broke the whole noble landscape came into view . . . The light increased [to] the full blaze of noon . . . Ominous rumbling was heard . . . smoke . . . belching red-hot lava . . . the lurid glare of the molten fire rushing down the mountain-side.'⁷⁰ In both this and Marion's account, Daguerre's cataclysmic diorama of a landslide evokes a stychomathic series of past-tense verbs, both to evoke succession *and* simultaneous change among the elements: 'First there appeared a smiling fertile valley, its sides crowned with verdure; a storm gradually rose, the rain fell, the wind blew, the lightnings flashed, and the thunder rolled in the distance. Darkness at last closed in, and when the sun once more rose over the valley, nothing was to be seen but a mass of fallen rocks.'⁷¹

The dissolving *view* can be gentle or violent, but it performs a state of 'becoming'. 'Becoming is both arising and passing away', Heidegger said of Hegelian time.⁷² The 'nows' of time are either no longer or not yet, and neither has any priority. A radically perspectival condition of multiple change is required for this account. Perhaps the fascination of the dissolving *view* is its state of contradiction. The desire to tie oneself into the world by negotiating the hermeneutics of light, exploring its interpretative possibilities, is one way of thinking about its lure. The Nebulae show on a cosmic scale what these possibilities were.

The Dissolving View, the Magic Lantern: Choric Lyrics

Tennyson's Lotos Eaters find a land 'In which it seemed always afternoon' (l. 4). But 'Full-faced above the valley *stood* [emphasis added] the moon' (l. 7) simultaneous with sunset, and yet 'all things always seemed

the same' (l. 24). It is a landscape of transition and yet stationary, a view both dissolving and arrested, as several times are superimposed on one another. It is a land of ever deeply recessed inward depths created by multiple layered surfaces, and veiled by waterfalls—the oxymoronic 'slow-dropping veils of thinnest lawn' (l. 11). Repetition keeps things the same and *becomes* after-image with its delayed action—downward smoke, downward smoke, fall, fall, stream, streams, sunset, sunset, three, three. The stream 'Along the cliff to fall and pause and fall did seem' (l. 9). Distant water oscillates to the eye between movement and static immobility. The line oscillates round an almost caesura after 'pause'. This is Ruskin's 'undecided' landscape. Yet 'Appearance' in this *trompe l'oeil* waterfall is of a different order from the normative Kantian, optically enlarged 'Full-faced' moon. For here the eye and mind are forced to shift between two positions as the waterfall dissolves from one aspect to another. This is no category mistake (as Helmholtz would have it) but rather an ontological condition in which the mariners are confronted with contradiction. The alternation of fall and pause *is* what we see. The undecidable, not the decidable, might be the normative experience. The nagging, paralysing question is not, is it an illusion? Rather, for these exhausted, trauma-marked mariners, how do we define appearance, the real?

'[O]ne phantom figure . . . I look and see it there, shrinking, shrinking, | I look back at it amid the rain' (Hardy, 'At Castle Boterel'). The film of an 'air-blue gown' in memory, an image 'in the air' has to be captured in present time ('The Voice'). The poet insists on the actuality of an ideal image to the mind—'let me view you, then'—but it always hovers at the point of vanishing. The *past* is not static, is in a state of becoming, which puts the speaker himself in an excruciating state of awareness of process: 'you had changed . . . Your being dissolved to wan wistlessness'. The extraordinary neologism is a verbal dissolve compounded of different forms of awareness and unawareness, witlessness overlaid with wistfulness, list [as hearing]lessness. Leaves 'falling', a woman 'calling', the poet 'faltering': these like participles relate to the past and the present. The poet's 'faltering' incorporates the dying fall of sonic and optical experience, voice and leaves.

Residual after-effects from a woman's presence shape Browning's 'Love in a Life'. The cornice 'blossomed', the mirror 'gleamed', responding to the brushing of a body or the wave of a feather. But the question which is prior, cause or effect, as each is inferred from the other, puts the speaker in a closed world ('room after room' puns on the camera) until the paired poem reimagines a necessary condition of projection and separation, 'Ever | Removed'. Like paired lantern slides, the earlier poems, 'Meeting at Night', 'Parting at Morning', explore a dialectic of change through the

self-reflexively luminous effects of lens projection and multiple light effects. The climactic ‘blue spurt of a lighted match’ (Helmholtz said blue is the only colour distinguishable in darkness) and ‘two hearts beating each to each’, receive a brilliantly lit and curt reversal, where undimmed solar light creates a ‘path of gold’ to the ‘world of men’. These exhibit two ways of looking at a landscape and implicitly two ways of ‘knowing’ or responding to spectacle. You can be ‘in’ it phenomenologically and sexually, or overlook it. Both poems produce gendered and ideological readings, hosted by the same rhyme schemes and the same syntactic ‘and’ structure. In the first the conjunction is paratactic and present-directed, in the other it is used as a causal particle to endorse the logic of male choice. Do the poems critique or obliterate one another?⁷³

The Dissolving View: The Nebulae

In 1864 Sir William Huggins, using a spectroscope, established that some nebulae consisted of glowing gases. Until then, and even after this, they haunted astronomy.⁷⁴ Classified by their apparent shape (spiral, helix, disk, ring, dumb bell) and not their composition, not differentiated as they are today, their diffuse, luminous masses were a mystery. Were they inchoate galactic matter in process, or could they be resolved into stars?

How to *describe* the Nebulae, mediated through a telescope, was a continuing problem. John Herschel’s terms, in the tradition of the descriptive physics he derived from Humbolt, were often quoted: ‘a curdling liquid’, ‘a surface strewn over with flocks of wool’, the ‘breaking up of a mackerel sky, when the clouds of which it consists begin to assume a cirrous appearance’.⁷⁵ By the same token, he described clouds at the Cape in the same terms as the nebulae: a ‘slowly pouring’ cloud formation ‘dissolving so rapidly as to melt into a delicate gauzy filmy mesh like veil floating, with the most exquisite grace and rounded adaptation to all the greater masses of the Mountain . . . unearthly aspiring fibrous lines and tangled webs’.⁷⁶ The astronomers round Lord Rosse’s great telescope at Parsonstown in Ireland, then the most powerful telescope in the world, struggled to find a shared vocabulary.⁷⁷ They evolved a code: ‘The words “mottled” and “patchy” mean the same thing.’⁷⁸ Rosse followed up this definition by saying that these terms signalled potentially resolvable areas—where nebulous matter could be undergoing a category change by appearing to have condensed into a separate star. Rosse in 1850 represented the nebula as a ‘luminous mist becoming rarer till imperceptible; a gauze-like tissue of the faintest imaginary flocculi, or hairy filaments, which become finer and more scattered till they cease to be visible’.⁷⁹ But as the Rosse team became invested in seeing these luminous films as resolvable stars their terms became more substantial. Lassell’s words, in a

paper of 1867, were relayed by Rosse: 'large masses of cotton wool packed one behind the other, the edges pulled out so as to be very filmy'. Hunter, who executed a delicate delineation of the Orion Nebulae for Rosse, described its formation as 'flour scattered on a grey surface' (p. 203).

'The profundities of the universe haunted him.'⁸⁰ The nebulae, for William Herschel, were in a state of Hegelian 'becoming'. They displayed the universe in a condition of uneven synchronic change, decay and renovation, aggregation and separation coexisting. Some ageing stars were drawing towards extreme condensation in a state of change and dissolution, setting towards decay and creating vast chasms and holes in space as they drew together, some scattered or branching stellar systems were in the unravaged energy of development. It was William Herschel who first classified and documented the nebulae intensively (he first catalogued 1,000 in 1786) because they offered a challenge to any reading of the *depths* or three-dimensional structure of the universe—they might be new universes or phenomena within this one—but they shook the stable frame of Newtonian cosmogeny.⁸¹ A great revisionary thinker who, like Freud, revised his own theories, Herschel evolved three overlapping theories of the nebulae over his career, theories often conflated or misinterpreted by followers. The first was simply that the filmy and evanescent nebulae were *all* stars too distant to resolve. The second (post-1791) was predicated on two discrete forms of galactic matter, nebular vapour and stars. The third (1811) resolved the discrepancy between two orders of matter by proposing that the nebulae evolved into stars. But throughout these revisions he never failed to see the universe as in a state of flux, flux at different stages of dissolution or *formation*.⁸² As De Quincey wrote, transferring these processes to earth, 'If she is not old at this moment, perhaps she *has* been old, and has a fair chance of becoming so again . . . she lies down for death, which perhaps a thousand times she has suffered; she rises for a new birth.'⁸³ The Milky Way is a chronometer marking decline, Herschel said, but to discontinuous temporalities that are not synchronized. He likened the stars to a luxuriant garden, displaying simultaneously all phases of germination and decay 'brought at once to our view'.⁸⁴ With Herschel the idea of the utter emptiness of space can emerge, a universe of waste. 'Terror and chance, cold and fire . . . desolateness' (Ruskin): 'monsters of magnitude without known shape. Such monsters are the voids and waste places of the sky' (Hardy).⁸⁵

Yet it is not the infinity of space and time—what De Quincey called the 'persecution of infinity'—or even the boundarylessness of the nebulae, that was the intellectual problem, but the perpetually changing relations, on a massive scale, between different entities all of which are in a state of change. This meant that the nebulae were inevitably seen from a limited

perspective and *affirmed* a limited perspective as a general condition—for instance, we think of them as flat because we see them only ‘from one side’, Proctor said.⁸⁶ Agnes Clerke made the observation of the Andromeda Nebula that with a glimmering ‘frontier’ more than half as remote from its centre as the nearest fixed star is from earth, variations in luminosity manifest themselves to us simultaneously; but they are successive, registering the light that can take up to six years to travel from end to end of the nebula. Thus ‘our view of the further margin may be of an earlier date than our view of the hither margin by a couple of years or more’.⁸⁷ The coincidence in time to our senses of widespread variations is illusory.

William’s son, John Herschel, writing in the *Edinburgh Review* in 1848, and influenced by Humbolt’s reading of the universe as a dynamic, oppositional, but harmonious interaction of forces, claimed ‘a one and indivisible whole’ from ‘this wondrous world of matter and thought, of object and of subject, of blind force and of moral relation’. Without this ‘Chaos is a reality, Polytheism a truth’.⁸⁸ Writing in *Tait’s Magazine* in 1846, however, De Quincey claimed that astronomy ungrounded knowledge by presenting the ‘equivocal phenomena’ of multiple premises. ‘All these cases of simulation and dissimulation torment the astronomer . . . in many cases, magnitude and distance are in collusion with each other to deceive him: motion subjective is in collusion with motion objective; duplex systems are in collusion with fraudulent stars, having no real partnership whatever.’⁸⁹

On the other hand, while De Quincey ended his article with Jean Paul Richter’s famous dream of cosmic instability—‘above was below, below was above, to the man stripped of gravitating body: depth was swallowed up in height unsurmountable, height was swallowed up in depths unfathomable’—Richard Proctor quoted the same dream affirmatively: ‘End is there none to the universe of God. Lo! Also, there is no beginning.’⁹⁰ But Proctor’s affirmative deconstruction also honoured concurrent perspectives in a universe ‘changing in all parts’, ‘instinct with energy and vitality’.⁹¹ Though the importance of the nebulae in his view was exaggerated, they confirmed, first, the displacement of our earth: ‘The earth, which has been displaced from her imagined central position in space, has been displaced equally from her imagined central position in time.’⁹² Thus he always imagined the displacement of the act of sight, and theorized the act of seeing from an impossible defamiliarized somewhere else, Jupiter’s moons, for instance, from the surface of Jupiter—if its atmosphere of steam has a surface. A creature with enhanced powers of sight would see, with different sensoria, not the past history of stars, not an ‘event’, not the ‘direct and immediate . . . event itself’, but would register only that ‘certain

light-waves have communicated certain impressions to the optical nerve'.⁹³ The sun is a different sun revisited by the same comet. Secondly, the universe compelled the acceptance of two views simultaneously even though one has to be chosen, a radically double vision. 'Both views are just', he said of a history that posed either a developing sun or a dead sun. '[B]oth thoughts may be admitted at the same time.'⁹⁴ The nebulae presented a 'choice of two views'.⁹⁵

The Dissolving View: The Telescope, Choric Lyrics

The stars, caught in the toils of the nebulae, 'blindly run; | A web is woven across the sky; | From out waste places comes a cry, | And murmurs of the dying sun' (section 3). But a 'phantom' Nature is the personified *Sorrow's* phantasmagoria in Tennyson's *In Memoriam*, a provisional nihilism. The larger problem is what the nebulae do to thought and language. Tennyson uses the phantasmagoria as analogy for the nebulae and, reversibly, the nebulae as analogy for phantasmagoria. The result is a ghostly tautology in which neither term can explain the other. 'Clouds of nameless trouble | Cross all night below the darken'd eyes' (section 4). The nebulae were commonly evoked as clouds, we have seen. Here the 'trouble' moving perpetually across the field of the unconscious in sleep is ghostly, phantasmagoric, and, because the 'darken'd eyes' suggest the spaces of the night sky, a kind of internal infinitude opens up in which the 'clouds' become nebular. Clouds do not extend analogical meaning—in a sense the clouds are 'nameless' too. This namelessness is passed on to the literal meteorological clouds that create volcanic dissolving views of light in the poem. Rising cloud 'always higher', 'topples' to become 'a looming bastion fringed with fire' (section 15, anticipating sections 70 and 72). Analogy breaks down. Comparatives in the poem are often incomplete. They ask for but deny an answering comparative term, as here with 'always higher'—higher than what? 'A higher height, a deeper deep' (section 63). The effect is not simply to turn the nebulae into an internalized but 'nameless' entity: it is a problem of finding a cognitive language to mediate scientific knowledge, science's *wissen*. We may know of the discovery of Neptune in 1846 (section 21), but only *of* it.

Tennyson's solution was to convey astronomical concepts through a progressively intensifying phenomenological language of the displaced body—our own and planetary bodies—in space. He had read De Quincey. 'There rolls the deep where grew the tree' (section 123) is a paraphrase of one of the remarks on time (p. 568).⁹⁶ The *experience* of parallax and refraction was to give conceptual substance to what De Quincey had described as travelling through an abstract concept (p. 577). A beautiful, scarcely noticeable example is the enlargement of objects at the horizon

through refraction that finds an image for the ‘haze of grief’ (like the earth’s atmosphere) that distorts past happiness to ‘loom’ larger than it was. The poem takes for granted a constant planetary change of *place* and aeons of vast incommensurable space and time (sections 9, 41, 46, 76, 89, 121, 101). Tennyson also experiments with a constantly resituated subject, often by hypothesizing a subject seen or seeing from another planet, as in the investigations of the logic of light and distance in sections 61–3. These fail phenomenologically rather than rationally (section 62). The double star, suns moving round suns, comes to the rescue as a type of relationship, a planet moving to a larger orbit, ‘vaster motions’, than earth’s. But the parallax of these ‘circuits’—‘A higher height, a deeper deep’ (section 63)—is incalculable: an orbit could take thousands of years, astronomers said. No one then knew the distance of stars. It does not work as an imagined world.

The Galaxies and Nebulae speak in Christina Rossetti’s thoroughly modern beatitude, ‘All Thy Works Praise Thee, O Lord’: abandoning an earth-centred perspective they ‘Float neither far nor near’. In her great ‘Mysteries of Life and Death’, a metaphysical poem without a teleology, unlike Tennyson, she abandons analogy as a mode of understanding the universe. ‘As the flush of a morning sky . . . As the Sun . . . As the Moon’. A second comparative term never appears. It would introduce ontological closure, and create hierarchies of substitution. As it is, all these entities can be left as primary terms. The ‘As’ particle then resignifies as *duration*, as, *while*. All the discrete entities of the universe are in play concurrently in a permanent state of change. Every creature fulfils its own being uniquely in a constant present tense without past or future, ‘never at rest’. The logic of this world of concurrence is that it is without origins. The sun, ‘ready to run’ with unthinkable velocity through space, coexists with the burrowing mole, the forest fire. William Herschel’s astronomical world of concurrent cosmic growth and decay is transposed fearlessly to terrestrial conditions. And yet—this fearlessness allows the reader the alternative of parsing the poem as *linear and evolutionary*. ‘[B]oth thoughts may be admitted at the same time.’

Hardy imagines the moon reversing the impersonal telescopic gaze, observing the earth from another place. ‘The Moon Looks In’, like a stranger. It orbits from one scene to another and observes in montage two windows, revealing respectively a close-up of a male lover’s longing ‘upturned face’, and a female figure dressing for flirtation.

I have risen again,
And awhile survey
By my chilly ray
Through your window-pane

Your upturned face,
As you think, 'Ah- she
Now dreams of me
In her distant place!

The obvious interpretation of longing and betrayal may simply be a function of the mediating windows, transparent and opaque—'I pierce her blind'—and the position of the moon. Nothing guarantees this empathyless narrative. The montage creates the meaning, and arises from the moon's own punctuated positions. Hardy's poem is moving from lanternesque to cinematic mediation and another form of knowledge. It depends on an analytic uncoupling of the spatial track of the moon's orbit from the two separate times when its gaze is registered. The staccato cutting of the lyric's brief lines breaks them into instants and endorses the section-izing that prevents moments from passing into one another.⁹⁷

The Dissolving View of the seeing subject: The Magic Lantern

Here I move from the 'view' as object to those elements that affected the viewing subject and made the gaze problematical.

The screen in collaboration with lens-transmitted light technically dissolves the view, which, we have seen, is a composite. Light and screen are one and indivisible. It is impossible to say what exactly constitutes the 'view' and how the viewer has seen it. There is an anxiety of the screen in lantern and diorama poetics.

'As its etymology indicates, the pictures shown are seen *through*', Marion commented of the Diorama.⁹⁸ But both lantern and diorama depended structurally on a screen. The 'brilliant beam of light' refracted through the magic-lantern lenses was passed through the screen of the 'slider', the rack supporting the glass slides, which were painted with strong transparent colours,⁹⁹ before it projected these images onto a screen, a 'clean-washed sheet', stretched tightly upon a wall, or a turpentine or water-painted wall itself,¹⁰⁰ or even a child's hoop, covered in wetted tissue paper and tied to a domestic chair.¹⁰¹ The diorama 'picture' or basic screen, 'several thousand of square feet of canvas' in the case of the Polytechnic, was highly complex, mediated by constantly moving coloured screens, the *Magazine of Science* explained. Without the organization of weighted pulleys and slides organized round different fulcrums created by simultaneously moving 'coloured transparent moveable blinds or curtains', the audience, winched back and forth in a 'saloon' between alternating frames, could not have seen images mediated by daylight alone. Filtered through two ground glass windows behind the picture and a skylight above it, the light was intercepted and transformed by screens, some partly transparent, lowered and raised both behind and 'upon *the face of the picture*'.¹⁰²

The relation between light and screen became highly sophisticated. But this calibration was never simple. Projecting *on* to or *through* an opaque surface meant a constant adjustment between light and screen. Tissue paper, oiled tissue paper (thought too transparent), wetted muslin, waxed muslin, and the ancient medium of smoke¹⁰³—in 1822 ‘frankincense’, according to *The Mirror*, was burned in Dublin as a medium for images—were all explored as screen constituents for the phantasmagoria.¹⁰⁴ The genealogy of the double lantern, a narrative of technological sophistication, moves from the primitive practice of Phillipstall, who ‘raised the wick of his lamp’ while a person standing by was ‘drawing his hand gradually’ before the lenses of another lantern, to Clarke’s Biscenoscope, exhibited at the Royal Adelaide Gallery in 1842. When the two-in-one lantern replaced argand lamps by cylinder-fed hydro-oxygen limelight, and produced a double illumination, the *Mirror*, continued, it required two looking glasses placed at right angles to it to control the image. Moreover, the cost of advances (limelight required a hard, opaque screen for image definition, a less mobile and adaptable surface than paper or sheeting)¹⁰⁵ and image definition, since the radiant image was strongest at the centre and faded at the periphery, was itself a problem. How, in this context, did one see?

The Dissolving View: The Nebulae

There was an inherent tendency for astronomical imaging of the nebulae to dissolve observation. Astronomy was a science of observation, John Herschel said. ‘But how are we to ascertain *by* observation, data more precise than observation itself?’¹⁰⁶ Though the answer was to take ‘the average of a great many observations’, it prompted an anxiety of looking.

Astronomical imaging (and even the early photograph of the 1880s) was a composite, an ideal representation that was an artefact of seeing. It was the result of severally mediated acts of seeing—sometimes spread over years—at different times, in different places, and by different people. John Herschel began working on micrometric measures for his second figure of the Orion Nebulae with ‘skeletons’ in January 1835, continued in December 1836, and completed his drawing over November and December 1837.¹⁰⁷ The astronomical image was a palimpsest of discontinuous and posthumous acts of recording. Herschel relied on information for the Right Ascension of 670 stars provided by Thomas Maclear, the Royal Astronomer at the Cape. The best features of drawings were often fused together by proxy observers as observer and draftsman operated separately. Lord Rosse commissioned Samuel Hunter and others to execute astronomical drawing.¹⁰⁸ Setting aside the reinterpretation required by the transmission of drawing to the engraver, and the choice between steel

engraving and lithographic process, the act of transmission was already complex.¹⁰⁹

‘[I]n the denser portions of the nebula, so bright is the diffused light, that it is extremely difficult to fix attention on such minute points, and that glimpses are often caught and lost again, in a manner which renders it impossible to say positively that a *star* has or has not been seen,’ John Herschel said.¹¹⁰ The act of seeing was deeply questioned. The eye and the gaze became uncoupled in the act of verification: what it meant to see, and what the *event* of seeing was, became questionable. It was an empirical obligation to describe the hazardous and artefactual nature of seeing, as the telescope swept segmented zones mapped on space. Concurrent with discrete and brief acts of systematic ‘sweeping’ (John Herschel’s term), mid-century techniques before photography required a series of rapid samplings, sketching alternating with a few seconds of observation. The result was a quick, unfinished partial sketch or diagram where the broad outlines could intimate what had to be later superadded. Herschel would verify a single observation four times, twice for its discovery, twice for verification. But it was impossible to retrace any particular occasion because of the movement of objects in space. The astronomer caught—and lost—a glimpse. Rosse, in his 1844 reports on the nebulae, stressed the very brief time available for observation: sketches, paradoxically, impede observation by taking time away from it. His sketches only represented objects as they ‘appeared’, ‘not as they actually exist in space’.¹¹¹ The eye was influenced by the mind when phenomena were seen with difficulty, he admitted, but speculation can make you see—it draws attention to that which would otherwise escape observation and even makes objects seeable in telescopes of a lower power subsequently (p. 113).

In an age when a positivist physics of light was conveyed through geometry that presupposed unmediated vision, as Simon Schaffer has observed, to turn to visual images and the two-dimensional resources of drawing constituted a generic problem.¹¹² ‘The most important error to guard against is that of supposing the well-marked confines of the Nebula on paper really represent the boundaries of the object in space in all cases. Frequently there is a very gradual fading away at the edge.’¹¹³ Depths had to be represented through a plane surface and ‘granular’ effects, for a start. Lord Rosse described how the feeble light requisite for observation forced the observer to mark sketches too strongly, but in different observers and sketchers these values were inconsistent, as was contrast. The astronomical gaze is forced to construct markers, boundaries, and topographies inferentially.

Drawings of the Orion Nebulae, which became the obsessive test case for observation, indicate how differently the telescopic image could be

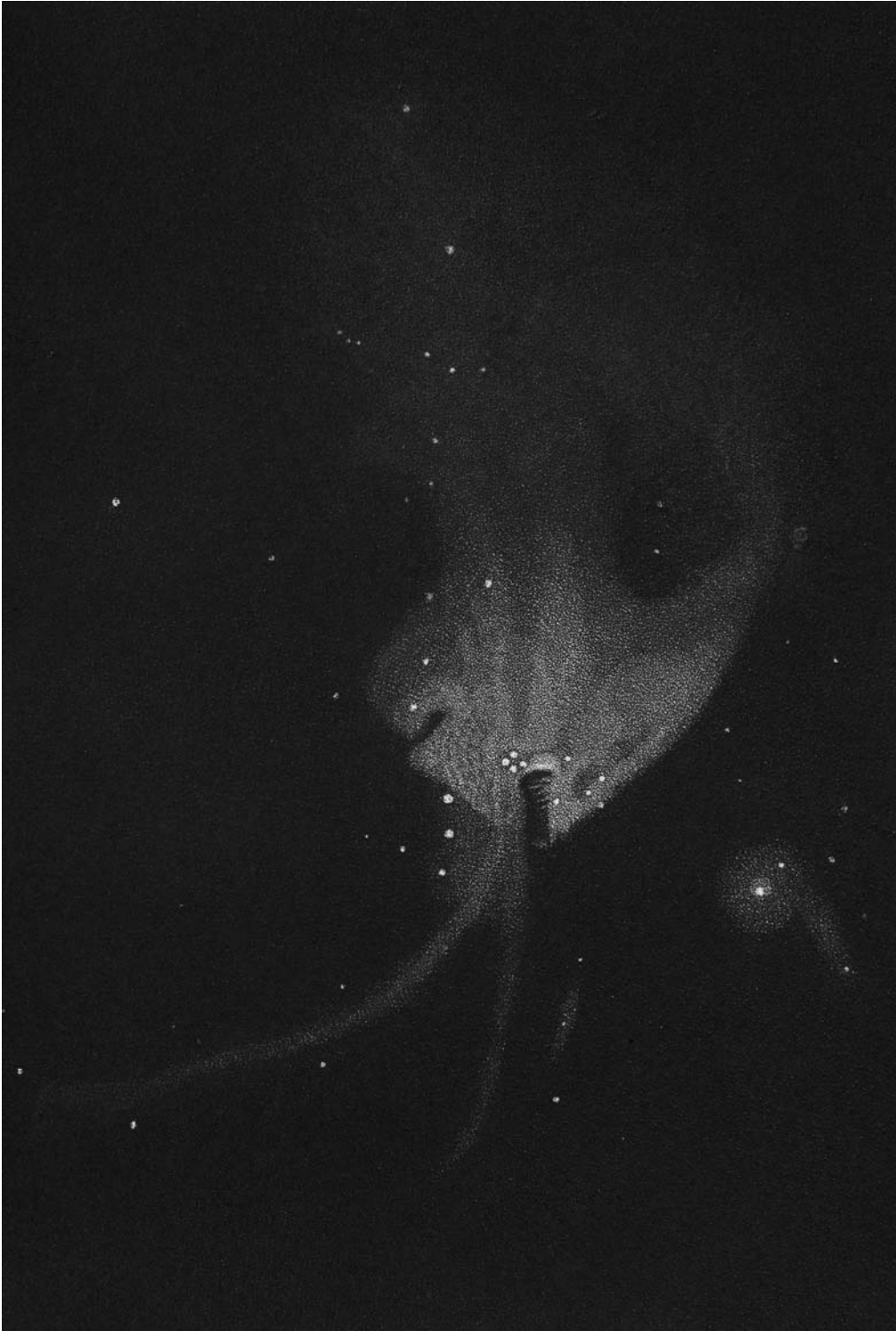
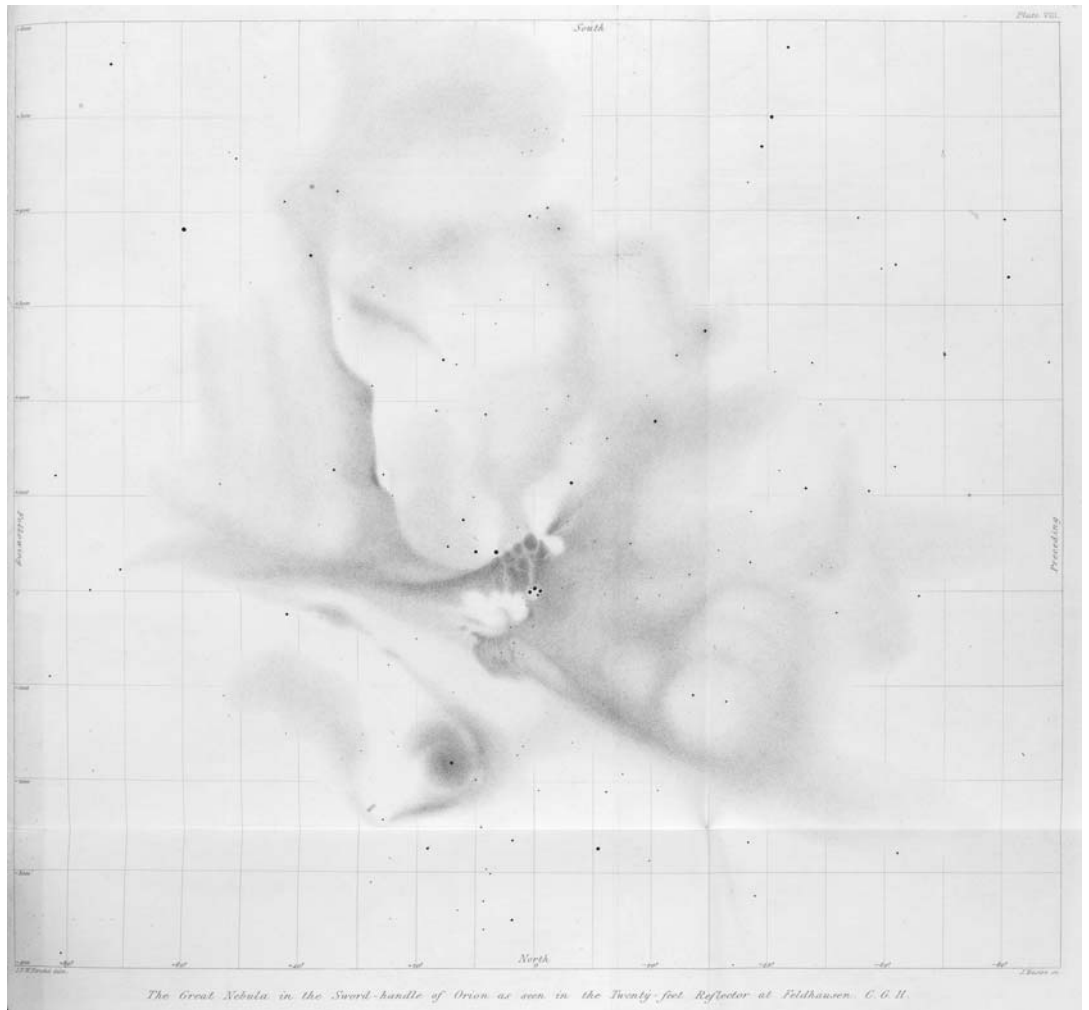


Figure 75 John Pringle Nichol's selective choice of nebulae images: 'Nebula of Orion figured by Sir J. Herschel' (1825), in *Thoughts on Some Important Points Relating to the System of the World*, 1846



represented. John Herschel's two drawings, or 'figures' or 'delineations', as he preferred to term them, of the Orion Nebulae, the first in 1825 (published then but dated 1824), the second in 1837 (the latter executed at the Cape in South Africa), compare with Samuel Hunter's rendering published in 1868 (executed by the same engraver).¹¹⁴ The first, of 1825, is a steel engraved 'positive', indicating the stars as white points against blackness and light as a chiaroscuro with an almost metallic gleam. The second is, like Hunter's a 'negative', indicating stars as black dots against a soft, convoluted, shaded white ground. Yet the gradations of these negatives are tonally different. Nichol's earliest plate of the Orion Nebulae (1837), where a diffuse white mist stretches across darkness, is very different from the hard-edged 1825 version by John Herschel that he used later in *Thoughts*. The positive highlights the diffuse mist of the Nebulae, the negative asks to

Figure 76
John Herschel, 'The great Nebula in the Sword handle of Orion as seen in the Twenty-foot Reflector at Feldhausen' (1837), *Results of Astronomical Observations at the Cape of Good Hope*, plate 8, 1847

be interpreted as figure and ground. One emphasizes dispersal, the other the concentration of stars.

The Dissolving View: Magic Lantern and Nebulae—Choric Lyrics

‘I cannot see the features right . . . the hues are faint | And mix with hollow masks of night . . . Dark bulks that tumble half alive’ (section 70)—De Quincey’s Orion in *In Memoriam*. Grief ‘Is given in outline and no more’ (section 5). Mediated seeing as optical tricks of projection, refracted light from below the horizon modelling the perception of future events (section 92), the self screened on clouds in the Spectre of Brocken effect (section 97): mediated seeing as fragmented reflection, the poem constantly examines these effects. The Somersby brook in the uncanny departure poems breaks up the sailing moon (section 101) or the ‘dim dawn’ (section 99) is reflected breaking through its own reflected ‘darkling red’ in the waters of the ‘swollen brook’. A different kind of sceptical uneasiness, about what and why one sees, haunts Browning’s ‘By the Fire-side’, which returns to viewing a ruined chapel (also a favourite Daguerre motif) no fewer than four times in two remembered walks. The overlaid chapel memories are a palimpsest of past and future. In stanzas 37 and 38 they become a screen to conceal and finally reveal a ‘trouble’ that ‘grew and stirred’. The poem’s walkers stoop, kneel, peer through the window grating (36), physically close to the fabric of the building but emotionally separate from one another, seeing more and more empirical detail, less and less about themselves.

Christina Rossetti is the celebrant of a time-bound universe and the limits it places on seeing. In ‘Venus’s Looking Glass’ (1873), Rossetti plays with the limits of telescopic vision and its narrow field, and with the discontinuous appearance of the star Venus. The poem could be spoken by the mirror itself as a *looking* glass, an optical reflector actively in search of an image.¹¹⁵

I marked where lovely Venus and her court
 With song and dance and merry laugh went by;
 Weightless, their wingless feet seemed made to fly,
Bound from the ground and in mid-air to sport.
Left far behind I heard the dolphins snort,
 Tracking their goddess with a wistful eye,
 Around whose head white doves rose, wheeling high
Or low, and cooed after their tender sort.
All this I saw in Spring. Thro’ summer heat
 I saw the lovely Queen of Love no more.
 But when flushed Autumn thro’ the woodlands went
I spied sweet Venus walk amid the wheat:
 Whom seeing, every harvester gave o’er
 His toil, and laughed and hoped and was content.

'I marked where lovely Venus... Tracking their goddess with a wistful eye... All this I saw in spring... I saw... I spied... whom seeing.' To some extent the mirror organizes the visual field but it also *follows* the weightless and wingless feet that fly, as the metrical feet do, in 'sport'. And it confesses, the syntax allows, that it tracks 'their goddess' as the dolphins do, with a 'wistful eye'. 'Left far behind', like the dolphins, it is not omniscient or penetrative. It accepts the cyclical return of Venus in 'flushed autumn'. And of course the telescopic image is 'weightless', existing, like all virtual and real images, in 'mid-air'. Venus's return confers plenitude and erotic delight on the scene, not simply for the glass but for all who labour in it. Seeing becomes communally pleasurable and emancipatory. For a moment the energies of ludic optical pleasure come into play as the mirror and labourers share the same sights. For a moment estranged labour is suspended.¹¹⁶

Comment

The 'view', then, was a dissolve. The scopic image, cause and effect of ungrounded experience, manifested this with particular sharpness because optical phenomena made such immediate demands on the sensoria. The *Dissolving View* arose from the many-times-mediated image, by the indivisible union of screens and light in popular spectacle, and by severally mediated *uncertain* acts of seeing in the agonistic empiricism of telescopic observation. The *Dissolving View* arose from the recognition of the process of 'Becoming', both an arising and a passing away, in the sidereal universe and through the enactment of it in screen media. This in turn was predicated on a contradictory universe in which all elements were in a state of non-synchronic change. The universe of parallax provoked a range of reaction, from celebratory scepticism to anxiety to fury, but it created the terms of controversy.

Vesuvius—Dissolving View and Volcanic Nebula

Politics of the Volcano

A fire on Devil's Hill, a 'truly sublime *spectacle*' (emphasis added), John Herschel wrote in his Cape diary in January 1835, had 'precisely the appearance of the representations of Vesuvius during the course of a great lava current: Streams of lines of bright flame. Volumes of smoke from the slopes and fiery columns mounting... At night Monograph of Neb in Orion.'¹¹⁷

The volcano and the 'Neb in Orion' became indissolubly linked in a ferocious political and scientific controversy over the nebulae, a cathectic

power that was paralled in popular spectacle's fascination with Vesuvius. It was far-reaching, and at times became associated with another debate, which is not my concern here, on the status of the nebulae as possible inhabited 'island universes'. De Quincey's racial language of miscegenation and inversion in his account of the Orion nebula, and his attempt nevertheless at a guarded apologia for the views of John Pringle Nichol, with whom he did not actually agree, but whose book he reviewed in 1846, take us to the essence of the problem.

By ungrounding Nichol's Orion plate and turning it upside down, he enables 'Brutalities unspeakable' and a spectacle of oriental violence to be exposed. The Grotesque emerges here as racial horror. The 'very anguish of hatred' in the head thrown back, its 'Assyrian tiara', 'the upper lip, which is confluent with a snout', the 'umbrageous growth' suggestive of 'the plumes of a sultan', come into visibility. This is a tainted, androgynous and hybrid creature. It is kin to Milton's 'incestuous mother', 'Sin', the daughter of Satan who mates with him to give birth to Death.¹¹⁸ This is not only the psychosis of colonial paranoia. De Quincey refers to Nichol's democratizing of knowledge and work of popular education in Glasgow with some sympathy. Yet the inverted Orion is a coded allegory of the results of inverting the order of things, and letting loose a primitive species—the working class—incapable of culture. Above all it is an allegory of Nichol's supposed category mistakes in astronomy.¹¹⁹

Eliding social and natural law, Nichol seized on the nebulae (particularly the spiral nebulae) to elucidate a developmental theory of the universe. Orion was his test case. He extrapolated from it a model of progressive structural change and fused an unfortunately crude *linear* misreading and conflation of William Herschel's second and third nebular theories with Laplace's reading of the physics of spiral movement in the universe that must compress to matter. The universe was in a state of momentous transformation, as the self-luminous nebulae, demonstrably diffuse and fluid, were preparing to evolve into stars by a process of aggregation. 'Even the larger forms of the heavens are not stable! . . . the new order of things is slowly up-growing' and by 'progressing aggregation' is 'preparing to be born': 'all things are in a state of change and PROGRESS'.¹²⁰ It was essential for Nichol's reading of the heavens that the nebulae should *not* be resolvable into stars—or not just yet—in order to demonstrate the living progress of evolution in the cosmos. Thus the model could be seen by hostile critics as a miscegenated one, as unlike matter united into Nichol's 'grander forms of being'. Furthermore, it was also essential to argue for a model of violent volcanic change (politically coded as revolution) in geological history, because records of catastrophic upheaval substantially greater than modern volcanic forces could 'prove'

the nebular origin of the earth and other planets. It was necessary that volcanoes derived not simply from underground igneous lakes but should be eruptions of the very substance of the earth's original nebular matter.¹²¹ Sequences of abrading and levelling followed by volcanic elevation of the earth's surface, and the even more extreme 'torn, crateriform and disturbed surface' of the moon, suggested that the nebulous bed or least condensed stratum of the earth had erupted after cataclysmic contact with leakage of water to subterranean reservoirs of fluid heat.¹²²

Why should this volcanic theory have mattered so much, and produced such violent attacks from the still forming scientific establishment? Why should the Rosse group, having refuted Nichol (or so they believed) by resolving Orion in 1846, have reacted with dismay and panic, insisting they had observed stellar structure, when Hubble revealed its gaseous components in 1864? Others, Simon Schaffer, James Secord, and Adrian Desmond in particular, have charted the complexities of this debate, which ramified when Chambers used the nebulae to support his 'development theory' in *Vestiges of Creation* (1844).¹²³

There were two answers to what was at stake, entwined with ideology and teleology. First, Nichols's understanding of the nebulae and the volcano as primal matter was too like materialist and egalitarian readings of unaided matter which had the power to generate self-determining life. This radical science, questioning both design and hierarchy, had been taken up by working-class and atheist constituencies in England and France since the 1790s. Nichol had been associated with J. S. Mill and with the middle-class radicalism of the *Westminster Review* in the 1830s, which had entertained the nebular theory and supported popular education, thus threatening the unshakable spread of subversion.¹²⁴ Secondly, the very nature of what constituted an 'event' was in question. Catastrophic historiography of violent, uneven, and cataclysmic volcanic change, William Whewell, its foremost opponent, argued, was based on recording *sensory* phenomena that were inherently unsound, not to speak of materialist—observations of frozen lava, or the filmy dissolve of the nebulae through the telescopic lens. These did not recognize the act of mind in constructing experience. Drawing outlines (one thinks of Rosse drawing the nebulae here) is drawing something 'we do not see', he insisted, in *The Philosophy of Inductive Sciences* (1840).¹²⁵ Though deemed 'affirmative', he admitted, in comparison to 'negative' gradualist theories like his own (positioned as Tory Anglican), he argued that his own theory was preferable because it distrusted origins. Catastrophic theory committed the fundamental mistake of assuming a past radically different from the present. It projected cause forward from an *ab initio* moment of primal matter in violent volcanic rupture in the past through a repeated series of

upheavals far greater than anything known to the present. For Whewell history could only be known by inference from the present, by an act of *re-tracing* which inverted ‘progression’ as cause and effect (which could not be distinguished from one another), through a backwards reading of the event. What he called his ‘palaeological’ philosophical history, by which geology, comparative archaeology, and philology were structured, depended on reversing the progressive model and moving from ‘what *is*’ (p. 101), from the present to the past, by a second order act of inference. We are not warranted to work forwards to the condensation of a mass of diffused nebulous matter from existing nebulous patches (p. 105). When we ‘calculate backwards’ (p. 113) it is clear that violent volcanic action coexisted with slow, imperceptible movements of the earth’s crust (p. 117). Cycles of change, read backwards, even out over time—it may be that catastrophic cycles are working to a timespan so colossal that their continuities can only be seen outside human consciousness by a God (p. 129). John Herschel had committed himself to Whewell’s views, which followed those of Lyell, as early as 1830, when he called the volcanic theory ‘Interregnums of chaotic anarchy’.¹²⁶

Whewell freely admitted that his theory produced its own scepticism in the service of teleology: how do we see the limits of the ‘present’ from which we work backwards? It left nineteenth-century modernism with further scepticisms as origins disappeared, and inference backwards became, at least for Whewell, an idealist act that saw time as a series of instants or points held together by imperceptible memory (memory of which one is not aware), not a state of becoming. Tautologically, we consider ‘an occurrence [such as a volcanic eruption] as *coinciding* with the portion of time which it occupies’.¹²⁷ This deconstruction of crisis is not merely an opposition to revolutionary change. It closes down the movement of changing relations, which is the positive moment of parallax. It also disputes the ownership of seeing, of the event, and of memory.¹²⁸

Passions of the Volcano

The volcano through the lens and in screen spectacle above all offers spectators the ownership of seeing. The thrill of rupture, light in crisis, incandescent change, the sudden restructuring of the landscape, as glowing matter becomes protean.

‘1829 Destruction of Pompei . . . 1830 Mount Vesuvius—Three slides, day and Night, and an Eruption . . . 1831 Ditto ditto.—Three slides, with Rackwork to exhibit the Smoke and Lava in Motion’.¹²⁹ so runs the Negretti and Zambra catalogue. Vesuvius was active up to 1850 and for a century before. Entering the space of terrestrial upheaval, Goethe climbed to the crater of Vesuvius (and made it the orgasmic context for lovers in

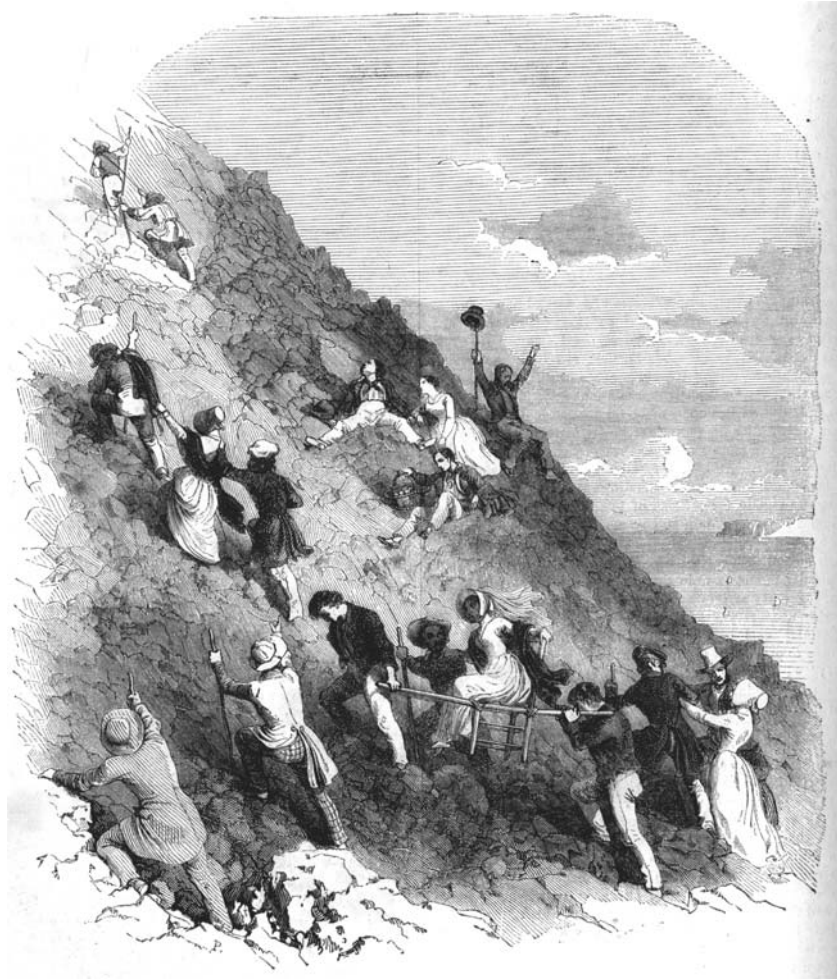


Figure 77
Climbing Vesuvius:
'Ascent of the Cone',
Illustrated Exhibitor
and *Magazine of Art*,
1852

Elective Affinities), so later did Dickens. Michael Faraday in 1814 picnicked with Sir Humphry Davy on the 'smoking lava' of the crater, and John Herschel climbed into the crater of Etna. In 1852 the *Illustrated Exhibitor* carried an article on Vesuvius and illustrated it with two engravings of innumerable tourists clambering on the slopes, ladies in crinolines pushed upwards by companions or slithering down the rocks, rocks hot enough to fry an egg.¹³⁰ In 1872 Charles M. Doughty described Vesuvius both as the eruption of 'stupendous elemental rage' and a 'vulcanic womb delivered of its superfluous burden'. He saw people burned alive.¹³¹ Vesuvius became a new nineteenth-century myth organized primarily by the lens and screen.

Antecedents of the volcano dissolve went far back. A huge special-effects transparency was pioneered by Sir William Hamilton, scientist and scholar of the volcano, whose backlit clockwork apparatus, sent to the Royal Society in 1767, produced the violent 'impression of a continuous stream

of lava and sporadic outbursts from the crater, accompanied by thunderous blasts of eruptions'.¹³² The apparatus engendered a number of variations, notably Dean's 15-minute Vesuvian eruption, which was shown concurrently in 1780 with one of the earliest forms of screen spectacle, de Louthembourg's Eidophusikon. The iconography was remarkably consistent.¹³³ The Surrey Gardens Vesuvius advertises itself as a 'picture' rather than a diorama, and would probably have been a large transparency with special effects to convey the drama of light and fire in process with matching sounds. Fireworks enacting volcanoes or volcanoes created from fireworks, this typology goes back to the Renaissance. (Milton has Satan springing upward in a pyramid of fire (*Paradise Lost*, book II, 1014).) The association of the volcano and fireworks was 'an already established topos' in the early seventeenth century.¹³⁴ But representations of volcanoes by fireworks were manifestations of family power or for state occasions. Now they were demonstrations of violence whose signification was open. No longer was fire secured in a frame of meaning in which it was the dominant, warring element. Significantly, paintings of Vesuvius or the explosions of the famous Roman girandole, affiliated to Vesuvian iconography, painted by Hamilton's artist and others, portray this event with crowds of spectators, as if requiring an interpretative frame.¹³⁵

The volcano's openness of meaning not only meant that it could be inflected as private or public violence, psychic or social, repression or freedom, retribution or revolution, jouissance or depletion. But its openness was also itself a source of terror and constituted a sort of hermeneutic sublime. Napoleon, the great exemplar of the catastrophic event, attracted apocalyptic volcanic imagery that was associated both with destruction and creation.¹³⁶ (A popular dissolving view slide set faded from Napoleon in captivity to Napoleon as Commander.)¹³⁷ The volcano was an element of Chartist rhetoric.¹³⁸ The violence of the industrial furnace was also incipient in it. The sun was increasingly seen as a massive volcanic body.¹³⁹ Vesuvius brings unconsecrated death into the world on a massive scale. In the words of Andy Warhol, who executed many cartoons of Vesuvius, which last erupted in 1944, it is a *disaster*, not an accident, not simply uninterpretable, but the sign of the uninterpretable.¹⁴⁰ Ruskin spoke of the 1877 Java volcano that 'boiled' 12,000 people.¹⁴¹

Vesuvius was a type of the absolute contingency of violent catastrophe. Carrying the binary structure of the dissolve to an extreme, its violence failed to contain the contradictions the dissolve embodied. It was violence waiting to happen, whose effects spread arbitrarily among thousands, penetrating to the domestic world, and whose causes were *hidden*. The cross-class obsession with it suggests the hypertension of Helmholtz's somatic enquiry. By opening up the problematic of cause at a visceral level, it

generated the will to 'know' and define the limits of the 'event'. In fact, a volcano produces repercussions before its 'event' in the underground workings of a buried causality before it erupts. Its hidden energy consummates prior consequences and its post-eruption effects extend well beyond the immediate scene of destruction in the delayed action of shock waves. Writing of the trauma of fire Bachelard connects it with Promethean knowing, the desire for change, a speeding up of the passage of time, magnifying human destiny by linking the small to the great—'the hearth to the volcano'.¹⁴² The image of power, as Signor Farinelli's descent indicates, was no longer the sovereign as sun surrounded by planets. It was the unpredictable cataclysm that hit everyone. The 'focus' of the projected image, the Latin word for 'hearth', goes to the core of the Victorian family space. The lens-made image struck at the centre of the home. Like Newton's radiant spectrum, the volcano entered the interior of the domestic room. Vesuvius is one of glass culture's formative myths, combining the lens-made image without correlate and the violence of matter.

After-Life of the After-Image

As if leaping into being after a dark period of 'interference' represented by the Lady's chamber, Lancelot's embodiment of light comes into the mirror with a traumatic violence that causes its shattering. This destruction enunciates the shattering of an illusory hierarchical account of a 'real' landscape offered by the mirror, signalling crisis and change.¹⁴³ It replaces this scene with an equally problematical optics, the image without correlate. It speculates on what Kant was unwilling to concede, 'appearance without anything that appears'.¹⁴⁴ Here in Tennyson's optical elegy the oppositions between virtual and real image conjure many paradigms, one of them being the constant reproduction of images disarticulated from an original, matched by the seeming autonomization of things in industrial production. Tennyson's poem draws out the contradictions that are a structural part of nineteenth-century glass culture. Christina Rossetti's 'Mirrors of Life and Death', on the other hand, intransigently transvalues the non-correspondent image, the 'shadow' which has no equivalent, to circumvent economic exchange and protect unique experience from dissolution. Through the lens-produced image many questions appear like the view 'thrown' by a lantern. The underlying question is about knowledge and the possibility of thought in a lens- and mirror-based environment. The question is self-reflexive—is it possible to *reflect*? This may be why the anguish of women, who are also surrogates for working-class experience, both deemed unthinking, is so insistent.

The lens's epistemological questions led to teleological ones for nineteenth-century modernism. Subsequently, in the glass culture of twentieth-century modernism, the lens migrated. It reappears in psychoanalysis and the disputes of phenomenology, dealing epistemologically with the unfinished business of nineteenth-century teleology. '*You never look at me from the place from which I see you*': conversely, '*what I look at is never what I wish to see*'.¹⁴⁵ Here Jacques Lacan exploits nineteenth-century geometrical physics of reflection and refraction to reframe them in psychoanalytic terms, the scopic drive, the misalignment of the eye and gaze. His scepticism brackets the ontological—he refuses a 'dialectic of truth and appearance' (p. 71). The subtext of his specular theory, an (impossible) attempt to square Bergson's photographic positivism—'But is it not obvious that the photograph . . . is already taken, already developed in the very heart of things and at all the points of space?'—with Merleau-Ponty's phenomenology, is beyond the scope of the present discussion.¹⁴⁶ But its importance lies in pointing up the qualitative intellectual differences between nineteenth- and twentieth-century glass culture.

A transitional moment is Freud's 'Screen Memories' of 1899. Its date coincides with the supersession of the dissolving view by cinema. Almost contemporaneously a forum in the *Magic Lantern Journal* in the early 1890s discussed the dissolve as an archaic form, reconstructing its history as an act of cultural memory.¹⁴⁷ Through an 'ultra-clear yellow' dandelion that reactivates the memory of a girl's 'yellowish brown' dress, Freud tracks the delayed action of memory or *Nachträglichkeit*.¹⁴⁸ It is a psychic after-image. For Freud as for Goethe memory is a compound. Freud uses the language of lantern projection and the dissolving view: he had 'projected two phantasies on to one another and made a childhood memory of them' (p. 315). A childhood memory can be accounted for by a later event, or a subsequent event can 'exhume' a childhood memory, one lens closing off while another opens its beam.

Microscopic Space

12

‘All this time the Guard was looking at her [Alice], first through a telescope, then through a microscope, and then through an opera glass.’¹ When Carroll’s Guard tries out different forms of prosthetic optical instrument, the farcical allusion is to the manifold types of lens available at the time, the monocular lens of the microscope, telescope, kaleidoscope, the binocular lens of opera glass and stereoscope, all of which created different ways of seeing. (Three different Alices appear through the three instruments.) The glassworlds of the microscope, the stereoscope, and the kaleidoscope are the subject of this and the next chapter. The microscope and the telescope (each with different histories) were frequently described as forming a perfect antithesis.² ‘The telescope brought into view worlds as numerous as the drops of water which make up the ocean; the microscope brought into view a world in almost every drop of water. Infinity in one direction was balanced by infinity in another,’ William Whewell wrote.³ Their objects of study are not comparable, however: far distant bodies in motion seen by the light of prehistory, sub-visible entities, dissected into infinitesimal sections or pullulating with importunate life in a drop of water. Extreme nearness, and endless particulars in close-up, not the dissolving view, are the microscope’s essence. Moreover, it was incorporated into glass culture with a degree of popular epistemophilia and scopic wonder quite unlike popular accounts of the telescope.

Nevertheless, though for very different reasons, the microscope created the ungrounded perspectival world that emerged in astronomy and spectacle alike. Its structural refraction organizes all its images. Additionally, under the microscope at this time, the object exists in atopic space, preternaturally distinct, but freed from relational coordinates. It has no norms. As Catherine Wilson has pointed out, one image is predicated on losing another.⁴ The image is like a metonymy where the referential term

has been amputated. There is no part and whole, simply diminishing autonomous or segmented parts. An infinite regress of ever smaller organisms cavorted unseen in drops of water, grains of dust, blood, leaves. It was no longer possible to conceive of the smallest small thing. According to the arbitrary powers of magnification the worm or fly grows big, and 'little things go lessening', Browning's *Sludge* remarks.⁵ Scale retreats, the minuscule and gigantesque become incomparable: a goat and a beetle inhabit Alice's railway carriage on equal spatial terms. The stereoscope, as its name, derived from solidity and volume, implies, appears to redress the ungrounded precision of the microscopic image. But its antithetical project actually allies it with this group. Stereoscopic images 'rise up' from a surface, 'spring' into being, 'start forth', 'instantly start into all the roundness and solidity of life'.⁶ They were crucial for Helmholtz's theory of knowledge.

The microscope lens brought four disputed accounts of the world close up against the eye. They were the cardinal problems of glass culture. Each threatened different forms of ungrounded experience. In one proposition, 'The microscope shewed that there had been, close to us, inhabiting minute crevices and crannies, peopling the leaves of plants, and the bodies of other animals, animalcules of minuteness hitherto unguessed, and of a structure hitherto unknown, who had been always sharers in God's preserving care' (Whewell).⁷ A 'physico-theological' assumption that 'God's preserving care' reigns over every element of the universe was checked by the violence of voracious life exposed by the lens itself. The contradictory aspect of nursery and forcing house inherent in the conservatory reappeared in the natural world. 'Praise Him and *magnify* [emphasis added] Him forever,' Kingsley wrote, parodying the Beatitudes with the robust blasphemy of the believer.⁸ But magnification only intensified the shock of cohabitation with the gross feeding and sexual avidity of animalcules. Glass raised directly theological problems here and in the following proposition as it did in no other glassworld context. The second proposition: a fixed morphological hierarchy, typologically immutable, orders different groups of species in the living world. This taxonomy was checked by various readings of 'development' or evolutionary theory, many of which were dominated by transgressive sexual reproduction. The hermaphrodite and the hybrid carried the Grotesque and its monstrous jouissance into biology. Here glass culture's necessary concern with taxonomy and the violation of categories emerges. The third proposition: the eye is a perfect self-correcting optical instrument analogous to the microscope; checked by accounts of the dissociated eye, subject to aberrancy, and no longer an index of species being. The instability of sight, crucial to the 'view', returns in the epistemology of the miniature. Lastly, a dialectic of

transparency and distortion, 'crystalphilia' and anamorphosis, attends disputes over the lens and directly opens up the issue of our species being. Classical anamorphosis, distortion according to 'a specific set of rules', was displaced by the kind of deregulated, serio-comic anamorphosis that operated in Exhibition artefacts, and was at work in 'crevices and crannies', leaves, plants, the body. The grotesque reappears.⁹

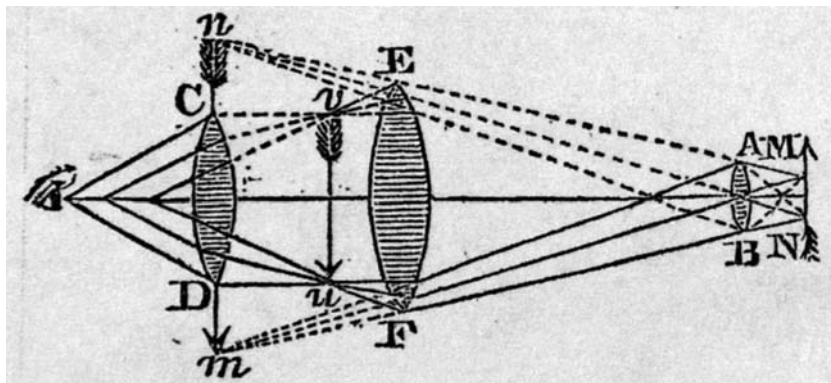
All these debates were a subtext for each other. They were to produce some of the most bitter conflicts of Victorian modernism. The first three debates belong to this chapter. Carroll's *Through the Looking-Glass*, with its brilliant, condensed understanding of glass culture, is a lens for these controversies. In the next chapter I focus on the last debate, the movement between transparency and distortion, and its connection with the stereoscope, which was invoked to solve the problems of the microscope.

Alice also helps to explain the peculiar fascination of the microscope for the nineteenth century and the intensity of gaze it provoked, an intensity passed on to the debates it occasioned. The microscope gave access to a *hidden* world, it gave access to a *distinct* world. It allowed a hallucinatory, dreamlike visuality to coexist with precision. Wonder and hyper-real immediacy, enchantment and the empirical belonged together. It was the compound microscope image's sensory materiality combined with the abstraction produced by a series of mediating lenses that made it useful to Freud as an analogy for the movement of ideational content into irreducible sensory images in dreams, the process he called 'regression'.¹⁰ 'Psychical locality' for Freud is to be identified with a constructed but actual reality represented by the appearance of the image at a focus and its concentrated visual intensity.

Through a looking glass, through a microscope lens, through a dragon-fly's eye, 'pass with me through a wonderful brazen tunnel, with crystal doors at the entrance', Agnes Callow, wrote, as if one might actually enter a drop of water through the microscope. Its function as prosthesis is elided. 'These doors are bright, circular, and thick... A spirit named Science opens them to all who seek her. At the end of the tunnel we find other portals, much smaller... when they are opened we are in the new world spoken of. And now I see your astonishment, your minds are bewildered with the variety of new beings and forms.'¹¹ Agnes Callow's *Drops of Water; Their Marvellous and Beautiful Inhabitants Displayed by the Microscope* (1851): *The Story of a Drop of Water* (ed. Catharine Long, 1856): Charles Kingsley's *Glaucus, or the Wonders of the Shore* (1854), imagine entering a watery world. '[E]very grain of sand may harbour within it the tribes and the families of a busy population.'¹² (As if the creatures of Cinderella's world had become minimized.) But it was water in particular that displayed the microscope's penetration into hidden worlds, and 'all

Figure 78

Brewster's diagram of a compound microscope. It shows an object, MN, placed before the object glass, AB, forming an enlarged inverted image at *nm*. This enlarged image is again magnified when placed in the focus of another lens, CD



the lions and tigers 'perdus' in a drop of spring water', as Arthur Hallam described the large-scale projection of microscopic images at the Polytechnic Institution. Water, and its invisible contents, polyps, infusoria, rotifers, water-bears, polyzoa, drawn from the sea or fresh water but particularly from the meeting point of land and sea, spawned a popular literature of microscopic investigation and, indeed, helped to bring into being the category of 'popular' science in an avid print culture. Works such as *Sea-Side Studies* (G. H. Lewes, 1858), *A Year at the Shore* (Philip Henry Gosse, 1865), *Marvels of Pond Life* (Henry James Slack, 1861), made the marine organisms, Cydippes, Noctilucae, Medusae, familiar terms: the fresh-water hydra entered common knowledge. The 'wonders' of the microscope became a common trope. Mrs Ward's *A World of Wonders Revealed by the Microscope* (1858) showed how to strip the eyes of fish, cows, and sheep to the crystalline lens, and the way the multiple lenses of a dragonfly's eyes directed to a window would reflect 'a great number of little windows' and the views beyond.¹³

'With this instrument Dr Wollaston saw the finest striae and serratures upon the scales of the *lepisma* and *podura*, and upon the scales of a gnat's wing.' Brewster succinctly defined the compound microscope through its passing on of enlarged images of images—'two or more lenses or specula, one of which forms an enlarged image of objects, while the rest magnify the image'.¹⁴ The properties of the lens that produced 'distinctness' in the simple microscope (minute globules of glass, garnet, diamond, a fish's eye, could all become lenses) and the variation in placement and type of the lenses in the compound microscope that could produce ever more detailed images fascinated him. It was a space-splitting exercise. Space became infinitely divisible as objects became minuscule to infinity. Yet the image deletes a prior norm and cannot be 'translated' back into it. The same specimen magnified to different powers produced different forms of

distinctness, the miniature moving to ‘the dreadful and immense’, as Browning’s Mr Sludge put it. This is why Alice can see a gnat the size of a chicken.

Proposals and Anti-proposals of the Microscope

“I like the Walrus best . . . because he was a *little* sorry for the poor oysters”: “He ate more than the carpenter”, said Tweedledee.¹⁵

Proposition: The terms of seventeenth-century physico-theology, and what Catherine Wilson has termed a ‘daring last-ditch fideism’, were still current in the nineteenth century, but increasingly on the defensive.¹⁶ After the establishment via the lens of ‘objective’ experimental science, the argument moved from Revelation to the unmediated book of nature to secure the circular but empirical argument by design, in which a well-ordered universe indicates divine creation, and divine creation indicates a well-ordered universe. John Ferguson, for example, set up the compensatory world of the microscope, that ‘tells me that in the leaves of every forest, and in the flowers of every garden, and in the waters of every rivulet, there are worlds teeming with life, and numberless as are the glories of the firmament . . . [it] suggests to me, that within and beneath all that minuteness which the aided eye of man has been able to explore, there may lie a region of invisibles; and that . . . a universe within the compass of a point so small as to elude all the powers of the microscope [exists], but where the wonder-working God finds room for the exercise of all His attributes.’¹⁷

Against this a world of terror, pain, and violence emerged, also known since the seventeenth century (Swammwerdam saw ‘beauty and horror everywhere’), but increasingly violent and voracious.¹⁸ Kingsley wrote of the madrepora as a ‘moveable mouth’. (It is a capacity to read this violence that fits young men to be servants of empire in the colonies.) For Philip Henry Gosse (a Plymouth Brother) ‘The whole world lieth in the wicked one’. Sub-visible life in a rock pool operates on the same principles of chance, freedom and the struggle for life divinely appointed in the upper world, a violent laissez-faire pastoral where the free and guilty are one, the Calvinist’s impossible paradox.

What microcosms are these rugged basins! . . . What arts, and wiles, and stratagems are being practised there! what struggles for mastery, for food, for life! what pursuits and flights! what pleasant gambols! what conjugal and parental affections! what varied enjoyments! what births! what deaths! are every hour going on in these unruffled wells, beneath the brown shade of the

umbrageous oarweed, or even the waving slopes of bright green *Ulva*, or among the feathery branches of the crimson *Ceramium!*¹⁹

In a non-theological and anti-anthropomorphic mode, interpreting the subaqueous, like everyone, through his own politics, Lewes insisted that the ‘humble mollusc’ (‘I never detected any humility in my molluscs’) cannot feel pain.²⁰ He describes horrible sensory stimuli to prove the fallacies of pain in simple forms. Shrinking, struggling, writhing, crying out, shrieks, are ‘no certain indications of pain’ (p. 347). An insect pinned to the table will continue to eat, a headless fly, fish, or worm writhes and twists if touched, slugs allow their skins to be consumed by others and continue to function. A decapitated man struggles to free his hands, attempts to stand upright, and stamps his feet. There is no hierarchy of pain or of species. Pain, simply a function of a more complex nervous system, is humanly made (hence his view that women, along with savages, suffer pain less than men (p. 348)).

“‘Crawling at your feet,’ said the Gnat . . . ‘you may observe a Bread-and-butterfly’”.²¹

Proposition. The microscope confirms the hierarchy of organized life, with human beings at the apex, and the unalterable permanence of the five Cuvierian embranchements (which consolidated the intelligent design argument). This inviolable taxonomy moved through molluscs, crustaceans, fishes, and up to vertebrates.

Against this the microscope revealed both to the amateur Lewes and his friend the self-professionalizing Huxley the possibility that these rigid typological features might be subsumed in ‘typical form’ (Lewes) or ‘archetypal form’ (Huxley).²² Darwin’s quiet critique of the embranchements was mounted through painstaking microscopical work on the Barnacle or Cirripede, classified as a mollusc but thought to be, as Darwin proved, a Crustacean.²³ Thus categorical boundaries were subtly revised. Huxley was at this time sceptical of any ‘development theory’, whether of Lamarck’s understanding that one species could be transformed into another, which had fired working-class radicals in the revolutionary period, and continued to be politically inflammatory, or the derivation of an evolutionary law of progress in the writings of Robert Chambers and Herbert Spencer. But he did challenge conservative figures of comparative anatomy in his own field—the fixed hierarchical archetypal theory of Richard Owen, for example.²⁴ A ‘common denominator of all vertebrates or molluscs’, as Darwin expressed Huxley’s theories to him, meant not only that the embranchements would be broken down but that an archetype itself might be ‘*undergoing* further development’, establishing a ‘generalized forerunner from which any number of specialized descendents



could evolve'.²⁵ Huxley 'missed the point', his biographer said, but the microscope was crucial in the debate.

The grotesque sexual body and category problems go together, as Rebecca Stott has shown.²⁶ From Darwinian microscopic investigations emerged the unisexual hermaphrodite Barnacle, and its extraordinary capacity to differentiate itself from infinitesimal males lodged parasitically upon it as 'mere bags of spermatozoa', a route to differentiation through Malthusian over-production.²⁷ Moreover, in popular microscopy the paradigms of species difference, and the grounds of *both* family relationship and miscegenation were thrown awry. Classifications are ways of holding on to ordering principles, Harriet Ritvo argues.²⁸ There is considerable difficulty in 'at once distinguishing between the lowest forms of animals and plants.' Even amoeba are deceptive, Lankester noted.²⁹ Ferguson described the ambiguities of the Hydra: 'Up to that time [1750] the Hydra had been classified with *plants*, but it was then found to be a true animal' despite its propagation by buds.³⁰ The taxonomical confusions of reproduction were central problems. Simple and compound forms of the *Salpa* mollusc propagated alternately, for example, 'related' mothers to grandmothers but not to daughters (pp. 157–8). 'Imagine a lily producing a butterfly, and the butterfly producing a lily. . . Nay, the marvel must go farther still; the lily must first produce a whole bed of lilies like its own fair self, before giving birth to a butterfly; and this butterfly must separate itself into a crowd of butterflies before giving birth to a lily,' Ferguson wrote (pp. 155–6). The butterfly's transition from caterpillar to winged insect had been among the earliest of Swammerdam's microscope discoveries.³¹ Malebranche used it as

Figure 79
Philip Henry Gosse,
barnacles, from *A Year*
at the Shore

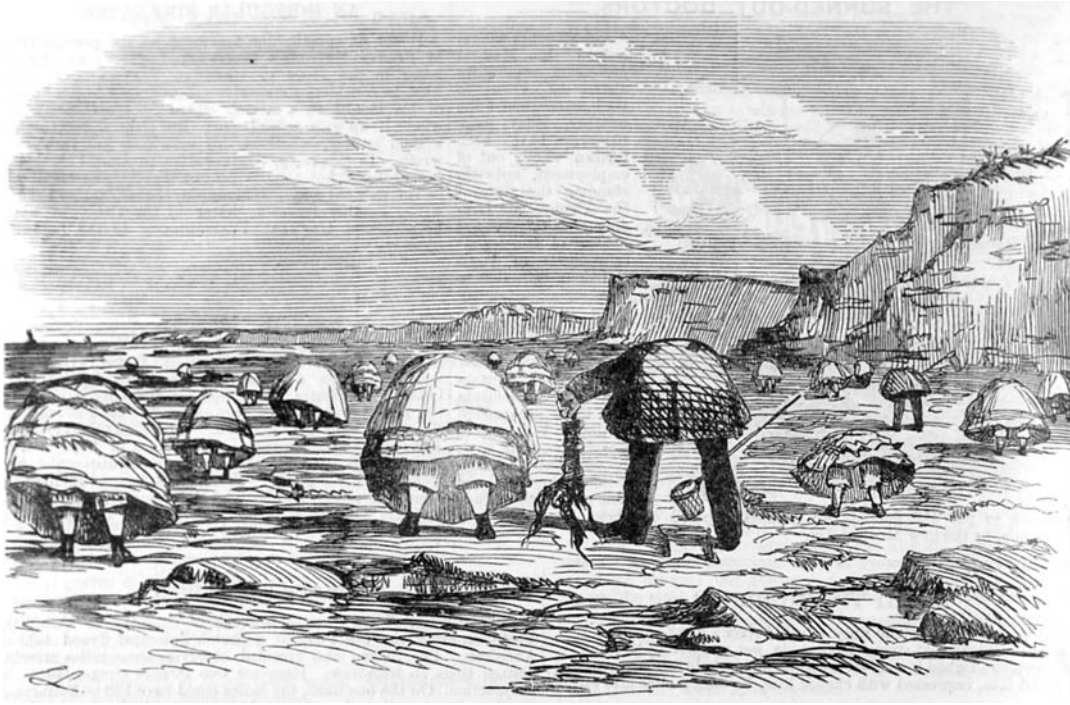


Figure 80
Grotesque bodies,
anemones and limpets.
'Common Objects at
the Sea-Side—
Generally Found Upon
the Rocks at Low
Water', *Punch*, 1858

a symbol of the resurrection. Alice's bread-and-butterfly is more like the scrambled categories emerging in the nineteenth century.

'[T]he egg only got larger and larger, and more and more human: when she had come within a few yards of it she saw that it had eyes and a nose and a mouth.'³²

Proposition. The eye is perfect, like a wonderful piece of technology, like a glass lens. '[T]he human eye, that masterpiece of divine mechanism . . . this noble organ'.³³ The dissociated eye is specimenized as the object of neural and muscular research. The pupil is a beautiful piece of self adjusting mechanism:³⁴ 'The eye is a camera obscura, with its refracting lenses, the retina playing the part of the plate of ground glass in the ordinary camera.'³⁵ 'As the cornea and the crystalline lens must act upon the rays of light which fall upon the eye exactly like a convex lens, inverted images of external objects will be formed upon the retina.'³⁶ Darwin repudiated the 'presumptuous' eye/optical instrument analogy, and though his diagrams of the eye do not have the absolute dissociation of Brewster's images, the eye and twelve eye muscles are the most prominent in his diagrams of the face, which is a measurable index of emotion and the index of measurable emotion in his *The Expression of Emotion in Man and Animals* (1872).³⁷ The eye was generally described exactly as if it were a manufactured multiple lens.³⁸

Figure 81 David Brewster, the dissociated eye, *A Treatise on Optics*, showing *a* the sclerotic coat and *b* the cornea

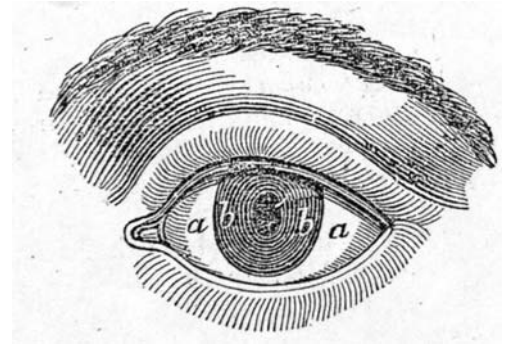
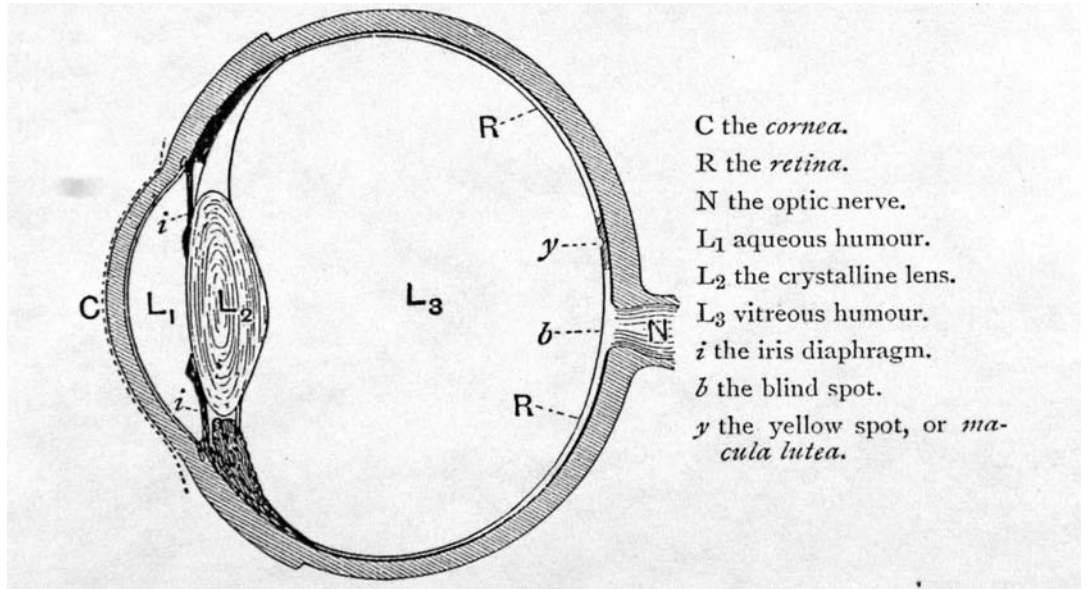


Figure 82 Silvanus Thomson, key to the chambers of the eye



Though the eye resembled a microscope, the *microscope* was seen as a supplement aspiring to the eye's perfection, aspiring to return its artefactual technologized seeing to an ideal moment of transparency that reproduced the conditions of the naked eye. The microscope is the equivalent of eyes to a man born blind, Lankester affirmed in *Half-Hours with the Microscope*. Working to a model of defects, correctives, and supplements, he describes its images as progressively mediated and abstracted. The instrument brings the eye as close as a twentieth of an inch to its magnified object. Two or three more lenses added to the eyeglass bring the eye ever closer: to remedy the impossibility of achieving a short focus with a hand-held apparatus the object glass is fixed to a stand and incorporated in a tube, the human arm replaced with a mechanical arm that can regulate the distance of object and lens. This in itself requires an adjusting mechanism to stabilize the short focus of the lens. The compound microscope further

supplements the simple microscope by enabling the ‘picture of the object’ that exists in the air at a certain point beyond the lens to ‘be looked at by another glass’ and this in turn is brought ‘to a condition’ by the eye-piece, itself a multiple lens, so that it can come into focus.³⁹ A supplementary lens must redress the excess magnification that makes objects indistinct, as other lenses are required to correct the lens’s spherical aberration. A powerful lens condenser to focus light is required to reflect light on to opaque objects, a concave mirror beneath the stage to transmit light through transparent specimens. There is a final adjustment and corrective: the right hand becomes the left; the picture ‘is always the wrong end upwards . . . always the reverse in the Microscope to what it is in the naked eye’ (p. 9). The microscope is such an awkward optical instrument that the best position for observation, Brewster said, was horizontal, on one’s back.⁴⁰

Against this, the eye is a botched instrument, the epitome of misalignment. ‘[I]f an optician wanted to sell me an instrument that had all these defects’, a self-respecting purchaser would refuse it, Helmholtz wrote.⁴¹ Spherical aberration (as the rounded surface of the eye refracts more at the circumference) and chromatic aberration (as varying refraction disperses the light), defective focus, floating membrane (*muscoe volantes*), the capacity of the retinal vessels to cast shadows on to the observed object, the non light-sensitive blind spot, all these defects were recorded. To see the eye as aberrant is to recognize it as part of a total, fallible physical body, not a technologized prosthesis. Henry James’s short story, *Glasses*, takes the human eye as specimen to a grotesque conclusion as his narrator, deeply conscious of the phallic power of seeing, presents a woman transformed by her prosthetic ‘goggles’: her face is ‘wholly sacrificed to the apparatus of sight’; ‘the big gold bar crossing each of her lenses, over which something convex and grotesque, like the eyes of a large insect, something that now represented her whole personality, seemed, as out of the orifice of a prison, to strain forward and press.’ The ‘great vitreous badge’ glittered ‘like a melon-frame in August’.⁴²

Ideally, the face is an index of human species being, where the whole face assumes intentionality through the eyes. An anxiety of the technologized eye, the anthropomorphic desire to locate eyes in non-human life, a search for the residuum of a face, however grotesque—Alice’s face in an egg—is pervasive. ‘[E]very unknown spot is an eye’, attributed to any body part that will bear the analogy, Lewes commented ironically.⁴³ He pointed to the useless ‘eyes’ of his mollusc, located where they could not see. Darwin’s studies of the marine invertebrate, the cirripede, crucial to his early evolutionary research, locate eyes in the stomach and by the testicles—‘The male is transparent as glass . . . In the lower part we have an

eye, & great testis.⁴⁴ Seeking out the displaced eye is a common pursuit. Lankester wrote of the fresh-water *Rotifer*, ‘This leads to an oesophagus, a stomach, and an intestinal tube. Two little spots on the neck seem to indicate the existence of eyes.’⁴⁵ ‘These little organs are eyes’, Gosse said, of the ‘gleam and glitter’, like ‘diamonds or emeralds’, of multiple points at the base of a scallop’s tentacles.⁴⁶ Agnes Callow wrote of ‘*T. Cylindrica*’ ‘red eye’; *Microglena*, ‘the first to possess an eye’.⁴⁷ Rebecca Stott has shown how persistently the grotesque microscopic body is anthropomorphized. The attempt to retain classical ways of seeing by organizing description around eyes resists distortion in one way, but to superimpose a face on specimens is to reintroduce aberration. The ‘living loving countenance’ of God, human and divine, Kingsley said, redeems the ‘terror’ of the naturalist’s world, where the order of nature only emphasizes the flux and despair of the human world. Unperturbed by theories of transformation of species (though he was not a transformationist), he required, in an anticipation of Levinas, the *face* of God to underwrite them.⁴⁸

Alice sees something ‘poking its proboscis’ into flowers. It could be either a bee or an elephant, but if an elephant ‘what enormous flowers they must be!’ Later, she experiences another relational moment: ‘I could show you hills, in comparison with which you’d call that a valley.’ ‘No, I shouldn’t.’ said Alice . . . ‘a hill *can’t* be a valley, you know.’⁴⁹

Proposition. Through the microscope we encounter the transparency of primal life: we approach nearer to the pure forms of pellucid being the more we magnify an object, that arcana where beginnings are revealed, and where ‘Life, reduced to its simplest expression, seems invested with even deeper and more thrilling mystery’, Lewes wrote.⁵⁰ The raw material of being reveals itself.

Against this the anamorphosis of the microscopic image insists on the illegibility of the object, that we move further and further away from experience—‘Microscopy generates representations, but representations by themselves do not mean anything’, Wilson insists.⁵¹ Indeed, indentations could look raised under the early microscope and vice versa. Descartes said of the microscope that an insect might as well be an elephant—Alice’s plight.⁵²

Choric Lyrics

An obsession with the minuscule turns organic phenomena into specimens, viewed with strangely loving detachment and attentive scopophilia. Browning’s lyrics carry the close-up into organic phenomena: Ferns ‘fit

their teeth' to a block of rock; 'one small orange cup amassed | Five beetles, -blind and green they grope | Among the honey-meal' ('Two on the Campagna', 1855); 'small eft-things course' about Caliban's spine, simultaneously viewed with detachment and relished with sensory immediacy ('Caliban upon Setebos', 1864). For Tennyson hair-like filaments (one of the microscope's favourite specimens), threads, and fibres, from roots to the leaf that holds a future history in the morphology of its cells, call out his meticulousness in *In Memoriam* (1850) 'silvery gossamers' (section 11), 'dewy-tasselled wood' (section 86), 'rosy plumelets' (section 91), a daisy's 'crimson fringes' (section 72). Hardy cohabits with insects in a kind of lyrical myopia: '[W]inged, horned, and spined—| A longlegs, a moth, and a dumbledore . . . A sleepy fly . . . rubs its hands' ('An August Midnight', 1901); 'slothful flies | On the rotting fruit' ('Signs and Tokens', 1917); 'leg-laden' bees in 'a prepossessed dive' ('The Later Autumn', 1925).

Michael Field focuses on seeds, berries, spores, and fruits, but not on flowers, which they repudiate as the marker of femininity. They celebrate the fruit of a poppy, a ripened apricot, 'Berries and seeds set brightly' ('So jealous of your beauty'), the iris, 'brimful of seeds . . . packed in a thousand vermilion-beads | That push, and riot, and squeeze, and clip | Till they burst the sides of the silver scrip' ('Unbosoming'). Seeds are polymorphous, refusing gender assignation and moving towards bisexuality. In 'Unbosoming', the heart is a biological organ, a pod tight-packed with seeds: 'So my breast is rent | With the burden and strain of its great content.' Bartolommeo Veneto's courtesan of 'A Portrait', holds an admonitory bunch of 'fading field-flowers', and her 'spiky' box leaf is biologically ambiguous—at that time it would have belonged to the Linnaean taxonomy of spore-propagating, non-flowering plants whose reproductive organs are not self-evident. Michael Field's systematic ambiguities raise the possibility of cross-species connection: the myrtle with its 'Erebus-black fruit' in 'To the Winter Aphrodite' merges syntactically with the goddess it propitiates: the 'burning spices' of a rose that is past flowering, moving 'From flesh to mould' in 'Your Rose is Dead' belong both to plant and woman.⁵³

Crystalphiles, Anamorphobics, and Stereoscopic Volume

‘She must be labelled “[G]lass with care,” the insect voice in Alice’s Scariage remarks when there is talk of sending her home.¹ Alice has become a transparent specimen. The dialectic of crystalphilia and anamorphosis represented two sides of the same problem—the longing for transparent legibility and the fear of a distorting, illegible medium that could not hold ordering principles in place and thus threatened the status of human species being. This dialectic of the lens, and the stereoscopic experiment that triangulates the opposition, is the concern here.

The transparency of the biological organism, far from being a traceless, unindividuated element, *was the trace itself*. It was evidence of the pure principle of life, identified through the microscope as pure transparent matter. Popularizers of the microscope developed a thesaurus of transparency unique to lens culture. The microscope seemed to make life itself transparent, to enable the viewer to look *into* and *through* the object, not at it. A vocabulary ranging from the ‘semi-pellucid’ to the ‘crystal’, and an intensified diction of clear and limpid substance, is brought to the scopic experience of the microscope. Of the Sea Egg’s self-creating organic transparency Kingsley wrote: ‘Conceive a Crystal Palace (for mere difference in size, as both the naturalist and metaphysician know, has nothing to do with wonder) whereof each separate joist, girder, and pane grows continually without altering the shape of the whole.’² ‘There I have just detected an ascidian, standing up like an amphora of crystal, containing strange wine of yellow and scarlet’; ‘The *Noctilucae* are pin-heads of crystal, which in the dark are brilliantly phosphorescent’ (Lewes).³ ‘The bright colours, or delicate transparent appearance of the lorica’; Amoeba is ‘so extremely transparent’ as to be almost invisible (Agnes Callow).⁴ Gosse celebrated the ‘pale red glass’ comprising the disks of a frog’s blood.⁵ A single human hair is a ‘perfectly translucent cylinder, having a light brown

tinge' (p. 4). The scales of a gold fish took on the nacre of mother of pearl, a perch's scales were 'fine crystalline points', the cuttle fish's shell was like an iceberg 'rendered porous and laminated', rising in floors supported by an 'infinite number' of 'thin pillars of crystal' (p. 48). The transparent webbing of a fly's wing, its crystal viscera and respiratory organs, the 'glass-like' tongue of the slug (p. 60), presented the world as diaphane, calling out a poetics of limpidity that attempted to capture the source of life in visual language—chrysophrase, lustre, iridescence.⁶

With this passion for transparency glass culture seems to have penetrated the sub-visible world. It entirely reverses negative early modern readings of the microscope's production of transparency. Margaret Cavendish saw this as its supreme falsification. To Boyle its tendency to make 'opaceous' things disappear or become transpicuous was bemusing. 'Opaque bodies grow transparent, blood grows gray.'⁷ Most of the sceptical critiques problematizing the microscope's mediation made in the nineteenth century had already been made in the seventeenth by Locke, Hume, and Berkeley: that it produced a depthless play of surfaces never revealing an interior, that its images were illusory because appearance is all we see, that its representations explain nothing, that it trivialized knowledge, that the great and small cannot be calibrated.⁸ These arguments were given a new intensity by the popularizing of the microscope disseminated in cheap print and periodicals, by the implied democratic politics of the lens in the work of its chief popularizers (often self-trained, in comparison with the emergent professional scientist of the period) and of course by the circulation of evolutionary ideas long before Darwin. But this does not suggest why the nineteenth century rejoiced in transparency where early modern microscopists did not.

The birth of crystalphilia is concurrent with the derangement of nearness. Distinctness without content, aberrancy without a norm, stimulus without source, content without signification, an object without coordinates: these experiences were intensified by technological improvements to the lens that sharpened the image. Transparency assuaged the ambiguity of anamorphosis, which provided no contract for seeing and released the eye into the fantasmatic. 'THE THINGS I HAVE SEEN IN TAPIOCA PUDDING', Lewes joked, implying anything from pearls to semen.⁹ Tuffen West added a note to his plates illustrating *Half-Hours with the Microscope*, one of which included a grain of tapioca, warning the reader that they were not all drawn to the same scale or with the same powers of magnification.¹⁰ The microscope created the conditions of the close-up for the first time. Whether it presented the blood of a frog, a hair, the cells of a leaf, a new dimension opened up. The magnified object amounted to a close-up without a face. Individuating and socializing, the face enables the nearness

of recognition, that which 'bears upon men', and 'concerns everybody', as Heidegger put it.¹¹ The image severed from space is the negation of the propositional nature of the face. Instead of an identifiable expressive image, a proboscis, a filament, a section of cartilage, made strange, an anamorphosis without a pre-existing undistorted state invaded the microscopic field. Borrowing from C. S. Peirce's classification of images Deleuze thinks of the close-up image as exemplifying his category of 'Firstness'. While 'Secondness' is relational and dialectical, its locatedness a source of action and reaction, 'Firstness' denies interspatial relations. It is a fresh ensemble of qualities 'considered for themselves, without reference to anything else, independently of any question of their actualization'.¹² Suspended as affect rather than expression or meaning, the contours of 'Firstness' move outside coordinates and beyond individuation. At this historical moment, such images call out a compensatory effort to create 'nearness' and relationship.

The dialogue between transparency and anamorphosis played itself out in the works of two popularizers, Philip Henry Gosse and George Henry Lewes, and in Ruskin's attack on the microscope. Helmholtz's annulment of the distinction, though, introduced other difficulties.

Philip Gosse

Gosse saw the scientist as the privileged agent of revelation, tracing 'the handiwork of the God of glory' in the sub-visible world, a God 'never more great than when minutely great'.¹³ The ideal of the poetics of crystal was to reveal 'the transcendent fitness and perfection of every organ and structure'. The scientist was a spy on the visible world, tracing it back to the ultimate transparency: a Corkscrew Coralline 'bathed in its native sea-water, clear as crystal' could be traced back to the 'presence of many lines of transparent vessels of strange and dissimilar shapes, overlying each other' (p. 77). But the expositional conventions of microscopic viewing he developed actually led away from transparency. The reader was led through a progressively closer series of investigations, serial acts of viewing that remake the object with each discrete observation, which is without end. Gosse carried this to extremes in the febrile detail of his observations. His extraordinary account of the saw-fly's progressively complex weapons of aggression unfolds in a series of optical shocks, where the space of the insect body is repeatedly split and divided to reveal ever further complexity.

The first portion of the apparatus that protrudes on pressure, was this pair of saws of an f-like figure. These agree in general with those described [by other

microbiologists]; here is, in each, a doubly-curved blade, the strengthened back, the rasp-like jaggings of the lateral surfaces, the teeth along the edge, and the secondary toothlets of the latter . . . Each main tooth of the saw in this case is the central point in the edge of a square plate, which appears to be slightly concave in its two surfaces, being thickened at its two sides, at each of which, where it is united to the following plate, it rises and forms with it a prominent ridge running transverse to the course of the saw. Each of these ridges then forms a second tooth, as stout as the main edge-tooth, which, with the rest of the same series, form a row of teeth on the oblique side of the saw, in a very peculiar manner difficult to express by words.¹⁴

The lethal surprises of hidden knives sheathing knives, the optical shocks of a series of ever more finely organized hitherto unrecognized weapons of destruction, emerge with oedipal force.

There is, however . . . a second set of implements [not so far discovered] . . . This pair of saws that we have been looking at is but the sheath of a still finer pair of lancets or saws which you may see here . . . Their extreme tip only bears saw-teeth, and these are directed backwards, but one side of the entire length presents a succession of cutting edges, as if a number of short pieces of knife-blades had been cemented on a rod, in such a manner as that the cutting edges should be directed backwards, and overlap each other . . . The appearance of these implements is very beautiful.

Other observers learned from him. Mary Roberts, author of *A Popular History of the Mollusca* (1851), who believed that natural history provided evidence of the Creator, and understood the voracious feeding of marine life as a divine form of population control, is an example. *Pinna*

when examined by transmitted light it will present, on each of its surfaces, very much the appearance of a honeycomb. Look narrowly, and you will discover further, that whilst at the broken edge it exhibits a fibrous aspect it may be compared, in reality, to an assemblage of basaltic columns. A still closer inspection will reveal that the shell is composed of a vast number of prisms arranged perpendicularly to the surface of its laminae, forming the thickness of their length, and the two surfaces by their extremities.¹⁵

Honeycomb, basaltic columns, prisms: later the same specimen resembles pith, small mirrors, nuclei, sun spots—the list of discrepant analogies distorts rather than clarifying. Excess of metaphor suggests we are really bereft of it.

Gosse combined Calvinism with a popularizing impulse that democratized detail. Like the Anglican natural theologians, he believed in the argument from design and deprecated evolutionary ‘infidelity’.¹⁶ But, reactionary in so many ways, he was an arduously self-made scientist from the dissenting lower-middle class. Meticulous observation *de novo* and the authority of Gosse’s eye becomes truth. All God’s creation was unique, and thus people as well as the teeming data of the invisible world

were included (he was one of the few Victorians explicitly to eschew racism).¹⁷ Though Gosse published taxonomical studies, his God did not require such frameworks to create divine meaning, because creation means through endless particulars. He struggled to find a language for minutiae and descending orders of minuteness—barbs, barbules, barbu-lets—but such diction exposes, not only the will to control, but a kind of observer’s delirium. This is the positivist observer gone mad. An infinite regression of detail sanctioned by an invisible God, luring the observer on to ever more invisible phenomena, produces a world of proliferating parts. It is a world strangely without repression, where no detail can be subordinated and nothing can be left undescribed. At the same time a manic scepticism emerges, despite the descriptive absolutism. It is impossible to get to the end of seeing, impossible to see everything, to reach the ultimate transparency.

George Henry Lewes

The *Blackwood’s* articles of 1856 and 1857 that initiated the book *Sea-Side Studies*, were a deliberate and unexpected response to galling criticism of Lewes’s science by Huxley.¹⁸ Huxley had attacked the scientific accuracy and intellectual credentials of Lewes’s study of Comte in the *Westminster Review* in 1854.¹⁹ Without professional training and a naïve view of the development hypothesis, Huxley argued, Lewes was not eligible to write serious scientific reviews. In reaction, Lewes presents himself as a flagrant, transgressive amateur, *not* a ‘pure’ scientist, though one with considerable practical and bibliographic knowledge. He insists on the libidinal, addictive nature of research. The non-abstract knowledge he pursues can teach conventional science. He writes with a persistent, deliberately ‘Cockney’ sensuousness and vulgarly sexualizes knowledge. The bliss of scientific discovery is like the first kiss. The Daisy, *Actinia bellis*, is a ‘coquette, ‘who displays her cinq-spotted bosom, beautiful as Imogen’s, in the crystal pool’.²⁰ Groping in the holes into which such creatures disappear is clearly an erotic experience.

Knowledge is driven by the passions. This is actually the condition for untethering thought from detail so that the discovery of form can take place. It is the passions that drive generalization and the will to conceptualize and give it ‘definiteness’. The search for typical form is a fascination with the defining morphological *categories* that structure groups of species. It can only be discovered under the microscope which renders matter transparent, and the hunt for morphology disclosed by the lens becomes an obsession. ‘The typical forms *took possession* of me. They were ever

present in my waking thoughts; they filled my dreams with fantastic images . . . they teased me as I turned restlessly from side to side at night' (p. 196). Science calls out the aesthetics of transparency, the unveiling of pure form: '*Clavelinae* almost as translucent as the water in which they stood' (p. 188); 'the transparency of the tissues allows us to see the pulsating heart' (p. 192). It is a passionate and sexualized intellectual experience, felt with somatic intensity. This libidinal knowledge is a democratizing force. But it is rigorously anti-anthropomorphic: 'The strong devour the weak without any religious scruples' (p. 196), a drive not a choice. Bachelard connected the microscope with dreaming rather than knowing.²¹ Lewes dreams and researches, an oniric cognition. He insisted, in the book form of his articles, that with proper experimental rigour, the microscope was not distorting. Nor did it produce purely subjective images.

Lewes used transparency daringly to deconstruct the hierarchy of biological life, not to keep species apart but to conflate them, most challengingly the mollusc and the human being. Thus the route to a strange aberrancy lay through the microscope's transparent medium. Huxley's own research area was the mollusc. Lewes implicitly challenged comparison with Huxley in the second article, claiming to have discovered a new genus of mollusc, insisting, like him, that the polyzoa belong to the mollusc class. And, like him, he questioned the five embranchements with his theory of 'typical form' that might cross categories. Simple and complex nervous systems alone determine what we are. 'In creation there is neither high nor low; there are only complex and simple organisations, one as perfect as the other.'²²

Sight is the deciding factor transgressing categories and aligning human and mollusc, a tactile seeing structurally akin in mollusc and human. Invoking Müller's optics, and ahead of his time, Lewes argues for a phenomenological understanding of sight, anticipating Helmholtz. The mollusc is blind. It sees by touch. In reality we all touch what we see. It is precisely by being 'blind' that we release ourselves into cognitive experience. For seeing by touch displaces the notion of the passively received image on the retina and substitutes for it the process of experiment with data. We see very much with our fingers, by palpation, as seeing is diffused through the skin. The physiology of vision is a process that creates no direct correlation between vision and image. It is the result of a wave of light translated into a nerve stimulus. '[T]actile sensations and sensations of light' are the optical prerequisites for image formation. It is the mollusc that substantiates this model, for the eyes of the three genera under investigation are '*underneath* the skin and muscle, and rest on the brain . . . attached thereto by a microscopic nerve. There is no aperture in the skin, as there is in ours, through which the rays of light may fall directly on the eye' (p. 350). Molluscan vision is not seeing but feeling, and though

it is not human vision it is archetypically analogous to it. The double body of the grotesque—mollusc/man—appears here in the microscopic image as insistently as it appeared in material artefacts. ‘Typical form’ paradoxically crosses boundaries.

Ruskin

Ruskin parodied the myopic teleology, the heterogeneous metaphor and incoherent description and analogy propagated by the microscope. In this satire he recognized the seepage of violence and libido into the language of microscopic displays and their uncontrolled scopic detail. Here the lens scrutinizes the flower *Brunella*.

First, that the blue of the petals is indeed pure and lovely, and a little crystalline in texture; but that the form and setting of them is grotesque beyond all wonder; the two uppermost joined being like an old-fashioned and enormous hood or bonnet, and the lower one projects far out in the shape of a cup or cauldron, torn deep at the edges into a kind of fringe.

Looking more closely still, I perceive there is a cluster of stiff white hairs, almost bristles, on the top of the hood; for no imaginable purpose or use of decoration—any more than a hearth-brush put for a helmet-crest,—and that, as we put the flower full in front, the lower petal begins to look like some threatening viperine or shark-like jaw, edged with ghastly teeth—and yet more, that the hollow within begins to suggest a resemblance to an open throat in which there are two projections where the lower petal joins the lateral ones, almost exactly like swollen glands.²³

(‘So the two brothers [Tweedle Dum and Tweedle Dee] went off hand-in-hand into the wood, and returned in a minute [to fight] with their arms full of things—such as bolsters, blankets, hearth-rugs, table-cloths, dish-covers and coal-scuttles’.)²⁴

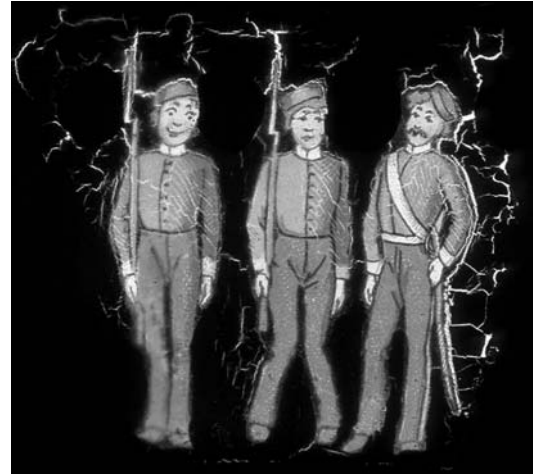
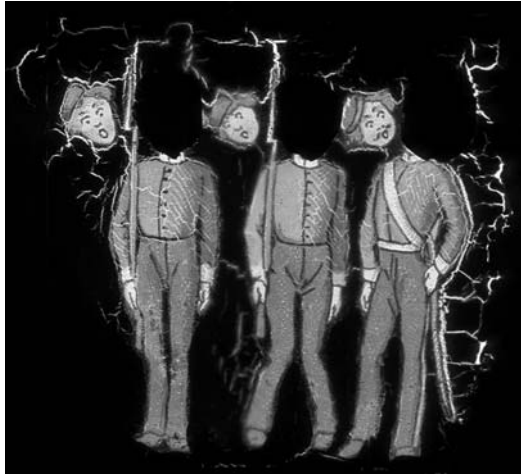
Pervaded with a sinister sexuality—all pathologized, vaginal mouth and jaw without eyes—this account is also an assembly of arbitrary *things*, a bonnet, a cauldron, a hearth brush, a helmet-crest, commodified articles that have lost their bearings. Ruskin’s ruthless analysis of the fetishizing of ungrounded atopic images of the microscope shows that Grotesque virtuality arises the more meticulous descriptive language attempts to be:²⁵ ‘We must never lose hold of the principle that every flower is meant to be seen by human creatures with human eyes.’²⁶ To modern science ‘the eye seems rather an external optical instrument, than a bodily member through which emotion and virtue of soul may be expressed’. Microscope fanatics, ‘would give themselves heads like wasps’, with ‘three microscopic eyes in the middle of their foreheads, and two ears at the ends of their antennae’.²⁷

Commonly seen as reactionary, this is a critique of glass culture's acceptance of the violence of technology and the monocular lens. Glass culture's assumption of unproblematic transparency in fact belongs to the optics of anamorphosis. It produces a deviant imagination that 'writes' on consciousness as the cultural imaginary accepts distortion: 'the vision is seen as in a broken mirror, with strange distortions and discrepancies, all the passions of the heart breathing upon it in cross ripples, till hardly a trace of it remains unbroken.'²⁸

Ruskin's attack is political and social. The images of the microscope are part of the bombardment of visual media competing for the consumer's gaze and exhausting the sensoria through a systematic principle of rapid erasure. This has repercussions for the whole culture. The random inscriptions that dominate the scopic experience of the city—bills, posters, advertisements, signs, shop windows—fragment the scopic field so that the exhausted eye requires ever more glaring visual stimuli. 'The vast extent of the advertising frescoes of London, daily refreshed into brighter and larger fresco by its billstickers, cannot somehow sufficiently entertain the popular eyes.'²⁹

Philanthropists give the children whom 'the streets educate only into vicious misery', corrupt 'scientific vision' instead of genuine knowledge: 'in microscope or magic lantern; thus giving them something to look at such as it is;—fleas mostly; and the stomachs of various vermin; and people with their heads cut off and set on again; still something to look at'.³⁰ Ruskin is fiercely aware that the visual image independent of its source is at once placebo and distorting figure without referentiality. Scientific vision creates passive subjects and performs a fragmenting, cutting exercise ('with their heads cut off'), a form of cultural castration that can never 'restore' the split-off entity, the object torn from coordinates, because these are independent of context. The faceless 'people with their heads cut off' are a violation of species being as the human face is destroyed.

Ruskin's critique discloses a searching understanding of nineteenth-century glass culture and its dialectic of transparency and anamorphosis: it is a demanding analysis for all his resistance to glass culture's technologies. He was in fact in thrall to glass culture; but just as his allegiance was to reflection and its complex traceries, rather than refraction, so he was committed to the binocular stereoscope because it reproduced the depth of field commensurate with the unaided vision of the eye. Optical plaything and scientific instrument—Brewster reckoned that upwards of half a million of his lenticular stereoscope were sold within a few months of its invention—stereoscopes enabled two plane images on a card, adapted to the axes of the separate eyes, to be converged through two lenses.³¹



Though they exploited other media, the photograph commonly supplied the image.

Figure 83
Magic lantern slides of
decapitated men

Helmholtz: Optricks and Double Vision—‘transparent ice . . . comes out as if it were real’

It was Helmholtz who made the most brilliant reading of the stereoscope: two discrete images of the same object, seen as separate and different images by each eye—‘two distinct nerves’—became an instrument for exploring the astonishing feats of normative sight.³² As it did so, the distinction between transparency and distortion became unimportant.

Transparency was essential to his thought, and completed his thinking on the semiotics of vision, nerve-end stimuli, and somatic knowledge. *Stereoscopic lustre*, a hyper-real relief or polish, was the key to his cognitive theory. Transparency—of ice, glass, or crystal—was crucial. Visual images without the markers of dimension and distance, such as crystals and irregular rock formation, form ‘a confused mass of black and white’ (p. 182) on a plane surface, ‘especially when they are transparent, so that the shadows do not fall as we are accustomed to see them in opaque objects’. But they stand out in the stereoscope with translucent clarity—‘glaciers in stereoscopic photographs appear to the unassisted eye an incomprehensible chaos in black and white, but when seen through a stereoscope the clear transparent ice, with its fissures and polished surfaces, comes out as if it were real’ (p. 184). Strange places, once seen through the stereoscope, possess uncanny familiarity, not achieved by plane photographs.

Figure 84
A stereoscope



Stereoscopic lustre decisively proves that the impressions on the two retina are not combined into one unified sensation *prior* to interpretation: that is, there is no unified *picture transmitted to the brain*, what Helmholtz deemed the passive, 'intuitive' theory. For the union or coalescence of black and white would be *grey*. *Lustre*, on the other hand, can only be the result of binocular vision, where the skilled eyes manipulate two sensations and bring together two unlike images. *Disconnection* is the prerequisite of *connection*. The stereoscope achieves its effects by separating out and *misaligning* two images in order for them to be realigned by a mental act. Just as Lewes brings phenomenological sight out of blindness, Helmholtz insists on the non-correlation of stimuli and interpretation precisely in order to deny passivity to the eye and to empower the act of seeing as an active *mental act*, a *praxis*, the result of experiment, a kind of optical hermeneutics. This is the rival active, 'empirical' theory. If the same surface figuring crystal is made white in one plane panel and black in another, 'the combined image appears to shine, though the paper itself is quite dull' (p. 188). Unequal reflective brightness will be perceived by each of the two eyes, and thus the black and white images, when reconverged, appear like that of a polished surface.

The empirical theory supports the epistemology of *kennen* for Helmholtz. 'Meaning' is something we have to learn by experience. Sight is an acquired knowledge, the production of the world from an 'incomprehensible chaos of black and white' (p. 184) where by experiment 'we have the rule for the movement of the eyes which are necessary for seeing it' (p. 195). The arduous phenomenological work of the infant as researching being is a model.

We become acquainted with their meaning by comparing them [signs] with the result of our own movements, with the changes we thus produce in the

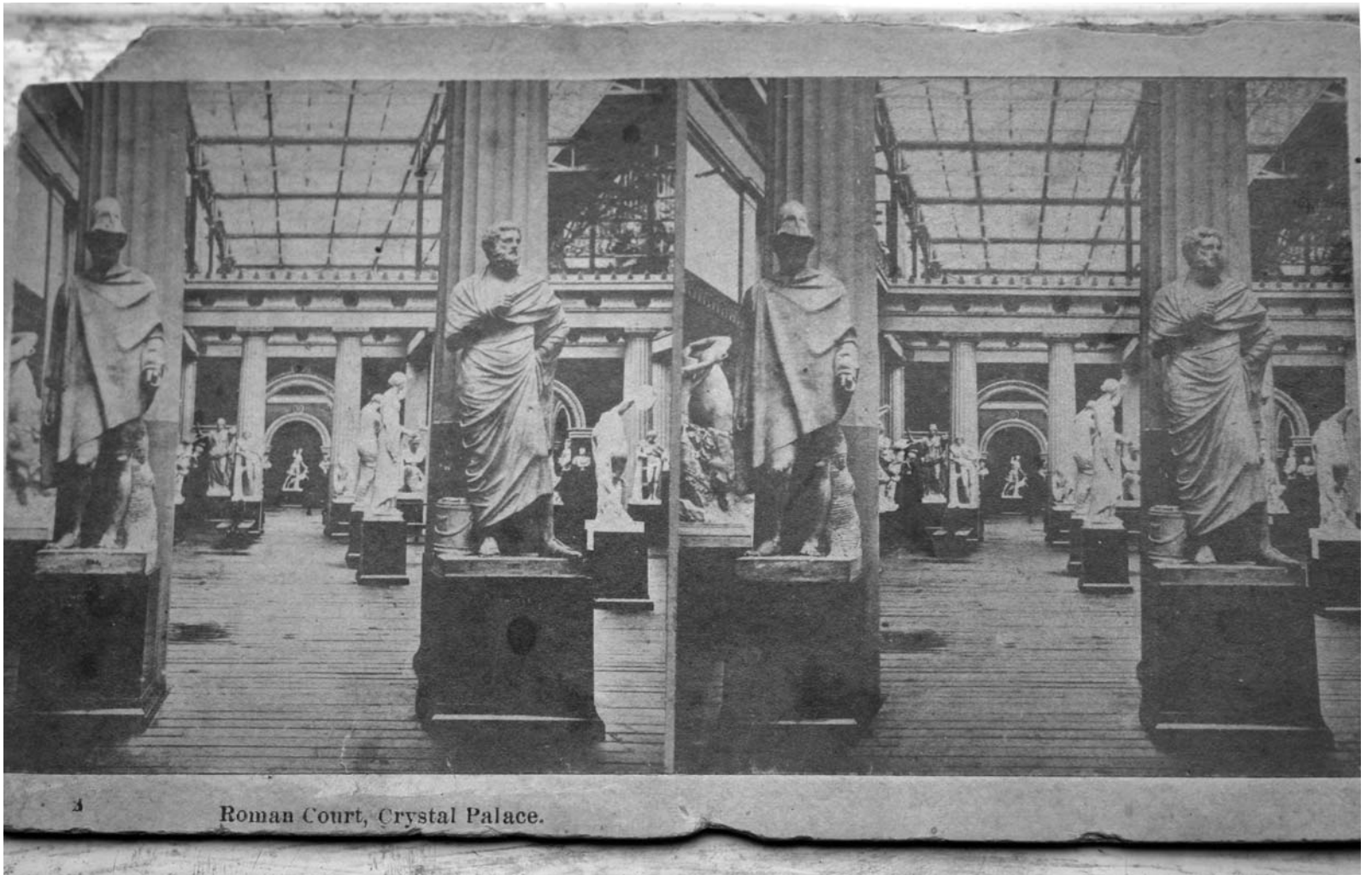
outer world. The infant first begins to play with its hands. There is a time when it does not know how to turn its eyes or hands to an object . . . When a little older, a child seizes whatever is presented to it, turns it over and over again. Looks at it, touches it, puts it in his mouth. . . . After he has looked at such a toy every day for weeks together he learns at last all the perspective images which it presents . . . By this means the child learns to recognise the different views which the same object can afford, in connection with the movements he is constantly giving it. The conception of the shape of any object, gained in this manner, is the result of associating all these visual images . . . we are then able to imagine what appearance it would present, if we looked at it from some other point of view. (pp. 194–5)

‘Looking-Glass House’, ‘looked at from some other point of view’ is ‘just the same as our drawing-room only the things go the other way. [Alice sees] ‘all but the bit just behind the fire-place. Oh! I do wish I could see that bit!’: ‘[N]ow we come to the passage. You can just see a little *peep* of the passage.’³³

The Crystal Palace at Sydenham: four moments in a stereoscopic view of the Roman Gallery

For Helmholtz the stereoscope’s disarticulation of vision from its object, double vision, as it was sometimes termed, was a liberation, not the technologized visuality later readings have described. Looked at in his terms, as an instrument of cognitive arousal, a stereoscopic card of the Sydenham Crystal Palace yields propositions such as Helmholtz associated with the knowledge of *kennen*. The image echoes the space-splitting practices of the microscope. It does not offer the restoration of a disjunct composite, but instead provokes an examination of its phantom volume. Four principles can be derived from its ‘other point of view’:

1. The stereoscope, you might say, is *about* space and the artificial creation of volume. It makes propositions about space mediated through the deliberately manipulated lens and eye. It must deal with distances and surfaces, surfaces that disrupt distance and distance that disrupts surfaces. It thus recognizes anamorphosis but is not in thrall to it. Both distance and surface take on strangeness because the eye cannot see near and far objects simultaneously. A sculpted foot projects above the viewer, for instance, or the receding glass roof, a series of suspended transparent squares, temporarily suspends referentiality. The flat photograph is ‘about’ planar imaging, the stereoscopic image is about the strangeness of depth of field. Brewster elaborately described the geometry of light and shade in the ‘rounded’ image of the stereoscope in order to demonstrate that effects of light quite alien to the plane photograph could appear in a stereoscopic photograph,



3
Roman Court, Crystal Palace.

so that previously unseen details emerge.³⁴ **The first term of the stereoscope's syllogism is the nature of distance when the eye moves from foreground to background and back.**

2. One of the stereoscope's propositions is **that we give up the classical gaze's authority: we question the stable relation between subject and object, ceding ownership of the gaze.** The illusionistic space within a space that the stereoscope creates depends on the extension of space *behind* as well as beyond the viewer—the moment of entrance to the Roman Gallery at which we stand is not a threshold that marks entry into a different dimension but an extension backwards of that dimension, always already the same space. That is why commentators always speak of 'being there', in a space, not at a fixed point outside it looking in. This immersion means that there is no frame. The perspective of the Roman Gallery tunnels centrally through the walkway between symmetrical groups of statues on either side towards a distant, central, alcoved effigy, but it is a parody of classical perspective. It puns on symmetry, doubleness. Space stretches away beyond the viewer, on the left a half-hidden pillar or amphora, on the right a lone statue (the Diskobolos?), and there is no control of the gaze. Above right, through the glass roof in asymmetrical angularity, a section of the glass reveals tree silhouettes behind it. The cut-off looks accidental. The field of vision is sectioned and segmented by the groups of immobile, gesturing figures, rigidly divided into two groups, but within these sections unevenly located and receding unevenly at different depths, just as the glass mezzanine roof recedes *against* the lines of the figures below. The view is blocked on the right by alcoves. On the left an archway takes the eye obliquely beyond. There is always an unknowable space.

3. **Space is relativized.** The figures gradate discontinuously from roundness to flatness, their fluctuating volume depending on the object to which they are related. The distortions depend on where the eye moves. The backs and profiles of the single statues on the right move in a rhythm of contrast to the frontal figures in the foreground, providing that 'seeing behind' impossible to the eye, and yet they flatten in relation to a group yet further beyond. The eye can only move discretely. The stereoscope exchanges this negative understanding for researches into an endlessly perspectival visual field.

4. **The ideological tensions of space and power emerge.** The reproduction of ancient Roman gravitas (only two figures appear female) for mass consumption in a transhistorical museal space invokes dehumanizing power to represent the art of empire. Only one of the faces of the flanking figures is in full frontal light. The hunched, crouched, blanched figures transfixed in stone (one is the Venus de Milo?), all *copies*, seem to be in mourning, alienated bodies calling to our own.

Figure 85 Stereoscopic card of the Roman Court, Crystal Palace, Sydenham

The Kaleidoscope

If Helmholtz reconciled transparency and anamorphosis through the stereoscope's misalignment, Brewster's kaleidoscope turned anamorphosis into atopic symmetry. Its principle is pure atomization abstracted to the furthest degree, endless but unreplicated pattern within endless replication—it creates a glittering, prismatic rearrangement of coloured particles, 'never again recurring with the same form and colour'. Brewster explained it as the multiplication and arrangement of images based on strict geometrical rules.³⁵ Two mirrors at an angle of 60 degrees enable images of images to be reflected, forming 'a perfect equilateral triangle'. When the object reflected is moved, 'all the images will move, and the figure of all the images combined will form another figure of perfect regularity, and exhibiting the most beautiful variations'. Brewster sometimes added a lens that would reflect and incorporate the outside world, but its true principle is distinctness without content distilled into pure, formal, molecular being. Cray called this synthetic visuality 'industrial delirium'.³⁶ But the kaleidoscope also thematizes the limits of experiment and change. Like the child's primitive fort-da experiment, it grants some control to this enquiry. Constituted from pattern and randomness, freedom and repetition, order and chance, its propositional logic is *about* these contradictions.

Choric Lyrics: Two Stereoscopic Poems

The stereoscope appeared between the first (1832) and second (1842) versions of Tennyson's 'The Lady of Shalott'. 'On either side the river lie | Long fields of barley and of rye, | That clothe the wold and meet the sky; | And through the field the road runs by'. This is a cut and riven landscape, doubly scored by road and river. The fields, split but doubling themselves, are replicated symmetrically, just as they are replicated in the repetition of these four lines. Punning on agrarian (humanly cultivated) fields, the field of vision, and the *depth* of field, these prescient lines bring the split field of the flat stereoscopic card together with its strange depth of field when seen through the lens. They evoke the discrete eye movements that register separate parts of the visual field (river, fields, wold) as well as perspective depth (sky, road). Throughout this first section in particular an overdetermined experience of depth and surface suggests stereoscopic meditation: the resolute geometrical volume of the castle's 'Four grey walls and four grey towers', the contrast between reapers tunnelling barley, and the convexity of the 'uplands airy' on which they work, an optically deceptive harvest moon.

This is an optical elegy on radical *misalignment*. Non-convergent space-time relationships occur throughout: in the non-convergence of slow, labouring barges and the ‘unhail’d’ aristocratic shallop afloat on the same river but without contact, between the labourers themselves, who appear to hear different songs from the Lady, one that is from the every-day, one magical, as the rhymes ‘cheerly’ and ‘fairy’ suggest—reapers ‘Hear a song that echoes cheerly... the reaper... whispers “’Tis the fairy | Lady of Shalott”’. Lancelot’s flight through the mirror is oblivious of the watching Lady. Tennyson uses the disarticulated visual field to render a fragmented culture, as the final shattering of the mirror suggests. The rigorous formal repetition and doubling at every level of diction, invites an association with the kaleidoscope, as if its symmetries might redress the fracture of vision. But the formal elements of the poem themselves give divided messages. Lancelot’s “‘Tirra lirra,’ by the river’, offers correspondence (though semantically empty) on one level and the not-quite-aligned elements of double vision on the other.

A number of poets experiment with a form of ontological anamorphosis that bespeaks violence. Browning’s ‘Childe Harold to the Dark Tower Came’ begins with the action of one dissociated eye, ‘Askance’, on another. The speaker, a prey to perverse looking, refracts the ‘malicious eye’ of his cripple interlocutor, assessing the ‘working of his lie’ on ‘mine’. And the quest narrative continues with a distorted, brutalized wasteland, metonymic images without cues to meaning. Morris’s ‘The Haystack in the Floods’ ends with the severed head of Robert, watched by his lover, uttering a sound before being violently kicked to pieces by enemies. Ruskin’s men with their heads cut off, Lewes’s beheaded man automated by the nervous system, are contexts here. Dissociated body parts—eyes, hands, fingers, feet, neck, throat—figure societal and psychic dismemberment. Analysis of pain finds its culminating moment in Swinburne’s work, but here I turn to his extraordinary exploration of double vision in ‘Before the Mirror’, his meditation on Whistler’s painting, *The Little White Girl* (1864).³⁷

‘Art thou the ghost, my sister, | White sister there, | Am I the ghost, who knows?’ Linked but alienated, the reversible dyad of the mirror image, I/thou, makes each potentially ghost to the other. Compare Merleau-Ponty’s optimism, where the circuit of reflection makes the body in the mirror as sensate as that outside it. The girl—or her reflection—speaks the central lyric. Flanking it are two reveries that each constitute a change of focus, from surface to depth. Swinburne’s three-part meditation, each section triangulated into three stanzas, on Whistler’s painting, is deliberately stereoscopic in its play with surface and depth, and with the investigation of torn parts of the field of vision that were never originally joined. Whistler’s girl in white, her dress of white transparent ruching veiling a



Figure 86 James McNeill Whistler, *The Little White Girl*, 1864

white underdress, leans against a mantelpiece, her face reflected in the mirror above it, but turned in profile athwart her reflection so that she does not make eye contact with her mirrored face. The face exhibits volume and mass as the girl in reverie does not. It is strangely detached from the profile, ravaged in comparison with it. Dashes of colour, pink flowers in particular moving out of the frame of the picture to the right, a red pot, a red streak on the Japanese fan she holds, her red lips, unfreeze a little of this blanched scene.

It is as if the two flanking lyrics follow the bifurcation of the mirror itself, which is split in two, so much so that the picture reflected in it from the opposite wall is slightly disjoined. We ourselves must be somewhere between that picture and the woman—that is, inside the space she inhabits, as the stereoscope demands. The picture, which may be one of Whistler's own Thames paintings, appears to feature an arched bridge. (The double arch, interestingly often represented double vision in discussions of the stereoscope.)³⁸

The poem is in threes because the narcissistic gaze in the mirror figured in the 'lips that pair'—'the flower is fair', the girl says of herself in section 2—is not the only way of seeing. By triangulating vision (paralleled in the curiously triangulated rhyme scheme), and in moving from surface to depth and back, Swinburne's poem moves from one to another reading as a fresh optical axis is adopted. But all the readings remain in play and alter one another. The poem experiments with altered focus. The first lyric intuits the snowy psychic landscape of the girl, 'Behind the [glazed] veil' as the composition of virginal white suggests. A frozen life formed from sexual fear—'Soft snows that hard winds harden'—could issue in 'joy' or 'grief', but the virgin snows are hardened like the frozen glass of the sterile mirror. The girl's own perspective of sexual self-delight in section 2 explodes this reading, one side of the mirror living through the *imagined* image of the other. 'Art thou the ghost . . . Am I the ghost?' There are hints of Baudelaire's lesbian poem, where the women are mirrors to one another, but most of all of the mirror, in 'L'irrémediable' 'sombre et limpide', where the 'sombre' contains 'ombre', shadow, within it, contradicting the mirror's clarity.³⁹ The third lyric refocuses, attempts to look below the surface at the fate of feminine desire, 'deep in the gleaming glass'. Here 'formless gleams' and the 'glowing ghosts [reflections?] of flowers', inchoate, lambent forms, coexist with 'all past things [that] pass', the sum of the mirror's past reflections. Despite the elegiac note of the final stanza, these things are still in flux.

For Ruskin, for Helmholtz, and for Swinburne, complex, perspectival stereoscopic vision annuls the opposition between transparency and anamorphosis. The cost is a contradictory world.

14

Coda: Fixing the Moving Image and Mobilizing the Fixed Image

Memory, Repetition, and Working Through

Repetition and recollection are the same movement, except in opposite directions; for what is recollected has been, is repeated backward, whereas genuine repetition is recollected forward . . . the person who chose repetition, he lives . . . what would life be if there were no repetition?

Soren Kierkegaard, *Repetition*, 1843.¹

And if all things have been here before . . . Must not this gateway, too, have been here—before? . . . and I and you at this gateway . . . whispering . . . must we not all have been here before?

Friedrich Nietzsche, *Thus Spoke Zarathustra*, 1883.²

As long as the patient is in the treatment he cannot escape from this compulsion to repeat; and in the end we understand that this is his way of remembering.

Sigmund Freud, 'Remembering, Repeating, and Working Through' (1914)³

This chapter turns from the lens-made image in space to the lens-made image in time—of all the ways of multiplying the image for mass spectatorship, these were of course to be the most potent. The lens was the agent of repetition. Devices for making the fixed image move, the motion toy, or for fixing the moving image, the camera—speeding time up or holding it still—developed concurrently. Movement devices generated the pleasure principle of whirling, gyrating, spinning, rotating, revolving toys—a variety of radially slit, disc-based instruments such as the Anorthoscope, the Phenakistiscope, the Zoetrope, the Praxinoscope, that framed a sequence of moving images and often used the mirror and the lens for projection. With the camera lens and the glass plate, 'sun pictures' were one of the consummations of glass culture. 'We now come to speak of sun pictures on glass, the perfect transparency and evenness of which, renders it peculiarly fitted for photographic purposes,' the *Illustrated Exhibitor* wrote in 1852.⁴ The glass plate, in conjunction with the wet collodion process, with an exposure of ten seconds to one and a half minutes (and sometimes less), seized an evanescent moment from temporality.⁵ To 'take' a photograph is to 'take' something from time. With the camera and the



Figure 87
Zoetrope images

Figure 88
A phenakistiscope



motion toy the grammar of cinema comes into being along with its antithesis, the still photograph.

Strictly speaking, motion toys, conventionally understood as the precursors of cinema and twentieth-century modernity, do not belong here. But they are bound up with the stasis of the camera, which belongs to the nineteenth century. It is the immobilizing other of these gyrating technologies, transfixing a figure and sealing it in light. This discussion does not foreclose on motion toys as the pre-history of cinema, therefore—it does not regard them as frustrated attempts at cinema, but devices with distinct concerns which turn on the dialectic of the motion toy and camera. This chapter is a coda because the opposition of still photograph and motion toy forms a transitional moment between nineteenth-century and twentieth-century modernisms, where early glass culture ends.

Motion toys and camera are time bound. What the photograph, a clock for seeing, reproduces to infinity has occurred only once, Barthes said.⁶ But the click/tick of fractional seconds marks both uniqueness and the entry of the image into the time of mechanized reproduction. The serial images of the motion toy mark the reverse process, as transfixed moments coalesce in the movement image. But both motion toys and camera make visible the traces of the past. They are committed above all to repetition, and belong to a phenomenon of widespread cultural anaphora, to repeat Meisel's term.⁷ The lens, as the great agent of repetition, releases the conceptual problems of anaphora. An enquiry into the extent to which minds and bodies are trapped in rote, mechanized replication, and industrialized reproduction is immanent in these forms of repetition, which explore both positive and negative structures of recurrence. In Elizabeth Barrett Browning's poem of 1844, 'The Cry of the Children', turning machinery 'turns the sky' 'blank and reeling' in the high factory window. When this concern migrates to philosophy its passionate quality is not lost. As the epigraphs to this chapter demonstrate, repetition and its degrees of freedom is the explicit object of theory in the nineteenth century, and at its end, in the transitional moment of glass culture.

The Camera and Movement Toys: Time, Motion, Repetition

Unlike the stereoscope, where spatial experiments predominated (for instance, the simple act of holding out a hand and its startlingly different planes viewed first with one eye and then the other), temporal experiments are the foundation of the camera and motion toys.⁸ These are concerned in different ways with what Helmholtz termed 'motion after-images', to distinguish the persistence of vision from colour after-images.⁹

An illuminated object whirled in a circle will produce a dazzling calligraphy of continuous lines of light, but a fast succession of sparks will alone produce the impression of simultaneity. If an ignited stick is whirled ten times a second, it can perpetuate the impression of brightness by keeping pace with the (approximately) tenth of a second the impression remains on the retina. A moving light coalesces to a continuous line traced in the air, but a rapid succession of impressions will also cause the sense of motion.¹⁰ It is not only motion, therefore, that comes into play through these ludic experiments but the fact of stasis and motionlessness. For by the same rule of the succession of sparks, the 'most rapid cannon ball, illuminated by a flash of lightning, would be seen for the fraction of a second perfectly motionless in the air'. 'A jet of water descending from an orifice in the bottom of a vessel exhibits two distinct parts: a tranquil pellucid portion near the orifice, and a turbid, or pellucid portion lower down . . . But when the jet in a dark room is illuminated by an electric spark, all the turbid portion reveals itself as a string of separate drops standing perfectly still. It is their quick succession that produces the impression of continuity.'¹¹

Eadweard Muybridge's serial images of bodily movement (chronophotography) bring together the contradictory elements of speed and stasis in their sequences of movement as they isolate micro-movements, a changing muscle-form in the back or the buttock, a thumb's projection and retraction, from frame to frame.¹² Because time can now, seemingly, be infinitely divided, movement and stillness belong together. 'If, now, sixteen figures be drawn, each of such a size as to fall within a sector of one-twentieth of the figured disk, and having the gradational variations proper for the Phenakistiscope or the Zoetrope, and these figures be transferred to the disk with an opening-out of their angular distances in the ratio of 5 : 4, each will occupy a sector of one-sixteenth of the circle, and will be momentarily seen *in succession* through the slit.' This is how William B. Carpenter, President of the Royal Society, analysed (1868) the use of two rotating disks in a sophisticated Phenakistiscope.¹³ Carpenter's calculations based on one-sixteenth of a circle happen to coincide with the sixteen sequential images perceived as continuous movement operating in early film footage.

The power of the celluloid strip begins to take over from the paramount centrality of the glass lens or its equivalent, the narrow aperture. But other implications of the motion toy should not be missed. The eye *owns* sight, Helmholtz said, in two ways, direct, and indirect, focal and peripheral vision. Moreover, the eye is free: 'To *look* at anything means to place the eye in such a position that the image of the object falls on the small region of perfectly clear vision.' 'Whatever we want to see we look at . . . what we

do not look at, we do not as a rule care for at the moment.’¹⁴ The fovea of the eye must be aligned with the chosen object of sight for seeing to take place. Choice is a necessary part of looking. But when Helmholtz spoke of direct and indirect perception of motion, the eye’s voluntarism is less evident. A slow-moving train or a crawling insect involves ‘the idea of an interval of time and that of two places’, as change of place can be inferred by calibrating time and space (indirect *voluntary* perception). But this grasp of traversal is not to perceive motion *in itself*. A bird’s or an insect’s rapid flight, an image gliding across the retina (or a stationary object in motion) resists the notion of traversal between terminal points (direct perception).¹⁵ It is intensity, not duration that matters here, and the physiological movement of the responding eye itself, consenting *involuntarily* to the ‘direct’ pulsation of movement.

A Zoetrope (discrete images on the inside of a rotating drum viewed from the outside through slits cut in the drum) in the Bill Douglas Centre, helps to explore the limits of Helmholtz’s distinction.¹⁶ A game of leap frog is in process. The effectiveness of the illusion depends on different visual choices. Concentrating on a single slit area as the drum rotates produces a sequence of climbing and vaulting actions in succession, as minute blue and red figures repeatedly bend, rise, and jump. The action is more or less jerky depending on the regularity of the rotation, and the action can be slowed and halted in mid-flight if the spin of the drum is halted. The tilt of the drum affects vision. Moreover, another way of viewing is through a succession of slits, where segmented parts of the vaulting process appear. Even when the eye settles on a single slit area, the presence of the others, and the intervals between them, is apparent. How these flickering images are seen depends whether you concentrate on the slit or the action. This motion toy freely mixes duration and intensity, voluntary calibration and involuntary reception. The comparative inefficiency of the incitement to involuntary receptiveness and the effort required to achieve it reminds us that effort can never be quite edited out of the scopic experience. Motion toys test out voluntary and involuntary motion perception and arrest because they are structurally organized round the two poles of seeing, direct and indirect. The syntax of the time within a time that they set up depends on hand-worked devices with a finite cycle of images that terminates before being repeated. It is another fort-da experiment with control, or a form of Helmholtzian research. The cognitive puzzle is not continuity but cyclical repetition and what drives it. The multiplication of the same image at speed questions the extent to which the moving image and the act of repetition is under the control of the viewer.

Grey Flowers, Black Leaves, Brown Sky

The 'tireless repetition of contingency', as Barthes termed the photograph, raised for early practitioners the same range of questions about stillness as the motion toy raised of movement.¹⁷ What *kind* of mediating agency did the photographer have in the emergence of the photograph's chiaroscuro? What is the *camera's* function, and how is it controlled? It was through the meaning of light and shade that this problem was negotiated, not simply the act of arresting the sun picture, but *creating* and transfixing the effect of mobile light and shade. It did not take long for Fox Talbot's reading of the automated looking of the camera as an objective eye, chronicling 'whatever it sees' with synchronic absolutism, obeying the laws of chemistry (nitrate of silver or albumen on a glass plate reacting to light), to be moderated.¹⁸ Fox Talbot himself speaks a language of *chance* light and shade ('they have just been watering the road, which has produced two broad bands of shade upon it'), and notes 'a single shutter standing open' in his cityscape, that catches a gleam of the sun, self-reflexively reproducing the camera shutter.¹⁹ (The accident of the punctum is here but unnoticed.)

By the 1850s, in the debates of the *Journal of the Photographic Society*, it was generally accepted that the photograph was neither a transcript of nature nor a mechanized mimesis, but a subtle technology for creating gradations of light and shade as a deliberative act of voluntary image making. Too much light flattens prominent features and brings forward receding elements, producing harshness, Robert Hunt said, speaking of the studio as the photographer's 'glass-house'.²⁰ Ruskin protested against the grey world of the photograph, grey flowers, black leaves, brown sky, but the degrees of control over its penumbra was exactly what intrigued practitioners.²¹

Sir William Newton, speaking in 1853, pointed out that what was light in nature (a red or yellow light, for example) appeared dark in the camera. The sky, black in the negative, appeared a 'hard', 'perfectly white surface' when developed: he felt justified in adding cloud effects through the use of Indian ink or cyanide; for the same reason he believed that parts of the image should be suggestively out of focus to convey the experience of the eye by massing light and shade, radiance and shadow, and avoiding the uniform distribution of minute detail, or 'lines' as they were habitually called. Large masses of light, half tint and shade, the subtle chiaroscuro of solar prints, were a constant preoccupation. The visual science of black and white was a major topic of research.²²

The late-century photographer P. H. Emerson developed a systematic photographic aesthetic, based on Helmholtz's work. He insisted that a truly philosophical photography could not emerge unless the camera lens

took on not only the aberrations of the human eye, but also the choices derived from direct vision. The camera then forms, not a likeness of the seen, but a likeness of seeing, its status as interpretative medium restored. A paradoxical non-mimetic naturalism emerged in which the image's internal adjustments of black and white, light and dark, reflected the modalities of the eye's priorities. Taking his data from Helmholtz's physiology, he insisted on *inequality of degrees* of darkness and light. 'The only constant factor, then, is the *ratio of luminous intensities*,—that is, the picture must be as true as possible in relative tones or values.'²³ In nature, black and white must be treated as primary colours, because light acts on both (p. 109), and both change their values. What 'is constant in the colour of an object is not the brightness and colour of the light which it reflects, *but the relation between the intensity of the different-coloured constituents of this light, on the one hand, and that of the corresponding constituents of the light which illuminates it on the other* (pp. 109–10). Though he makes no formal reference to Helmholtz's nerve-end account of vision, this formulation runs parallel to Helmholtz's understanding that visual stimuli work interactively like the chemistry of differential intensities of light on photographic paper, a move from the mimetic to the semiotic.²⁴

White paper in full moonlight is darker than black satin in daylight, or a dark object with the sun shining on it reflects light of exactly the same colour, and perhaps the same brightness, as a white object in shadow. 'Grey in shadow looks like white' (p. 110). The whiteness of paper and the blackness of satin are not absolutes: their values can be reversed to the darkness of white paper and brightness or even pallor of black satin according to the relative intensities of the light both reflected and falling upon them. Or the antithesis between dark and white can be cancelled out by the intensity of light in one case and shadow in the other. Or bright light brings out the brightness of some objects as dark of dark objects. In addition '*Atmosphere greys all things*' (p. 111). '[T]o all these difficulties are added those dependent on the subtleties of light reflected into shadow, and the thousand-and-one changes of colour due to the numerous shadows cast by objects in nature' (p. 113). Wittgenstein's understanding that a natural history of colour would be temporal, examining the juxtaposition of snow on white paper (which would look grey), or hazarding different words for matt and shiny black, is latent in Emerson's theory, which presupposes that thought animates the camera lens.²⁵

Photography begins with shadow. The rule of 'detail in the shadows' (p. 117) is the primary one. Brightness can take care of itself. Bright pictures destroy the 'thoughtful' seeing that begins with foveal choice. It is a different photographic world from Moholy-Nagy's twentieth-century passion for light: 'This century belongs to light.'²⁶ Emerson's non-mimetic

naturalism asks the spectator to live in a monochrome world where the perceiver inhabits the shades, the ‘darks’ (p. 107)—the twilight zone of Euridice or Persephone. The camera for Emerson makes the observer posthumous. The spectator’s is an afterlife entering a unique constellation of shadow at the moment of its reproduction. It is the ontology of the nocturne, the tenebrae of a black world that creates what might be thought of as a *poème noir*. The tautology of image and referent and the mystery of its trace is still a puzzle, however. The bodies transposed to glass plate to print are persistently both spectral and material. The record of shadow and shade irremediably vanished is at the same time the mark of a unique fraction of time, which, however secondary its life of reproduction, still registers only that time and that shadow. ‘The shadow and she are one’, Browning’s mesmerist says of the calotype print.

As the camera lens and the glass plate became an established element of glass culture an extensive genre of photographic lyric appeared, nocturne poems hypersensitive to the tonalities of black and white, light and darkness, and constantly reflecting the meaning of changing gradations of radiance and shadow. This ‘noir’ poem emerged in the latter half of the century, often structured as a temporal instant read intensively rather than through duration, often a city poem of twilight and lamplight, alert not only to the perception of tenebrae and penumbra but to the conceptual and temporal problems of the camera. Too numerous to be discussed here, the ‘noir’ poem ranges from Matthew Arnold’s ‘moon-blanch’d’ photographic elegy, ‘Dover Beach’, where history, like a negative, is a black repetition, to W. E. Henley’s bitter hospital ‘Nocturn’, ‘Where the shadow shuts and opens’, a camera shutter, the heart’s valves. Browning’s ‘Mesmerism’, fanatically imprinting a solar image on the void, as if ‘By the calotypist’s skill’, belongs here, as does James Thomson’s sable lexicon of darkness in *The City of Dreadful Night*, differentiating ‘shade in shadow’ as the accommodating eye adjusts alike to the ideology of the city and to blackness.²⁷ Nocturne poems regularly appeared by late century—by William Morris, Oscar Wilde, Mary F. Robinson, Graham R. Thomson. Earlier Michael Field experimented with the fleeting photographic moment or ‘record’ of sunset and ebbtide printed on wet sand (‘Ebbtide at Sundown’). Mary Coleridge saw shadow as the lethal unconscious of light—‘Thou canst not throw thy shadow self away’ (‘Shadow’).²⁸

Thomas Hardy was a supreme practitioner of the ‘noir’ poem and its scene of repetition, sensitive to photography as to other optical instruments. To ‘take’ a photograph is both an act of will and a consent to the involuntary working of the ‘will’ of light on matter. The power *of* the image, and power *over* the image are both uncertain outcomes. ‘I felt as if I had put her to death that night!’ Hardy’s casual incendiary in ‘The

Photograph' watches the fire consume the figure of an unknown woman, 'line by line', that is, detail by detail (but punningly, the printed lines of a text).²⁹ Heat reverses the calorific creation of light and its unselective record of particularities with an equal impartiality. It consumes the arm, the 'silkwork superfine', text and texture, until 'the flame had eaten her breasts, and mouth, and hair'. The flame 'gnawed' into the 'bosom's defenceless round', undoing the action of light that eats into the surface of a plate by eating into clothing and penetrating the flesh and visible sign of sexuality. It is as if she is being burned both as effigy and living woman. The 'taking' of a photograph and its destruction by fire is not a simple reversal of the action of light. We can never 'untake' a photograph. Burning the woman on paper, as a copy or virtual image, the speaker is 'taking' a photograph into his power but can never quite eliminate its material remains, 'the ashen ghost of the card it had figured on'. (The card becomes a 'ghost' presumably because its ash still retains the faint outlines of the prior 'figure' or print.) Is he destroying a record? Or the print of the body? What is the relation of the 'ghost' of the paper to the print, 'figure', or trace made on it? Could this photograph easily be substituted for an identical one? Its repetition is strangely irreducible. Tied to its referent by the material bond of light, surely the 'death' of the simulacrum cannot be without consequence? Benjamin speaks of the way 'faces in the picture could see *us*', the way the subject 'grew into the picture' in the aura of early photographs.³⁰

When 'Neutral Tones' opens it is already a recall—'We stood by a pond that winter day'—an arrested moment printed on the memory, and 'greyed' as much by the emotional atmosphere as by the tonalities of the scene. *'Atmosphere greys all things'* (Emerson). There is a hint of Ruskin's grey flowers. The final line—'And a pond edged with grayish leaves'—recapitulates the first stanza's last line. Winter leaves 'had fallen from the ash, and were gray', holding the lyric to its stationary moment as the paratactic conjunctions throughout create a syntax of immobility.

We stood by a pond that winter day,
 And the sun was white, as though chidden of God,
 And a few leaves lay on the starving sod;
 —They had fallen from an ash, and were gray.

Though it recreates Ruskin's grey world, the tonalities are not congruous. The 'sun was white, as though chidden of God', 'God-curst', that 'glaring' white distrusted by early photographers and abrogated by Emerson as an unbalancing whiteness. This is a toxic sun picture, whose lethal stasis bleaches out the world around the couple. The lens of the poem focuses on the woman's eyes, as if comprehended by the narrow field of the viewer's

foveal aperture, but the eyes seem to be directed further back in the past than the gaze of the lover-observer. They stare back over 'tedious riddles of long ago': 'her gaze passes him by', Benjamin wrote of the image of the photographer, Dauthenday's fiancée, who was to kill herself (p. 243). Here the subject of the photograph is not looking at *us* but at something in its own visual moment, now the inaccessible past within a past. With its forced smile, 'the deadest thing | Alive enough to have strength to die', the woman's grin of bitterness is almost a threshold movement diverting the gaze from the eyes. And Hardy uses a Helmholtzian image, a 'bird a-wing', to denote the evanescent flicker of the grin's image across the retina caught and held in this temporal instant. The poet gazer is caught up in a cycle of repetition, repeating this recall ('Since then . . . have shaped to me | Your face'), an interloper on a tableau of absorbed confrontation between past selves, living in their present time, who do not know that this moment is going to be a memory—the 'Here and Now', with which reality has . . . seared the subject' (Benjamin, p. 243). It is as if the dark vault of the past has yielded a memory so intense it is akin to the light fatigue created by a white sun, forcing the remembering subject to haunt his own past as a phantom. The last line restarts the memory.

'And a pond edged with grayish leaves'; ' . . . woods! When I wanted to behold you, you were withered!'³¹ Kierkegaard's sardonic novella, *Repetition*, as caustic as it is agonistic, written in the persona of Constantin Constantius, mercilessly lampoons a young man's erotic love. Desire is a test case for repetition. The young man has sought to keep feeling alive by *reliving* his love's passionate intensity. But this means death. Because he cannot *relive* passion he cannot *live it* either. He cannot 'begin with repetition' (p. 174), but instead repeats backwards, and thus the young man is already an old man (p. 136). The girl had turned him into a poet and signed her own death sentence—and his. It is a closed world where all is already over—the dancer, poised to leap, has leapt, the woods withered. Sexual love, because it is one of modernity's most perilous markers of identity and meaning, is the most important of one of the many forms of modern repetition, that Constantin busily researches. (Mundane repetition, another visit to Berlin, discloses subclasses of repetition, transport, theatre, habit, and the uncannily doubled room of his lodging.) The young man has committed the fallacy of the ancients, where the movement of repetition is 'recollection'. 'All existence, which is, has been.' The self is caught in a logic of repetition backwards, where freedom is lost in return and recuperation, and nothing can change. Generative repetition belongs to the moderns. 'Actuality, which has been, now comes into existence' (p. 149). In order for us to think futurity and therefore possibility, repetition forwards theorizes the present as repetition of the past and

understands itself as secondary, not to return but in order to be new. 'Freedom becomes the repetition', he says, because every repetition is simultaneously the same and different, paradoxically *because* it is a repetition. To *begin* backwards is thus different from repetition backwards. We cannot presuppose individuality and uniqueness without presupposing a prior individuality from which we are differentiated. In moments of ontological crisis we re-experience our individuality *as* individuality anew.

Fear and Trembling, published on the same day as its sardonic secular twin, *Repetition*, pushes this dynamic repetition further. In *Repetition*, Constantin says that 'repetition' is a more downright word for mediation, the Hegelian movement of change (p. 149). *Fear and Trembling* does away with what Kierkegaard's narrator thinks of as the economics of mediation—'shareholding bourgeois consciousness'—as a middle term, and describes a leap into paradox.³² The intermediary that is the universal of ethics can generalize or 'translate' a position into a moral condition, but thereby it loses its uniqueness and becomes an exchangeable ethical term (pp. 76, 77, 115). The narrator, who constantly affirms the value of passional repetition by responding to Abraham's willingness to sacrifice Isaac—'I cannot understand Abraham—I can only admire him'—insists that Abraham stands as a single individual in absolute relation to an absolute (God), his own uniqueness and a unique divinity existing in pure ontological states. In this 'dialectical lyric', Abraham's 'leap' of faith and resignation, the leap partaking of the dancer's pure, self-created somatic motion, free from instrumentality, immanent in the dancer's body, has a double movement (pp. 46–7). (At one stage Kierkegaard thought of naming the author a 'solo dancer'.) It is the return to the 'ground' of paradox—I must kill my son, he will survive. Two irreducible positions that cannot be resolved, infinite resignation to loss, utter belief in Isaac's survival, delete mediation. (Likewise the forsaken lover gives up his passion but remains convinced of the loved one's return.) Paradox cannot be mediated (pp. 70, 82). It is a permanent contradiction, as two irreducible positions coexist. A paradox by definition cannot be resolved and therefore must be in a permanent state of repetition, and because it is moving between the contradictory poles, the paradox achieves that mobility which reproduces the constant leap to freedom. In paradox the singularity of the one is renewed. 'One' is an act of differentiation that produces another singleness, a unique series of 'ones'. The *paradox* must be repeated if the leap is to recur.

But paradox can only be sustained through fear and trembling, anxiety, uncertainty, terror. This is why Kierkegaard remains nineteenth-century modernism's philosopher. Nietzsche's 'dance', on the other hand, where 'dancing mad' feet listen to the changing rhythms of life and the dancer wears his ears in his toes, is qualitatively different from the leap.³³ It is the

future as much as a past-centred life that is the problem for Nietzsche. 'I sprang to your side: then you fled back from my spring; towards me the tongues of your fleeing, flying hair came hissing!' (p. 241). For Zarathustra, in unison with but not in *union* with 'life', responsive to the libidinal, kinaesthetic rhythms of retreat and pursuit, aware of the threat of Medusan paralysis as well as the invitation to Dionysian rapture, to be a partner in the dance with 'life' demands pure, dynamic movement without interposition. This is predicated on separation from 'life', for it is only in this way that truly living in the present is possible. To be in union with 'life', to be immersed in it, means to be immersed in time. The willed variations of the dance require what Deleuze, a post-Nietzschean enemy of mediation, calls 'a question of making movement itself work, without interposition; of substituting direct signs for mediate representations; of inventing vibrations, rotations, whirlings, gravitations, dances or leaps which directly touch the mind'.³⁴

By achieving Dionysian presentness and consenting to live in the moment, Nietzsche's, or rather Zarathustra's, dance has already dispensed with the problems of immediacy and mediation that preoccupy Kierkegaard. But in order to do this Nietzsche does need the choreography of the eternal return and its logic, another form of repetition, but of repetition without secondaryness. '[M]ust we not all have been here before?' The spider in the moonlight, the moonlight itself, 'I and you at this gateway', whispering, must we not have been here before? (p. 179). The 'Moment' gateway is at the junction of two lanes in opposition to one another, stretching behind and before to infinity. But it is a contradiction to pass 'through' a moment because by definition it is the present. If the two eternities of past and future meet in the moment then everything that has happened and everything that will happen are drawn into it, including the moment itself. The animals surrounding Zarathustra attribute to him a Hegelian serenity in reassuring cyclical change, a world of the self-same that they misunderstand. Effectively the eternal return is a reformulation of Hegel's account of time, but inverted. Only the present is, but it is the result of the past and pregnant with the future. The true present is eternity—but for Nietzsche the true eternity is the present. The future is a form of reliving, an emptying out of time. The past lives with the 'it was', not the 'I will' (p. 161), and the bourgeois logic of a punitive morality consumed with the sick desire for punishment and revenge, and 'adroit virtues fathering padded rumpless daughters'.

This is a world that is both determined and free, liberating and 'terrible'. If the only freedom is to renew the present, if all that can happen has happened, this world is marked by death (for Zarathustra a corpse and a howling dog). One logic is the death wish, the other, willing the present.

This is a philosophy of immense psychic expenditure and daemonic energy, the energy to resist the death wish, the energy to live in the present, to live in immediacy.

Though Deleuze establishes Kierkegaard, Nietzsche, and Freud as a trinity of thinkers who move beyond both brute and mediated repetition, in Freud's case this is not wholly true. In his elegant and searching essay, 'Remembering, Repeating and Working-Through' (1914), the first time he uses the phrase, 'compulsion to repeat', Freud seems to believe that the only way we can prevent the subject from being trapped in blind repetition and acting out is to enable a patient to bring illness into the present through the fact of repetition itself. Rerouting the compulsion to repeat occurs through naming the resistance to memory in the 'playground' of the analytic transference, where an aesthetic repetition of an 'artificial illness' can occur. Paradoxically 'working-through' occurs in this 'playground'.³⁵ In one sense there's a Nietzschean 'dance' between analyst and analysand. In another, a more agonistic, time-bound process of mediation occurs, fraught with contradiction and difficulty. But Freud locates both freedom and labour in this process, and justifies aesthetic repetition.

Like nineteenth-century modernism's philosophical writers, Kierkegaard and Nietzsche, Hardy experiments with structures of repetition that both acknowledge and escape from its determinism. By sharing parallel problems with them (though the relation is not one of influence of course) he is in some senses their poet. He was aware of being on the cusp of two modernities. In 'The Fiddler of the Reels' the narrator calls the 1851 Exhibition a geological 'fault', 'an extraordinary chronological frontier or transit-line, at which there occurred what one might call a precipice in Time.'³⁶ Testing out the pressures of ancient repetition in the country dance patterns of a five-handed reel, but in a modern pub, a new context, the story makes the principal female character the axis of a dizzily rotating human wheel. Yet the dance's gyrating repetitions also belong to recent optical culture. Its patterns form a human zoetrope that becomes the centre of the narrative.

'At Castle Boterel', an uncoloured lyric where 'drizzle', 'fading byway', 'glistening wet' slope, create the optical conditions of differentially blurred and lustrous points of sight, was published in 1913, the year before Freud's essay. Structurally it veers between being a photographic lyric and a motion image lyric. It is not a lyric of a pre-existing recall but begins by bringing the conditions of repetition and memory into being. The poem works through bumpy, and slightly jolting transitions between motion and fixity, as if attempting to synchronize the past and present, to bring them to a junction, as the poet himself reaches a junction in supposed present

time: 'As I drive to the junction of lane and highway, | And the drizzle bedrenches the wagonette, | I look behind at the fading byway | And see on its slope' two lovers, his own past, himself and a girl. The speaker's backward glance, as he controls a vehicle in motion, attempts to synchronize this movement in the present with the past movement of the 'image', the walking lovers on the road behind, the pony that 'slowed'. There is also an attempt to fix the image altogether, to slow time, to keep it still. The road of the past 'led' to a moment, 'It filled but a minute', of consummation for the past lovers. But for the speaker in the present, it is only the memory of the moment, a repetition, which 'filled but a minute', and which leads to nothing.

The past *has* disappeared. There is a double movement of separation, where time is split into two different places and spaces. The time of the lovers, the time of the speaker. Rhythmically the poem labours to an uneasy dance of latent anapaestic pulses, slowing and accelerating through uneven caesura and enjambement, the rhythms of recall, but the rhythms of unsynchronized events. The strange intensifying repetitions of 'be' as a prefix—bedrenches, benighted, be balked of, that latter a virtual prefix—try to keep the present, the verb to be, in action but have the effect of redoubling the drenched, benighted, balked experience. The poet says, in a Bergsonian moment, that the primeval rocks 'record' the passing of the lovers as a perpetual memorial (and indeed theoretically light reduplicates an image forever in the universe). But timelessness is counteracted by time's 'mindless rote', the repetition of empty meaningless or mechanical time, which is what happens to time when passionate experience no longer gives it meaning. The primeval rocks have pulverized to sand in an hourglass. Rhyming in unison now, his sands are sinking, the image shrinking. But one figure has been written out of the memory—his, or hers?

I look and see it there, shrinking, shrinking,
I look back at it amid the rain
For the very last time; for my sand is sinking,
And I shall traverse old love's domain
Never again.

Tragic memory concludes: 'And I shall traverse | Old love's domain | Never again.' Yet the 'Never again' cites, as it were, Nietzsche's inexorable 'it was', an inexorability that can only be reversed (traverse/reverse) by the will to live in the present. 'I *shall* traverse' is a statement so intense that it becomes affirmative. It means that one can never repeat the original experience and thus *only* repeat and recreate as affirmation. Repetition *is* all that is left. Here Hardy, the last poet of nineteenth-century modernism, reaches out

to an ontological singularity of repetition and the play of unresolvable contradiction that guarantees repetition forwards. 'At Castle Boterel' is itself 'a precipice in Time'. This poem is at the junction of nineteenth and twentieth-century modernisms, Kierkegaard and Nietzsche, photograph and cinema.

Conclusion

The End of Glass Culture—from Nineteenth-Century Modernity to Modernism

At the time that I was writing my short stories, with my fondness for cleverly thought out characters and minute details, at that time, I once saw a carriage passing by in the street carrying a mirror, a large mirror in a gold frame. The green sky of the evening was reflected in it and I stopped to watch it as it went by, with great happiness and the sense that something important was taking place. I had been feeling very happy even before I saw the mirror and it suddenly seemed to me that the very image of my happiness was passing by, the green and shining mirror in its gold frame. For a long time I thought I might put it into a story, for a long time remembering the carriage with the mirror made me want to write. But I never managed to put it anywhere and one day I realised that it had died in me. And yet it had still been very important. Because during the time that I was writing my short stories I always dwelt upon people and things that were grey and squalid, I was looking for a world that was contemptible and without glory. . . . The mirror on the carriage seemed to offer me new possibilities, perhaps the chance to see a more glorious and brighter world, a happier world, that had no need for minute descriptions and shrewd ideas but that could be brought to life in a resplendent, happy image.

Natalia Ginzburg¹

Natalia Ginzburg's gold-framed mirror, carried away on a vehicle, images the disjoining of glass from the world of the everyday, and the end of nineteenth-century glass culture—'it had died in me'. The decisive shift from lens to screen (behind which there is nothing), from trace-filled transparency to the traceless presence of sheer glass, from material made by breath or cut by hand to a computer-controlled material floated on metal or gas, has generated another set of questions than those addressed in this book.

The felt presence of transparency, interposing between the self and the world, created a heightened awareness of mediation and its anxieties that is the ground of all three sections of this book. Glass culture was embedded in the life of the everyday in many different ways. I have not sought to force parallels between its many manifestations, though of course they exist. Just as some of glass culture's actants turn up in different sections of this book—Chance, Joseph Leicester, Whewell, Hardy—so some of its themes, virtuality, the Grotesque, and parallax, reappear problematically

from section to section. The Grotesque appears under the microscope and at the Crystal Palace: parallax structures the difficult negotiations between George Eliot's self and beholder, seeing each other through an invisible pane of glass, and the enormities of the nebulae. Glass culture is at the centre of the debates of what I have called Victorian modernism—labour, political radicalism, the 'free' human subject, spectacle in an industrial society, the politics of evolution in astronomy and under the microscope. Glass culture constitutes these debates through an anxiety of mediation.

In his enigmatic study, 'Diaphanëite', Walter Pater thought of the 'transparent' subject, cutting through 'intransparency', as a type of nineteenth-century modern consciousness. On the cusp of aesthetic modernism as Pater was, this is an idealized figure, but what distinguishes Pater's reading of the nature that 'crosses rather than follows the main current of the world's life' is his alliance of change with the transparency of Diaphanëite. This nature 'loves the lords of change': it is a 'revolutionist' because it is discontented with 'society as it is'.² This is the transparency that exposes contradiction and itself becomes a mediating third term, a prerequisite for change. This 'crystal nature' does not bring about change, but creates the conditions for it. I have argued that this is the condition brought about by the mass production of glass.

Many of the concerns of glass culture have migrated, in the twentieth and twenty-first centuries, to postmodern philosophy and to psychoanalysis, but they are inflected with a certain insouciance which often makes them difficult to recognize. Compare Slavoj Žižek or Lacan with Richard Proctor, no less sophisticated, on parallax, for whom it is a teleological and ethical, not an epistemological problem.³ Since glass culture was part of quotidian experience, its issues were felt to be 'no sport, but dead earnest in the affairs of the imagination'.⁴ This intensity called out dialectical possibilities: if it was necessary to wrestle with the unhappy consciousness, it was also possible to imagine a happy consciousness right there in the everyday. Ruskin, who loved the perceptual pleasure of reflection, would have been uneasy with the modernist reflections of Calvino's Valdrada, doubled in water, its images of copulation and murder 'limpid and cold in the mirror'.⁵ Ruskin, Loudon, the unknown reviewer of the Sutherland mirror in *Reynolds's Weekly Newspaper*, Charlotte Brontë, G. H. Lewes, the poets, for all their understanding of the 'grey and squalid' world of their modernity, could imagine, coexisting with its appalling contradictions, an experience of 'the green and shining mirror in its gold frame', not carried away by history but temporarily imaging a possible world.⁶

NOTES

Introduction: The Poetics of Transparency

1. Walter Benjamin, *Selected Writings, 1927–1934*, 4 vols., trans. Rodney Livingstone and others, Cambridge Mass., and London: The Belknap Press of Harvard University Press, 1999, vol ii, p. 734.
2. See E. Barrington Haynes, *Glass*, Harmondsworth: Penguin Books, 1948, pp. 16–20 for the origins of glass c.3000 BC as vitreous glaze. Egypt is his favoured location, though historians credit other areas of the Middle East as the source of early glass. Glass requires silica (sand), alkali (soda), and fuel. Its essential constituents did not change in the nineteenth century but methods of production and marketing, of course, made it almost a new material. See also *Five Thousand Years of Glass*, ed. Hugh Tait, London: British Museum Press, 1991. For brief histories of glass see Robert J. Charleston, in Harold Newman, *An Illustrated Dictionary of Glass*, London: Thames & Hudson, 1977, pp. 9–14; Hisham Elkadi, *Cultures of Glass Architecture*, Aldershot and Burlington, Vt.: Ashgate, 2006, pp. 1–15. For an alternative reading of its origins see A. von Saldern et al., *Glass and Glassmaking in Ancient Mesopotamia*, Corning Museum of Glass Press, Associated University Presses, 1970.
3. Between 1844 and 1865, the price of ordinary sheet glass (the type of glass most frequently used for windows and glass houses) fell from 1s. 2d. per foot to 2d. per foot, a nineteenth-century historian of Birmingham industry records. Samuel Timmins, ed., *The Resources, Products, and Industrial History of Birmingham and the Midland Hardware District: A Series of Reports, collected by the local industries committee of the British Association at Birmingham in 1865*, London: Robert Hardwicke, 1866, p. 149. See also T.C. Barker, *Pilkington Brothers and the Glass Industry*, London: George Allen & Unwin, 1960, p. 79.
4. Henry Mayhew, *1851: or, The Adventures of Mr and Mrs Sandboys and Family who came up to LONDON to enjoy themselves and to see the GREAT EXHIBITION*, London: George Newbold, 1851, p. 134; Harriet Martineau, *Household Words*, 5 (1852), p. 37.
5. The extensiveness of the glass environment will unfold with this book. For the circulation of cheap glass by mid-century see *Illustrated Exhibitor and Magazine of Art*, 1 (1852), pp. 54–9, 70–4; p. 71: the ‘extreme cheapness’ of pressed glass—drinking vessels, decanters, ornaments for candles—has made glass into a necessity in the ‘houses of the humblest cottagers’. Henry Mayhew describes a ‘Street Jewess’ bartering with a basket of blue glass—salt cellars, cigar-ash plates, blue glass dessert plates, vinegar cruets. *London Labour and the London Poor* (1851–62), London: Penguin Books, 1985, p. 207.
6. Charles Dickens, ‘Gin Shops’ (*Evening Chronicle*, February 1835), *Sketches by ‘Boz’*, ed. Denis Walder, London: Penguin Books, 1995, p. 21; Edward Fitzball, *Thirty Five Years of a Dramatic Author’s Life*, 2 vols., London: T. C. Newby, 1859, vol. i, p. v; Elizabeth Gaskell, *North and South* (1855), ed. Angus Easson, Oxford: Oxford University Press, 1982, p. 79; ‘On the Methods of Silvering and Ornamenting Glass’, *Illustrated Exhibitor and Magazine of Art*, 1 (1852), 258–9; p. 259: Emily Brontë, *Wuthering Heights* (1847), London: Penguin Books, 1985, p. 89; ‘Recent Discoveries in Photography’, *Illustrated Exhibitor and Magazine of Art*, 1 (1852), pp. 106–7; p. 107: F. Marion, *The Wonders of Optics*, trans. Charles W. Quin, New York: Charles Scribner & Co., 1870, p. 129.
7. Gilles Deleuze, *Difference and Repetition* (1968), trans. Paul Patton, New York: Columbia University Press, 1974, p. ix). Henri Lefebvre uses the term ‘triadic’ to denote a discourse where three terms that

- do not resolve into a synthesis are in play. *Rhythmanalysis. Space, Time and Everyday Life* (1992), trans. Stuart Elden and Gerald Moore, New York: Continuum, 2004, p. 12.
8. 'Glass works of Messrs Chance', *The Leisure Hour: A Family Journal of Instruction and Recreation*, 56 (20 January 1853), 59–62; p. 60: Karl Marx, *Capital. A Critical Analysis of Capitalist Production* (1867), 2 vols., trans. Samuel Moore and Edward Aveling (1887), ed. Frederick Engels, London: Lawrence & Wishart, 1975, vol. i, pp. 46, 47, 48: Christina Rossetti, *Time Flies: A Reading Diary*, London: Society for Promoting Christian Knowledge, 1885, p. 134: Morris Maugre, 'The Adieu of the Glassworker' (1899), epigraph to Joan Wallach Scott, *The Glassworkers of Carmaux: French Craftsmen and Political Action in a Nineteenth-Century City*, Cambridge, Mass.: Harvard University Press, 1974: 'The Prospect', *The Poetical Works of Elizabeth Barrett Browning*, ed. Ruth M. Adams, Boston: Houghton & Mifflin, 1974, p. 199: Charlotte Brontë, *Jane Eyre* (1847), chapter 4.
 9. Barker, *Pilkington Brothers*, pp. 192–4.
 10. Tao Matsumura, *The Labour Aristocracy Revisited: The Victorian Flint Glass Makers 1850–80*, Manchester: Manchester University Press, 1983, pp. 71–2.
 11. Martin Heidegger, *Being and Time* (1926), trans. John Macquarrie and Edward Robinson, Oxford: Basil Blackwell, 1962, p. 432.
 12. Maxine Berg, *Artisans and Factory Systems in the Industrial Revolution*, Warwick University Research Papers, 399, October 1991, p. 15, argues that a structure of child-assisted adult female labour (much like that in 'third' world countries today), was increasingly the pattern by the mid-nineteenth century.
 13. Douglas Jerrold, 'The Chronicles of Clovenook', *Illuminated Magazine*, ed. Douglas Jerrold (1843), p. 24.
 14. Samuel Johnson, *Rambler*, 9 (1750): Anna Laetitia Barbauld, *Evenings at Home* (7th edn.), 1807, 6 vols., vol. ii, *Ninth Evening*, pp. 114–15: John Claudius Loudon, *Remarks on the Construction of Hothouses*, London: J. Taylor, 1817, p. 49: 'A Visit to Apsley Pellat's Flint Glass Works', *Illustrated Exhibitor and Magazine of Art*, 1 (1852), pp. 54–9; p. 54. Douglas Jerrold, *Illustrated London News*, 20 December 1851, p. 738.
 15. Pilkington's required 13,000 tons of silver sand annually by 1900, investing in the Anglo-Belgian Silver Sand Company in 1903. Barker, *Pilkington Brothers*, pp. 33, 167.
 16. Matsumura, *The Labour Aristocracy*, p. 12.
 17. Mikhail V. Lomonosov, *Letter on the Uses of Glass* (1752), trans. Harold B. Siegel, *The Literature of Eighteenth-Century Russia*, 2 vols., New York: Dutton, 1967, vol. i. Thanks to Michael Rand Hoare for advice on the translation: Jean Jacques Rousseau, in Jean Starobinski, *Transparency and Obstruction* (1958), trans. Arthur Goldhammer, Chicago and London: University of Chicago Press, 1988, p. 256: *The Note books of S. T. Coleridge*, ed. K. Coburn, 5 vols., London: Routledge & Kegan Paul, 1962, vol. ii (Text), no. 2546 17.104, [13]–14 April 1805: Anthony Trollope, *The Struggles of Brown, Jones, and Robinson*, London: Smith, Elder & Co., 1870, p. 37.
 18. Samuel Johnson, *Rambler*, 9 (1750): Lewis Carroll, *Through the Looking-Glass* (1871), *The Annotated Alice*, ed. Martin Gardner, Harmondsworth: Penguin Books, 1970, p. 199: Christina Rossetti, 'A Royal Princess', ll. 10–11, *The Complete Poems* (1979–90), ed. R.W. Crump, London: Penguin Books, 2001: Thomas Hardy, *Jude the Obscure* (1896), ed. C. H. Sisson, Harmondsworth: Penguin Books, 1978, p. 236: George Meredith, *One of Our Conquerors* (1891), ed. Margaret Harris, St Lucia: University of Queensland Press, 1975, p. 134: Walter Benjamin, *The Arcades Project*, trans. Howard Eiland, Kevin McLaughlin, Cambridge, Mass., and London: The Belknap Press of Harvard University Press, 1999, pp. 537–8: Charles Darwin, 'A Biographical Sketch of an Infant', *Mind*, 2, pp. 285–94: Emily Brontë, *Wuthering Heights* (1847), p. 123: Thomas Hardy, *The Well-Beloved* (1897) ed. Jane Thomas, London: Wordsworth Classics, 2000, p. 128: Sigmund Freud, 'The Uncanny' (1919), *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, trans. James Strachey, London: The Hogarth Press, 1953–74, vol. xvii, pp. 219–56; p. 248.
 19. Charles Fourier, quoted by Jonathan Beecher, *Charles Fourier: The Visionary and his World*, Berkeley and Los Angeles: University of California Press, 1986, p. 244: *The Times*, 15 January 1851: Elizabeth Barrett Browning, *Casa Guidi Windows*, ed. Julia Markus, New York: The Browning Institute, 1977, l. 949: Heidegger, *Being and Time*, p. 481.
 20. Wolfgang Shivelbusch, *The Railway Journey: The Industrialisation of Time and Space in the Nineteenth Century* (1977), Berkeley: University of California Press, 1986, p. 46.
 21. John Ruskin, *The Library Edition of the Works of John Ruskin*, ed. E. T. Cook and A. Wedderburn, 39 vols., London: Allen, 1903–12, vol. ix, *Stones of Venice*, 1 (appendix 17), p. 456.
 22. John Ruskin, *Works*, vol. xi, *Stones of Venice*, vol. iii, p. 179: John Herschel, *The Telescope*, Edinburgh: Adam & Charles Black, 1861, pp. 3–4: Jacques Lacan, 'Seminar 1, *The Technical Writings of Freud* (quoted by Jacqueline Rose, *Sexuality in the Field of Vision*, London: Verso, 1986, p. 167).
 23. Letter from Sir G. Grey, to Henry John Temple, third Viscount Palmerston, regarding disturbances in London, 8 July 1855. Southampton University, #Docref=PP/GC/GR/2439: Glass artefacts itemized

- in *Illustrated Exhibitor and Magazine of Arts*, 1 (1852), pp. 70–1: Advertisement, W. F. Archer, Liverpool, in William Isaac Chadwick, *Magic Lantern Manual*, London: F. Warne & Co., 1878.
24. Jeremy Bentham, 'Panopticon Papers', *A Bentham Reader*, ed. Mary Peter Mack, New York: Pegasus (Western Publishing Co.), 1969, p. 200.
 25. G. W. F. Hegel, *Phenomenology of Spirit*, trans. A.V. Miller, Oxford: Clarendon Press, 1977, para. 658, p. 399. See also para. 640.
 26. '[A] palace of crystal . . . at which no one shall be able to put out his tongue, or in any other way to mock?' Fyodor Dostoevsky, *Notes from Underground*, trans. A. D. P. Briggs, London: Everyman, 1994, p. 31.
 27. G. W. F. Hegel, *Lectures on the History of Philosophy*, trans. E. S. Haldane and Frances H. Simson, 3 vols., Lincoln, Nebr., and London: University of Nebraska Press, 1995; vol. iii, p. 253.
 28. Maurice Merleau-Ponty, 'The Primacy of Perception and its Philosophical Consequences', *The Primacy of Perception*, ed. James M. Edie, Evanston, Ill.: Northwestern University Press, 1964, pp. 6, 22. Subsequent page reference in text. See also *Phenomenology of Perception* (1945) trans. Colin Smith, London: Routledge, 1962, p. 281. 'I do not have perceptions, I do not posit this object as beside that one, along with their objective relationships, I have a flow of experiences which imply and explain each other both simultaneously and successively.'
 29. Merleau-Ponty 'Eye and Mind', in *The Primacy of Perception*, pp. 170–4. For a further critique of Descartes see above *Phenomenology of Perception*, pp. 369–409. Also Martin Heidegger, *Being and Time*, pp. 128–35.
 30. Heidegger, *Being and Time*, p. 484.
 31. Edgar Allan Poe, 'The Man of the Crowd' (1840), *Great Short Works. Poems, Tales, Criticism*, ed. G. R. Thompson, New York: HarperCollins, 1970, pp. 263, 267; Anthony Trollope, *Autobiography* (1883), Glacier, Mont.: Kessinger Publishing, 2004, p. 79. Henry James, *What Maisie Knew* (1897), ed. Adrian Poole, Oxford: Oxford University Press, 1996, p. 90.
 32. It was necessary for a modernist avant-garde faction like the Bloomsbury group to declare a historical break with Victorianism. In fact, many nineteenth-century concerns return, figured through the aesthetic, in modernism. Consider Rosalind Krauss's reading of Ruskin in chapter 1 of her *The Optical Unconscious* (Cambridge Mass., and London: MIT Press, 1993), a study of abstraction, which is torn between quoting his insights and wondering how these could possibly have emerged from a sensibility so charged with ethical and social gravitas. On two Victorian modernisms, see Amanda Anderson on the opposition between 'Enlightenment or bourgeois modernity on the one hand and aesthetic modernity on the other', 'Victorian Studies and the Two Modernities', *Victorian Studies*, 47 (Winter 2005), pp. 195–203; p. 197. Note also Robert Pippin, *Modernism as a Philosophical Problem* (1991), 2nd edn., Oxford: Blackwell, 1999.
 33. Marshall Berman, *All that is Solid Melts into Air: The Experience of Modernity*, London: Verso, 1982.
 34. Gary Day, ed., *Varieties of Victorianism. The Uses of a Past*, Basingstoke: Macmillan, 1998, p. 18.
 35. Chris Hopkins, 'Victorian Modernity? Writing the Great Exhibition', in Day, *Varieties of Victorianism*, pp. 59–60.
 36. Robert Pippin, *Modernism as a Philosophical Problem*, 2nd ed., Oxford: Blackwell, 1999. Pippin derives 'modernism' from Kant and Hegel and the working through of the free self-determining individual and its contradictions. He sees aesthetic modernism as one problematic route deriving from Kant and Hegel.
 37. Benjamin, *The Arcades*, p. 4.
 38. Chris Brooks, *Signs for the Times. Symbolic Realism in the Mid-Victorian World*, London, Boston, and Sydney: George Allen & Unwin, 1984, pp. 145–57; p. 147.
 39. *Ibid.*, p. 150.
 40. Benjamin thought of the historical object of consumption as a 'monadological structure in which history was congealed'. Quoted in Susan Buck-Morss, 'Dream World of Mass Culture: Walter Benjamin's Theory of Modernity and the Dialectics of Seeing', in David Michael Levin, ed., *Modernity and the Hegemony of Vision*, Berkeley and Los Angeles: University of California Press, 1993, pp. 309–38; p. 321. Buck-Morss's succinct and comprehensive exposition of Benjamin's account of the dreaming collective pre-dates her later more specific study of the Arcades project. The shock of the dialectical image, blasted from history, lies in its essentially contradictory nature. At one and the same time it intimates redemptive utopian longing, a longing with the force of myth, and registers critically 'the failure to fulfill that longing' (p. 316). This socio-psychological theory, assembled, as Buck-Morss points out, from Marx, Freud, Proust, and Surrealism, is open to criticism as all theories of a mass political unconscious are. However, the importance of this reading is that 'it takes mass culture seriously' (p. 316). It is defensible to 'read' objects, and to see them as signifiers of desire. See Susan Buck-Morss, *The Dialectics of Seeing. Walter Benjamin and the Arcades Project*, Cambridge, Mass., and London: MIT Press, 1991, pp. 218–19, 260–1, 274–5, for an account of the dialectical image and the dream as both slumber and critique.
 41. Gaston Bachelard, *L'Eau et les Rêves: Essai sur l'imagination de la matière* (1942), Paris: Librairie José Corti, 1979, p. 12.
 42. Quoted by A. S. Byatt, *Guardian Review*, 24 November 2007, p. 12.

1. Factory Tourism: Morphology of the 'Visit to a Glass Factory'

1. Geoffrey Tweedale, "'Days at the Factories': A Tour of Victorian Industry with *The Penny Magazine*", *Technology and Culture*, 29/4 (1988), pp. 888–903.
2. Apsley Pellatt, *Curiosities of Glassmaking*, London: David Bogue, 1849, p. 39. William Gillinder, *Treatise on the Art of Glass Making*, Birmingham: S. Russell, 1851, pp. 6–12, describes workplace process and the unbearable heat of iron as opposed to brick furnaces. Pellatt, together with H. J. Powell, who also wrote on glass, was the principal decorative flint glass manufacturer in London. See H. J. Powell, *The Principles of Glass Making*, London: George Bell & Sons, 1883. Further page references in text.
3. *Penny Magazine*, 10 (February 1841), Supplement, pp. 81–8 (George Dodd); *Household Words*, 2, 1 February 1851, pp. 433–7 (Charles Dickens and W. H. Wills); *Illustrated Exhibitor and Magazine of Art*, 1 (1852), pp. 54–9, 70–4; *Household Words*, 5, 27 March 1852, pp. 32–8 (Harriet Martineau); *Leisure Hour*, 56, 20 January 1853, pp. 59–63. On 1 January, pp. 9–13, 6 January, pp. 24–31, and 13 January, pp. 39–41, it carried a series on 'Birmingham and her Manufactures'. The *Penny Magazine* carried another article in 1844, 'A Day at a Glass Factory', 13 (June 1844), pp. 249–56. The *Penny Magazine* for 1841 carried ten supplements, each (excluding the months of September and October) describing visits to a range of factories manufacturing as mass-produced articles the everyday commodities people were by then beginning to take for granted, often products that were just ceasing from being luxuries, or else had not been mass-produced earlier, from clothing (hats), food and drink (sugar and beer), to construction and transport (the shipyard and coach industry). The first volume of the *Leisure Hour* (1853) carried eleven 'visit' pieces, some to rural spots, others to industrial locations. The *Illustrated Exhibitor's* glass visit was preceded by a visit to a gutta-percha factory and followed by a visit to a flax works, and subsequently to a locomotive works.
4. Quoted and punctuated by Dickens: the 9th number of *The Rambler*, 1750. 'Who, when he saw the first sand or ashes, by a casual intenseness of heat, melted into metalline form, rugged with excrescences, and clouded with impurities, would have imagined, that in this shapeless lump lay concealed so many conveniences of life, as would in time constitute a great part of the happiness of the world? Yet by some such fortuitous liquefaction was mankind taught to procure a body at once in a high degree solid and transparent, which might admit the light of the sun, and exclude the violence of the wind: which might extend the sight of the philosopher to new ranges of existence, and charm him at one time with the unbounded extent of the material creation, and at another with the endless subordination of animal life; and, what is yet of more importance, might supply the decays of nature, and succour old age with subsidiary sight. Thus was the first artificer in glass employed, though without his knowledge or expectation.'
5. It has never been made wholly clear what an educated artisan readership might mean. However, the Society for the Diffusion of Useful Knowledge seemed to have aimed at a broad artisanal readership. Edited by Charles Knight for the SDUK, its articles on the glass industry exemplify its policy of documentary instruction. The factory visit articles in the *Penny Magazine* were by George Dodd, who published them as *Days at the Factories*, in 1843. The *Waterloo Directory* gives the *Penny Magazine's* circulation as 40,000. The *Leisure Hour*, a family periodical, priced at 1d. at its inception in 1852 but 2d. with stamp duty, seems to have been directed towards the same and possibly 'low bourgeois' readership (it included fiction, unlike the *Penny Magazine*). The *Waterloo Directory* puts its circulation by 1860 at 100,000. It was published by the Religious Tract Society and addressed itself to 'the thoughtful of every class', 'peer and peasant', 'master and man'. It was non-sectarian and non-didactic. The well-known *Household Words* had a wider class remit. The *Illustrated Exhibitor*, published by John Cassell, was directed towards what Brian Maidment has described as 'artisans both as consumers and as a significantly progressive element within industrial society'. See Brian Maidment, 'Entrepreneurship and the Artisans: John Cassell, the Great Exhibition and the Periodical Idea', in Louise Purbrick, ed., *The Exhibition of 1851: New Interdisciplinary Essays*, Manchester and New York: Manchester University Press, 2001, pp. 79–113.
6. By the end of the century Newton & Co were advertising 67 photographic lantern slides on 'Glass and Glass Making', either as 'plain' or 'beautifully painted' views. *Catalogue*, p. 818 (undated late-century catalogue, Bill Douglas Centre, University of Exeter). They also offered, with 'Printed Reading', a set of 16 slides on 'Glassware'. *Catalogue*, p. 829. The popular history of glassmaking migrated to boys' annuals and trade manuals—for example, *The Boys' Book of Trades*, London and New York: George Routledge & Sons, pp. 45–53; *How it is Made*, London: Thomas Nelson & Sons, 1907, pp. 117–31; *The Wonder Book of Why and What*, London: Ward, Lock & Co., pp. 238–43.
7. Since the 1980s the categories accepted by an earlier generation of historians have been challenged. (For instance, E. J. Hobsbawm's reading of a labour aristocracy descending hierarchically to the unskilled worker, Asa Briggs's understanding of Birmingham as a city dominated by small workshops with masters and men in reciprocal harmony, the Marxist account of alienated labour in large-scale industrial factories

- which moved from craft-based to unskilled machine-dominated factories.) For a succinct critique of the polarizations of small/large factories, craft-based praxis/alienated labour in Birmingham and Sheffield, see Maxine Berg, *Artisans and Factory Systems in the Industrial Revolution*, Warwick Economic Research Papers 379, October 1991, pp. 4–9. With Clive Behagg she argues that the large-scale factory had already taken hold in Birmingham by the 1760s (p. 15), a trend that accelerated in the mid-nineteenth century. See also her *The Machinery Question and the Making of Political Economy 1815–48*, Cambridge: Cambridge University Press, 1980, pp. 182–99. See also Patrick Joyce, *Work, Society and Politics: The Culture of the Factory in later Victorian England*, Brighton: Harvester Press, 1980, who argues controversially in this and subsequent work that a confrontational model of capitalist and radical worker should be displaced by an understanding of paternalistic relations and an internalized deference culture based on an ideal of mutuality. This is a Foucauldian ‘disciplinary’ argument turned on its head and personalized as a socially interactive system which is the outcome of stratification, not its source (p. 95). See below, Chapter 3, p. 38 and n. 6. For a Foucauldian reading of the factory visit, directed to commodity fetishism and the manufacture of subjectivity see Jonathan V. Farina, ‘Characterising the Factory System: Factory Subjectivity in *Household Words*’, *Victorian Literature and Culture*, 35 (2007), pp. 41–56.
8. In a collection of edited essays initiating new approaches to the history of work, Patrick Joyce pointed out that subjective and ideological accounts of work become part of the history of work itself. *The Historical Meanings of Work*, Cambridge and New York: Cambridge University Press, 1987. In his introduction he insists that the social relations and meanings of work are produced, and that the labour process evolves through the mediation of meaning. Though it is not his intention to lose sight of economic and political factors, he invokes a range of disciplines—anthropology, ethnography, and discourse theory—to reconceptualize some of the concerns of traditional Marxist criticism, for instance, capital, class, the division of labour, commodity fetishism.
 9. The Siemens Regenerative Gas Furnace was developed in the 1850s by the brothers Frederick and William. It was installed at Chance in 1861 and at Pilkington in 1864. Its advantage was a saving of fuel, the elimination of discoloration from coal impurities and the capacity to control temperature so that the unpredictable cycle of work could be regularized. See T. C. Barker, *Pilkington Brothers and the Glass Industry*, London: George Allen & Unwin, 1960, pp. 139–40.
 10. J. G. Wilkinson, *Manners and Customs of the Ancient Egyptians*, London: John Murray, 1837.
 11. Karl Marx, *Capital. A Critical Analysis of Capitalist Production* (1867), trans. Samuel Moore and Edward Aveling, London: Lawrence & Wishart, 1974, p. 330.
 12. T. J. Barringer, *Men at Work: Art and Labour in Victorian Britain*, New Haven: Yale University Press, 2005, p. 28.
- ## 2. Robert Lucas Chance, Modern Glass Manufacturer: Fractures in the Glass Factory
1. Cylinder glass was known as ‘sheet’, ‘German sheet’, and, when polished, ‘sheet plate’ or ‘patent plate’, the nomenclature adopted in the Chance factory history (James Frederick Chance, *A History of the Firm of Chance Brothers and Co., Glass and Alkali Manufacturers*, London, privately printed, 1919, p. 29). ‘Blown plate’ was Cylinder glass blown to more than one ninth of an inch thickness and so named to differentiate it from the one ninth of an inch thickness required of both Crown glass and Cylinder glass by Excise regulations (in order to achieve a rebate, see below, n. 4). It was also termed ‘Bohemian sheet glass’ (Samuel Timmins, ed., *The Resources, Products, and Industrial History of Birmingham and the Midland Hardware District: A Series of Reports, collected by the local industries committee of the British Association at Birmingham, in 1865*, London: Robert Hardwicke, 1866, p. 148). This is not to be confused with an early form of Cylinder glass ‘like horn’ (Chance, *History*, p. 4) displaced by Crown in the eighteenth century, and termed ‘Broad glass’ or, confusingly by Timmins, ‘German spread glass’, cut while hot, whereas Cylinder was cooled and reheated prior to cutting. See D. R. Guttery, *From Broad-Glass to Cut Crystal: A History of the Stourbridge Glass Industry*, London: Leonard Hill, 1956, pp. 43–5, 51–2). The standard for Cylinder became 16 oz 40 in by 30 in. Though the historian of Pilkington (see below, n. 2) describes this as 15 oz. See pp. 40–1 for the working practices of the 8-man ‘set’ who worked the ‘journey’ or day (journée) of 10–12 hours provided by a founded pot.
 2. Chance, *History*, pp. 53–4. This (in subsequent references in the text referred to as Chance) and his earlier history, *Chance of Bromsgrove and of Birmingham and the allied families of Lucas and Homer*, London: Witherby & Co., 1892 (printed for private circulation), and a pamphlet of 1924 commemorating the centenary of the firm, *One Hundred Years of British Glass Making 1824–1924*, Chance Brothers and Co. Limited, Glass and Lighthouse Works, Smethwick and Glasgow, are the printed sources for the history of Chance. T. C. Barker, *The Glassmakers: Pilkington: The Rise of an International Company 1826–1976*, London: Weidenfeld & Nicolson, 1977 (subsequently referred to as Barker, revised and expanded from his study of 1960,

- Pilkington Brothers and the Glass Industry*, London: George Allen & Unwin), provides a modern historical study of the rival firm, whose history converges with Chance on many occasions. See also Francis Buckley, 'The Birmingham Glass Trade 1740–1833', *Transactions of the Society of Glass Technology*, 11 (1927), pp. 374–86; p. 379. There is no study of the heavy glass industry comparable to Joan Wallach Scott's classic, *The Glassworkers of Carmaux: French Craftsmen and Political Action in a Nineteenth-Century City*, Cambridge, Mass.: Harvard University Press, 1974. For the Flint glass industry of Stourbridge see Tao Matsumura, *The Labour Aristocracy Revisited: The Victorian Flint Glass Makers 1850–80*, Manchester: Manchester University Press, 1983. Also Jason Ellis, *Glass Makers of Stourbridge and Dudley 1612–2002. A Biographical History of a Once Great Industry*, Harrogate: privately printed, 2002. Richard H. Trainor, *Black Country Elites: The Exercise of Authority in an Industrial Area, 1830–1900*, Oxford: Oxford University Press, 1994, includes the Chance family in his study of the provincial industrial elite with local power and national connections. For a succinct account of the history of glass as a luxury article see Maxine Berg, *Luxury and Pleasure in Eighteenth-Century Britain*, Oxford: Oxford University Press, 2005, pp. 117–26. The evolution of the Chance factory accords with Maxine Berg's revisionary reading of Birmingham factories as polarized between large capital enterprises and heavily subordinated small units rather than a congerie of small-scale workshops producing a democratic intimacy between masters and men. Maxine Berg, *Artisans and Factory Systems in the Industrial Revolution*, Warwick Economic Research Papers 399, October 1991.
3. *The Leisure Hour, A Family Journal of Instruction and Recreation*, 55 (1853), p. 60.
 4. Chance, *Chance of Bromsgrove*, p. 54. The long dominance of Crown (circular tables spun from a rod) Barker attributes to its capacity to produce thinner panes of glass than Sheet that cost proportionally less in duty on window glass (Barker, p. 59). But he also puts the production of Cylinder glass at Chance effectively down to an excise scam. There was a rebate of duty on exports of Crown because of the wastage involved in cutting the disks. Sheet glass was classified under the same rubric as Crown, and thus it was possible to claw back rebate for Cylinder without the wastage of Crown (Barker, pp. 59–60). This was a situation freely admitted by Chance (Chance, p. 6), but it is hard to believe that the rebate (even though duty was twice the prime cost of production) justified the investment in plant and manpower that the introduction of Sheet entailed.
 5. Barker, pp. 374–5. By 1936 Pilkington had acquired a dominating interest in Chance.
 6. Patrick Joyce first argued for the (subsequently much contested) 'consensualist' model of deference and

paternalism structuring master and worker relations, the one accepting responsibility, the other accepting subordination, largely in response to Marxist accounts of alienated labour and oppression in industrial production, *Work, Society and Politics: The Culture of the Factory in later Victorian England*, Brighton: Harvester Press, 1980. In his view compromise and cooperation by a 'mature industrial proletariat' (p. 79) that recognized authority meant a corresponding inhibition of coercion on the part of masters. Deference was the outcome of stratification, and not its source (p. 95). He initiated a continuing debate: see Richard Price, *Social History*, 8 (1983) (who critiqued Joyce's undialectical model of worker relations, ignoring the dynamic between resistance and subordination and confusing 'formal and real subordination' (p. 64)) and subsequent debate, *Social History*, 9 (1984) (January and May); C. Sabel and J. Zeitlin, 'Historical Alternatives to Mass Production', *Past and Present*, 108/3 (August 1985), pp. 133–76. The issues are further discussed in Trainor, *Black Country Elites*, pp. 149–61 (who argued, with reference to Chances, that if organized labour was not egalitarian, neither was it deferential (p. 154)) and in Robert Gray, *The Factory Question and Industrial England, 1830–1860*, Cambridge: Cambridge University Press, 1996, pp. 97–130. See also Maxine Berg, *Luxury and Pleasure* (n. 2).

As for the instrumental model, Andrew Ure celebrated self-acting machines and the factory as 'the combined operation of many orders of work-people, adult and young, in tending with assiduous skill a system of productive machines continuously impelled by a central power' (*The Philosophy of Manufactures* (1835), London: Frank Cass, 1967, p. 13). Charles Babbage celebrated the cost-effective and time-efficient nature of machinery as prosthesis and the division of labour as producing the most precise use of 'different degrees of skill or of force' (*On the Economy of Machinery and Manufactures* (1832) 3rd edn., London: Charles Knight, 1835, p. 175). Both were reacting to Robert Owen's socialist critique of political economy, for instance in *Report to the County of Lanark* (1821). Marx in turn reacted to them. He took the manufacture of glass bottles as the epitome of the 'one-sidedness' of the detail function in the collective labourer that converts a social relation into a machine. Workers become multiples whose work is organized to a 'fixed mathematical relation or ratio' (p. 327) and thus a 'never-failing instrument' (p. 330). He quotes a glass manufacturer manager on child labour: 'when they once begin, they must go on; they are just the same as parts of a machine', p. 330. Karl Marx, *Capital: A Critical Analysis of Capitalist Production* (1867), 2 vols., trans. Samuel Moore and Edward Aveling, ed. Frederick Engels, London: Lawrence & Wishart, 1974, pp. 327–31. See also Maxine Berg, *The Machinery*

- Question and the Making of Political Economy 1815–1848*, Cambridge: Cambridge University Press, 1980; Donald Mackenzie, 'Marx and the Machine', *Technology and Culture*, 25 (1984), pp. 473–502.
7. Even as late as 1965 a Managing Director of Thomas Webb & Sons testified to the high tension of glass-making. 'It is, in my opinion, an industry which can be very exhilarating one day and most depressing the next; such are the vagaries of making crystal glass' (Mr E. A. Stott). H. W. Woodward, *Art, Feat and Mystery: The Story of Thomas Webb and Sons, Glassmakers*, Stourbridge: Mark & Moody, 1978, p. 27. Maxine Berg argues for the diversity and variety of industrial structures and modes of production in the nineteenth century, challenging monolithic models, *The Age of Manufactures 1700–1820: Innovation and Work in Britain*, 2nd edn., London and New York: Routledge, 1994, pp. 182–8. In her edited collection of documents on labour, *Technology and Toil in Nineteenth-Century Britain*, London: CSE Books; New Jersey: Humanities Press, 1979, she uses the distinction between the 'vertical' and 'horizontal' factory organization, the horizontal print factory working in an 'orderly' (p. 118) way in contrast to vertical structures. Glass was certainly the latter.
 8. Paul Hollister, 'The Glazing of the Crystal Palace', *Journal of Glass Studies*, 16 (1974), pp. 1–110; p. 105. See also Barker, pp. 176–7, and time schedule of night and day shifts p. 177.
 9. George Dodd, 'A Day at a Glass Factory', *Penny Magazine*, 13 (1844), pp. 249–56; p. 251. The factory was Cookson's, South Shields. See Geoffrey Tweedale, "'Days at the Factories": A Tour of British Industry with *The Penny Magazine*', *Technology and Culture*, 29 (1988), pp. 888–903.
 10. *Penny Magazine*, 13 (1844), p. 252.
 11. *Ibid.*
 12. *Ibid.*, p. 255. See Joan Wallach Scott, *The Glassworkers of Carmaux: French Craftsmen and Political Action in a Nineteenth-Century City*, Cambridge, Mass.: Harvard University Press, 1974, p. 23; see her account of the bottle-making process, and detailed contemporary engravings of glassworking, pp. 23–34.
 13. Henry Chance, 'On the Manufacture of Crown and Sheet Glass', in H. J. Powell, ed., *The Principles of Glass-Making* (Woods Technological Handbooks) London: George Bell & Sons, 1883, p. 127.
 14. See Barker, appendix 1, 'Wage Lists for the Weeks Ending 12 and 19 May, 1849'.
 15. Men were guaranteed a minimum wage but paid by the set and at piece rates. Contract agreements for specified amounts of glass at particular weight and thickness were made. Barker, pp. 90–2, sets out Pilkington's pay rates in the late 1840s and instances an agreement to make 425 cylinders 40 by 30 in weekly (8 cylinders an hour if we allow 5 journeys a week). Chance also mentions 80 oval shades a day; Chance, p. 30. See also n. 25 below.
 16. See Barker's succinct exposition of the relation between window tax and excise duty (pp. 75–9). Tax on houses with seven or more windows was increased in the mid-eighteenth century (there was a sliding scale from seven to 180 windows). This was progressively increased (a wartime measure), but halved after 1823. Barker (p. 78) points out that commercial windows were not taxed (though Chance had argued that the window tax did affect demand in 1833): demand increased when standards improved and the building boom of 1845 occurred. The excise tax, levied on glass before, during, and after it emerged from the annealing oven, and occasioning the constant presence of excise men in the factory, who checked the final product (Guttery, *From Broad Glass to Cut Crystal*, pp. 34, 86), is again an imponderable. It was repealed on April 5 1845, but represented only a quarter of the revenue from window tax. Its repeal halved prices, but Barker argues that the surge in demand was caused by a rush to start building houses before the stringent provisions of the Building Act came into force after 1 January 1845.
 17. Timmins, *Resources, Products, and Industrial History*, p. 149; Barker, p. 79. Barker estimates that 700 skilled glassmakers serviced 14 firms in 1845: fewer than 200 of these were blowers and only a minority could blow to long lengths: there were as few as 50 large-Cylinder makers in the country in 1845 before the repeal of excise duty (p. 82).
 18. On production of glass for the Crystal Palace see Chance, pp. 52–4.
 19. 'Notes on Foreign Workmen', Chance Archive, Pilkington Glass, St Helen's, Pilkington Archive ZZ(21). Document marked Box 9,59. I am extremely grateful to Dinah Stubbs, formerly Information and Storage Manager at Pilkington Glass, for her help.
 20. 'Relative to the Management of the Sheet Glass Manufactory July 2 1850', Chance, pp. 57–60.
 21. On the observation of 'St Monday' see Eric Hopkins, *Birmingham: The First Manufacturing Town in the World 1760–1840*, London: Weidenfeld & Nicolson, 1989, pp. 110–11.
 22. Robert Lucas's concern over Leguay may have been because he migrated to Pilkington in the early 1840s and appears to have returned by 1850. Barker, p. 65.
 23. Joseph Neale was 26 at the time of the 1842 census and worked with five other members of his family. This self-righteous letter is from JW (John Withers?) to James Timmins Chance and documents the Neale family's excesses. Chance Archive ZZ21.
 24. 'Workpeople employed by Chance Brothers Dec 1842', Chance Archive ZZ21.
 25. 'Guaranteed Foreign and English Sheet Glass Blowers 6th April 1852'. Chance Archive ZZ21.

26. Dated 8 August 1849: 'Principle of paying *Extra* for *overwork*, to the Sheet glass blowers and gatherers'. Chance Archive ZZ21.
27. George Bontemps of Choisy-le-Roi worked with Chance from about 1830 onwards to introduce Cylinder production into England. He was a great scholar-technician, an expert in telescopic lenses and the rediscoverer of a fine red glass. He is the author of *Guide du Verrier*, Paris, 1868, and numerous reports on glass exhibits, for example on the Paris Exhibition Universelle of 1855 and 1867.
28. It is not always clear which Withers is being discussed. William Withers, a manager, had two sons, John and Samuel. John was given responsibility for the entire production of Sheet glass in 1841 (Chance, p. 35).
29. Henry Chance, 'On the Manufacture of Crown and Sheet Glass', p. 130.
30. '1847–30 July From the *Crown Glassmakers* as to reduction in their rate of wages'. Chance Archive ZZ21. The Crown workers struck on 20 July 1850 for 'an immoderate advance of wages' and, a momentous step, the number 4 furnace was put out. Draft Minutes, 18, 20 July 1850. Chance Archive ZZ9.
31. Trainor, *Black Country Elites*, pp. 313, 317, 318.
32. Centenary pamphlet, *One Hundred Years of British Glass Making 1824–1924*, p. 21.
33. Oxford DNB.
34. F. W. Hackwood, *Some Records of Smethwick* (1896), ed. Alan A. Vernon, Studley, War.: Brewin Books, 2001, p. 81. The posthumously published pamphlet (*ibid.*, p. 82) is A LETTER. ADDRESSED BY ONE OF THE CHRISTIAN PEOPLE CALLED SEPARATIST, TO AN ARDENT ADMIRER OF THE CHURCH OF ENGLAND; IN WHICH SOME OF THEIR RELIGIOUS OPINIONS ARE EXPLAINED AND VINDICATED, Birmingham: White & Pike, 1875. Trainor, *Black Country Elites*, p. 186, notes that the Chance brothers resolved not to discuss their religious differences in public.
35. *Ibid.*, pp. 102, 334.
36. See above, n. 6.
37. See Barker, Appendix 2, for the strains of the ideology of 'family' paternalism. In 1845 the Pilkington brothers issued an open letter to employees justifying their legal position over a defecting employee explaining their understanding of the 'rights' of the firm and the necessity for 'proper discipline, obedience, and order' in the works, at the same time appealing to 'that mutual goodwill' which is the foundation of employer/workmen relations. Both firms resorted to the Master and Servant acts to bind workers. Chance, unlike Pilkington, was not hostile to union membership (Barker, pp. 178, 180).
38. See Gray, *The Factory Question*, pp. 202–19 (n. 6).
39. Barker gives figures for early twentieth-century women's employment when the First World War intensified the recruitment of women. But some inferences can be made for the nineteenth century. Of the 4,277 employees at the main Pilkington factory in 1918, 750 were women and girls, about 10 per cent of whom were semi-skilled (a rather higher proportion of girls were semi-skilled). Well over a third of the male workers were skilled (Barker, p. 400). Allowing for the inflation of war-time employment, but mindful of the fact that processes earlier in the century particularly required women, we can probably assume the same proportion of women workers, approximately one sixth of the workforce, in a comparable factory such as Chance.
40. Maxine Berg, *What Difference Did Women's Work Make to the Industrial Revolution?*, Warwick Economic Research Papers 381, 1991.
41. Clive Behagg, *Politics and Production in the Early Nineteenth Century*, London: Routledge, 1990, pp. 45–7.
42. Ken Fones-Wolf, 'Transatlantic Craft Migration and Transnational Spaces: Belgian Window Glass Workers in America, 1800–1920', *Labor History*, 45 (August 2004), pp. 299–321; p. 306.
43. Martineau Papers HM 713, Birmingham University Library. Thanks to Anne Clarke, Birmingham University Information Services Special Collections, for help with this letter. There is an illegible word in the sentence 'instead of men at — cutting as in London'. What the task was is unclear, but it is clear that women worked as skilled cutters, work usually appropriated by men. For Birmingham and family and domestic ideologies see Leonore Davidoff and Catherine Hall, *Family Fortunes. Men and Women of the English Middle Class 1780–1850*, rev. edn., London and New York: Routledge, 2002.
44. Chance Archive, ZZ38.
45. Chance Archive, ZZ21.
46. Matsumura, *The Labour Aristocracy Revisited*, p. 40 (see n. 2).
47. *Quarterly Review*, 119 (1866), p. 390. Quoted by Matsumura, *The Labour Aristocracy Revisited*, p. 40.
48. Children's Employment Commission, 4th Report, 1865, p. 236, q 134; *ibid.*, p. 258, q 220. Quoted by Matsumura, *The Labour Aristocracy Revisited*, p. 41.
49. Children's Employment Commission, 4th Report, Appendix [8357] xx, p. 276. Gaskell. Quoted by Barker, p. 90. Did this 12-year-old boy belong to the family of William Gaskell, who already had one son, a sheet worker, paid 3s. in the wage lists of 1849 (cf. William's 18s.)?
50. G. C. Allen, *The Industrial Development of Birmingham and the Black Country*, London: George Allen & Unwin, 1929, p. 133.
51. Molten glass was poured between a pair of iron rollers after passing down an inclined plane, a device that enabled a pattern to be pressed into the glass. Barker, p. 137, Chance, p. 128.

52. Oxford *DNB*. For a detailed discussion of James Timmins's innovations in relation to Thomas Stevenson's lighthouse technology, and the economic implications of the Chance policy, see James Kenward, in Timmins, *The Resources, Products, and Industrial History*, pp. 157–63.
53. *Ibid.*, p. 161.
54. Allen, *The Industrial Development of Birmingham*, p. 271.

3. Riot and the Grammar of Window-Breaking: The Chances, Wellington, Chartism

1. From an exchange on the possibility of providing glass and iron buildings for the poor but for their stone-throwing habits in Margaret Oliphant, *Zaidee*, 3 vols., Edinburgh: Blackwood, 1856, vol. iii, pp. 289–90.
2. Ian Hayward, *Spectacular Violence and the Politics of Representation, 1776–1832*, Basingstoke: Palgrave Macmillan, 2006.
3. Persistent nineteenth-century 'irrationalist' readings of the crowd were contested (Freud, for instance, began his work on Group Psychology with a critique of Le Bon's *Psychologie des Foules* (1895)). See John Stevenson, *Popular Disturbances in England 1700–1832*, 2nd edn., London and New York: Longman, 1992; John Plotz, *The Crowd: British Literature and Public Politics*, Berkeley and Los Angeles: University of California Press, 2000.
4. Helen Rogers, "'What Right have Women to Interfere with Politics?': The Address of the Female Political Union of Birmingham to the Women of England (1838)", in T.C. Ashplant and Gerry Smyth, eds., *Explorations in Cultural History*, London: Pluto Press, 2001, pp. 65–100. Rogers's subtle readings participate in a debate on the political languages available and constructed by plebeian subjects, which has come about through the work of Gareth Stedman Jones, in his classic essay, 'The Language of Chartism', in James Epstein and Dorothy Thompson, eds., *The Chartist Experience: Studies in Working-Class Radicalism and Culture, 1830–1860*, London: Macmillan, 1982, pp. 3–58. It is continued in Patrick Joyce, *Visions of the People: Industrial England and the Question of Class*, Cambridge: Cambridge University Press, 1991, *Democratic Subjects: The Self and the Social in Nineteenth-Century England*, Cambridge: Cambridge University Press, 1994; and James Epstein, *Radical Expression, Political Language, Ritual and Symbolism in England, 1790–1850*, Oxford: Oxford University Press, 1994. The pivotal argument is whether languages are imposed on subjects by social structures or whether power relations are created through discourse. The latter view gives identity and agency to plebeian subjects. One way of seeing this problem is to assume, as

- Rogers does, that groups constantly rework available languages. For a critique of the turn to language see Catherine Hall, Jane Rendell, and Keith McLelland, eds., *Defining the Victorian Nation, Class, Race and Gender and the British Reform Act of 1867*, Cambridge: Cambridge University Press, 2000, pp. 23 ff.
5. *Argus* (October 1830), p. 210.
 6. For the Bull Ring riots of July 1839, see Clive Behagg, *Politics and Production in the Early Nineteenth Century*, London and New York: Routledge, 1990, pp. 202–18; Edward Royle, *Revolutionary Britannia? Reflections on the Threat of Revolution in Britain 1789–1848*, Manchester and New York: Manchester University Press, 2000, pp. 101–2. James Epstein, *The Lion of Freedom. Feargus O'Connor and the Chartist Movement, 1832–1842*, London: Croom Helm, 1982, pp. 108–38, gives a detailed account of the tense political background to this riot and the complex relationships between the BPU and the Chartists. See also Trygve R. Tholfsen, 'The Chartist Crisis in Birmingham', *International Review of Social History*, 3 (1958), pp. 461–80.
 7. *Argus* (October 1830), p. 210.
 8. E. Edwards, *Personal Recollections of Birmingham and Birmingham Men*, Birmingham: Midland Educational Trading Co., 1877, pp. 28, 27, 32.
 9. Behagg, *Politics and Production*, p. 207.
 10. E. J. Hobsbawm first defined differentiated 'classes' within the working class in order to explain the non-revolutionary stance of the privileged labourer: 'The Labour Aristocracy in Nineteenth-Century Britain', in J. Saville, ed., *Democracy and the Labour Movement*, London: Lawrence & Wishart, 1954. The sharpness of his definitions have been questioned but his category remains a term in use. See Takao Matsumura, *The Labour Aristocracy Revisited: The Victorian Flint Glass Makers 1850–80*, Manchester: Manchester University Press, 1983. Trevor Lummis, *The Labour Aristocracy, 1851–1914*, Aldershot: Scolar Press, 1994, argues that the stratification of trades occurred not through skill but through the degrees of security offered by different trades and within trades. The notion of a labour elite has become less tenable to historians as an understanding of the recombination of different elements of the working class, and the emergence of a popular plebeian radicalism after 1848 has been recognized. Eugenio F. Biagini and Alastair J. Reid, eds., *Currents of Radicalism 1850–1914. Popular Radicalism, Organised Labour and Party Politics in Britain, 1850–1914*, Cambridge: Cambridge University Press, 1991, pp. 1–8. It would be rash to assume that rioters and educated artisans occupied wholly different class positions. Behagg, *Politics and Production*, p. 215, demonstrates that the Bull Ring rioters were 'neither "criminal types" nor high-spirited youths. The majority were young men of some education'—and might even be described as labour

aristocrats, many were certainly skilled. George Rudé, *The Crowd in History, 1730–1848*, London and New York: John Wiley & Sons, 1964, also emphasizes the variables of literacy, religion, and occupation in early industrial crowds (pp. 208–9).

11. Despite differentials working men shared certain conditions: they were not enfranchised, they depended on wage labour, they lived in defined neighbourhoods, they frequently suffered privation. Behagg refuses to accept the narrowing down of political culture to the adult skilled male worker, and affirms that there were generalizable accounts of a desirable social order available to a range of workers. *Politics and Production*, p. 107. Helen Rogers (see above n. 4) in a superbly detailed discussion, argues for the participation of women in the Female Political Union who used a stylized language of affirmative domesticity (differing from middle-class domesticity) that could become militant. A context for this work is her earlier *Women and the People: Authority, Authorship and the Radical Tradition in Nineteenth-Century England*, Aldershot: Ashgate, 2000.
12. Wellington papers, University of Southampton. August 1830. Memorandum on the revolutions of Paris and Brussels. WP1/1170/4.
13. *Aris's Birmingham Gazette* remarked on the unprecedented depression in trade—'So extraordinary a depression . . . has been seldom, if ever remembered by the most experienced speculator' (6 September 1830). The *Argus* believed that Great Britain was 'plunged' into 'wretchedness, insolvency, convulsion, flame, strife and crime', and that one in seven workers were paupers (October 1830, p. 170). There were riots throughout the country (see below, n. 34). It is a moot point as to how near the country came to revolution in the years up to 1832; E. P. Thompson's view, 'Britain was within an Ace of Revolution' (*The Making of the English Working Class* (1963), rev. edn., Harmondsworth: Pelican Books, 1968, p. 898, is generally regarded as exaggerated. However, the perception of revolutionary possibility was certainly there. Nancy D. LoPatin, *Political Unions, Popular Politics and the Great Reform Act of 1832*, Basingstoke: Macmillan, 1999, insists, on the contrary, that political unions across the country helped to bring about peaceful reform, pp. 1–4.
14. *Birmingham Journal*, 25 September 1830; *Aris's Birmingham Gazette*, 27 September 1830.
15. The Birmingham Political Union had held its inaugural mass meeting shortly before Wellington's visit, calling its own independent meeting, chaired by Thomas Attwood. George Edmonds, a radical who had been active in Birmingham since 1816, made a thirteen-minute speech to which the *Argus* gave applause ratings. The management of mass meetings became a hallmark of the organization. See C. Flick, *The Birmingham Political Union and the Movements for Reform in Britain*, Hamden, Conn.: Archon Books, 1978; David J. Moss, *Thomas Attwood: The Biography of a Radical*, Montreal and Buffalo: McGill–Queen's University Press, 1990. Nancy D. LoPatin, *Political Unions*, pp. 38–65, emphasizes that the union movement was country wide—there were over one hundred—and her work is a corrective to exclusive concentration on Birmingham.
16. The lesion of middle- and working-class interests in the Union had not yet taken place. Though there was no working-class representation on the Political Council, and Attwood, a banker, did not concede universal suffrage until 1838, an alliance of those who worked for a living broadly defined as 'productive classes' and who could be defined as the 'People' against 'monopoly' and aristocratic privilege seemed possible. Radical activists could be shielded from sedition by the Union, while Attwood and industrialist George Frederick Muntz (who claimed republicanism at the Political Union inaugural meeting) could achieve the mass following they required to be convincing as wielders of power. See Clive Behagg, 'An Alliance with the Middle Classes: The Birmingham Political Union and Early Chartism', in Epstein and Thompson, *The Chartist Experience*, pp. 59–86. Nancy D. LoPatin, *Political Unions*, reminds us that the Birmingham Political Union's manifesto was drafted by 'a coalition of Birmingham Tories and Radicals' (p. 26) and quotes Attwood on the amelioration of 'all the grievances which are diffused amongst different classes of the community' (p. 10). For the later reconfiguration of working-class and middle-class radicalism around accounts of community rather than class see Reid and Biagini, *Currents of Radicalism*, pp. 9–14.
17. *Argus* (October 1830), p. 201.
18. *Ibid.*, p. 210.
19. Stedman Jones, 'The Language of Chartism', pp. 13–14, argued that the 'People' was identified as the 'nation' in radical ideology, comprising all those who stood apart from privileged groups of monopolizers. Tennyson's liberal rhetoric of the 'People' caused him to be mistakenly associated with the Political Union: *Aris's Birmingham Gazette* carried a notice in the same issue as it reported the Chance dinner repudiating this connection: on 13 September it carried a letter from Tennyson addressed to William Chance on its front page arguing that representation will come in time—if we 'abstain from all violent courses'. On 27 September this notice appeared: 'We are requested to contradict an unfounded statement that Mr. Tennyson has become a member of the Political Union in this town.' See LoPatin, *Political Unions*, p. 11, on Attwood's use of 'the English People' as a signifier of mutuality. But for Epstein, *Radical Expression*, p. 71, the language of the 'People', 'property', 'nation', 'patriot', 'industrious', is more ambiguous

- and indeterminate and could be fluidly resignified. See also Linda Colley, *Britons*, New Haven: Yale University Press, 1992.
20. Rudé, *The Crowd in History*, pp. 237–57.
 21. Behagg, *Politics and Production*, p. 202. The argument of his ‘An Alliance with the Middle Class: The Birmingham Political Union and Early Chartism’, pp. 59–89, is that the schism was created by the refusal of working-class members of the Union to accept a proxy political representation by the middle-class members of the Union instead of universal suffrage rather than by a disagreement over physical force. The municipal elections of the newly incorporated city in December 1838, gave power to middle-class Union members, such as Munz (who was one of the sentencing magistrates after 1839), who could no longer claim exclusion from government. John Belchem, *Popular Radicalism in Nineteenth-Century Britain*, Basingstoke: Macmillan 1996, agrees that a language of cross-class mutuality bifurcates after 1832 (p. 71) and that the ‘People’ became a working-class designation. While Chartism evolved different images and meanings for plebeian experience (p. 73), middle-class radicalism was on its way to Victorian liberalism (p. 82). Nevertheless, the two organizations are continually crossing each other, and even in the bifurcation of 1832, there are convergent positions and memberships.
 22. WP1/1017/13.
 23. August 1830. Memorandum on the revolutions of Paris and Brussels. WP1/1170/4.
 24. WP1/1182/29. Among the repercussions of this incident were that when in Poole, November 1831, the ‘radicals incited a mob to attack the houses of anti-reformers’ and to break windows, the radical lawyer cited the Duke’s failure to claim compensation as sufficient reason for dismissing the case for compensation in Poole. WP1/1201/28.
 25. 6 October 1831. Letter from Wellington to Lord Clifford. Enclosure in WP1/1198/24.
 26. 13 October 1831. Copy of letter from Wellington to M. Fitzgerald. Enclosure in WP1/1196/31.
 27. 18 February 1832. WP1/1216/18. He had been told earlier that ‘A mob can always be found for ale’. WP1/1144/3.
 28. ‘H’, 9 October 1831, WP1/1198/30.
 29. ‘F. Lloyd’, 19 October 1831, WP1/1199/8.
 30. Rogers, ‘What Right Have Women to Interfere in Politics’, p. 81. See Jutta Schwartzkopf, *Women in the Chartist Movement*, London: St Martin’s, 1991, for an account of women in Chartism; Anna Clark, *The Struggle for the Breeches: Gender and the Making of the British Working Class*, Berkeley and Los Angeles: University of California Press, 1995.
 31. Wellington’s informers convinced him that the Political Union was arming, that civil war was imminent, that ‘plunder, bloodshed and revolution’ was inevitable (WP1/1201/ 25, 11 November 1831), and he informed the king of the ‘great crisis’ that the ‘monster’ BPU was preparing (WP1/1203/1). He warned the king that this was an unconstitutional private army (it was the state’s prerogative, and the state’s prerogative alone, to authorize the mobilization of an army), comparable to the National Guard that had destroyed France’s monarchy. The BPU insisted that it was arming to protect itself and keep the peace, but its attitude to physical force was never wholly clear in that it envisaged some situations when force might be used. Epstein, *The Lion of Freedom*, p. 124, argues that the distinction between physical and moral force was never absolute, and that Chartist language could be threatening, and thus confusing as to its intentions.
 32. ‘It is not possible to prevent people from putting candles in their windows, but I shall be perfectly prepared to put down riot, if any is attempted,’ Wellington’s commander wrote of the situation in Dublin. WP1/941/7, July 1828, letter to Wellington from Lord Francis Leveson Gower.
 33. July 1827, letter to Wellington from Lord Beresford: ‘the mob broke the windows of the intendente’s house and those of the chancellor, whom they murdered.’ WP1/897/3; See also WP1/910/ 13.
 34. Merthyr—WP1/1187/21, Major Digby Mackworth to Wellington. Wellington was informed of the Bristol riots on 3 November 1831: WP1/1201/ 6. Lord Somerset to Wellington.
 35. Rudé, *The Crowd in History*, p. 218.
 36. A proposed bill by Lord Grosvenor to curtail Sunday leisure activities seems to have instigated the disturbances in central London and Hyde Park. Letter from Sir G. Grey to Viscount Palmerston regarding disturbances in London, 8 July 1855. PP/GC/GR/2349.
 37. Behagg, *Politics and Production*. The July 1839 crowd attacked the police who had victimized them over the preceding week, p. 207.
 38. *Ibid.*, pp. 207–8.
 39. Behagg (*Ibid.*, p. 217), notes that the 1839 crowd attacked shops whose owners had stoned them earlier—such shopkeepers were prepared for trouble.
 40. Stedman Jones, ‘The Language of Chartism’, ‘Chartists did not regard the working classes as propertyless. For since the only legitimate source of property was labour, labourers were therefore in possession of the most fundamental form of all property’ (p. 17). I argue that this is an attractive though specious position because the fundamental asymmetry between employers and employed produced different readings of property.
 41. For instance, Thomas Baker refused the model of ‘idleness and profligacy’, arguing for a national working class, *Birmingham Journal*, 22 September 1832.

42. Attwood's preoccupation with currency reform may have been undertaken in order to provide a logistical solution (a flexible currency that would increase both production and demand) to inequality and to galvanize industry. The constructed nature of the monetary system would become apparent. There would be no need to reify the system of exchange and substitution.
43. See George Howell, *Labour Legislation, Labour Movements, Labour Leaders*, 2 vols., London: T. Fisher Unwin, 1902, pp. 406–21 (on truck laws: he claims the practice continued to 1887, p. 413.); E. J. Hobsbawm, 'The Tramping Artisan', *Labouring Men. Studies in the History of Labour*, London: Weidenfeld & Nicolson, 1964, chapter 2.
44. For a reading of radical use of symbolic practices and their meanings see J. Epstein, *Radical Expression: Political Language, Ritual and Symbols in England, 1790–1850*, Oxford: Oxford University Press, 1994.
45. Window-breaking could even be seen as the other side of commodity fetishism, its complementary replication and analogue, for the avid hoarding of the commodity as material object and the destruction of the material object for its own sake, *because* it is a material object are equally forms of remaining with the literal. And yet they must invoke symbolic meaning.
46. For Suffragette protest see Maroula Joannou, *Ladies, please don't smash these windows*, Oxford: Berg, 1995. Jill Liddington, *Rebel Girls: Their Fight for the Vote*, London: Virago, 2006.

4. The Glassmakers' Eloquence: A Trade Union Journal, the Royal Commission, 1868

1. First epigraph: 'First-Ratism', *The Flint Glass Makers' Magazine*, 37 (October 1858), p. 293. 'The glass trade . . . contributing daily to the luxuries of tables of the nobility of the land.' This anonymous article argued both for high standards and egalitarianism (p. 295). In the text the magazine is cited as the *Magazine*, in notes as *FGMM*. I thank J. A. Henshall, Librarian, University of Warwick Library, for providing me with copies of *FGMM*. Second epigraph: Apsley Pellatt, *Curiosities of Glassmaking*, London: David Bogue, 1849, p. 129.
2. *Royal Commission on Trades Unions*, 10th Report, 1867–8, vol. xxxix, paras. 18778, 18797. Subsequent paragraph references in text.
3. Tao Matsumura, *The Labour Aristocracy Revisited: the Victorian Flint Glass Makers 1850–80*, Manchester: Manchester University Press, 1983, pp. 33–5. Except for split shifts Flint glassworkers worked very much to the pattern of heavy glassworkers, but the Chair, essentially comprised of three specialist workmen

plus one, was quite differently structured from the set of eight men, who worked in pairs. Apsley Pellatt, *Curiosities of Glassmaking*, p. 89, gives these figures as the standard. Four sets of workmen changing every six hours while four were at rest, worked the same furnace. Four Chairs worked 9–10 pots weekly, each holding 1,600–1,800 lb melted glass. Each of the four sets specialized in different forms of product ((i) heavy glass, e.g. large Chemist's flasks; (ii) smaller items e.g. smelling salt phials, flasks, and tubing; (iii) glasses; (iv) bottle). They were paid correspondingly. A mid-century workman (head of the Chair) making heavy glass articles earned as much as £3 per week, the workman making bottles earned 36s. They were paid according to the complexity of the task.

4. T. J. Heslop, writing on 'The Medical Aspects of Birmingham', in Samuel Timmins, ed., *The Resources, Products, and Industrial History of Birmingham and the Midland Hardware District: A Series of Reports*, London: Robert Hardwicke, 1866, pp. 689–703, noted the high incidence of deaths from lung disease and 'phthisis' among males—'a peculiar fatality begins to attend these men' (p. 700). Matsumura, *The Labour Aristocracy Revisited*, pp. 71–2: 'According to the quarterly report of the Death Fund of the FGMS, the average age at death of all flint glass makers in Stourbridge between 1858 and 1882 was 48.9, 2.4 years higher than the national average for flint glass makers.' (This does not include takers-in or apprentice footmakers: 'about 30% of glass makers in Stourbridge died before the age of forty, and about half before fifty'; 39 per cent lived to be over 55, 28 per cent lived to be over 60.)
5. Sidney and Beatrice Webb, *The History of Trade Unionism* (1894), rev. edn., New York: Longmans, Green & Co., 1920, p. 199. I draw from the *FGMM* over the years 1858–9, the period just before and after the strike and lockout (the magazine was suspended during the strike).
6. The Flint Glass Makers' Friendly Society of Great Britain and Ireland was quickly re-created from the earlier United Society in September 1849, which had exhausted its funds in an unsuccessful strike. It became a national body, initiating annual conferences in 1850 and produced its own journal from Stourbridge in 1850, the *Flint Glass Makers' Magazine*, which continued until 1897. See Matsumura, *The Labour Aristocracy Revisited*, p. 91. The *Magazine* represents the emergence of a confident plebeian radicalism following upon the renewed radical thinking across the life of all classes after 1848, a trend that Eugenio F. Biagini and Alastair J. Reid associate with a shift in political values that recognized community rather than conflict, cautiously aware of the interdependence of workers and middle classes (*Currents of Radicalism 1850–1914*, Cambridge: Cambridge University Press, 1991). The *Magazine* participates in what Keith McLelland has characterized as a working-class public sphere mobilized by trade union

- activity. See his discussion of civic humanism and currents of republicanism in Catherine Hall, Jane Rendell, and Keith McLelland, eds., *Defining the Nation. Class, Race and Gender and the British Reform Act of 1867*, Cambridge: Cambridge University Press, 2000, p. 109.
7. See Helen Rogers, “‘What Right have Women to Interfere with Politics?’: The Address of the Female Political Union of Birmingham to the Women of England (1838)”, in T. C. Ashplant and Gerry Smyth, eds., *Explorations in Cultural History*, London: Pluto Press, 2001, pp. 65–100.
 8. *FGMM*, 36 (July 1858), p. 217.
 9. *Ibid.*, pp. 152–3.
 10. *Ibid.*, pp. 154–5.
 11. *FGMM*, 35 (April 1858), pp. 139–40. ‘Vindex’.
 12. *Ibid.*, p. 156. ‘Un Jeune Homme’.
 13. *Ibid.*, p. 150. ‘Observer’.
 14. The poem is by W. H. Ravenhill (*FGMM*, 36 (July 1858), pp. 226–7). Between April 1858 and January 1860 seven poems appeared in the *FGMM*, which was published at quarterly intervals, though suspended over the strike months. The poems may have been submitted by workers themselves or ‘syndicated’ from popular print media, or taken from known poets, as with ‘Fare thee Well’, Byron’s last poem to his wife (p. 307). They deserve a much lengthier discussion than I can give them here.
 15. ‘Vindex’. See above n. 11.
 16. ‘Un Jeune Homme’. See above, n. 12.
 17. See above, Chapter 3, n. 40. Stedman Jones relates the self-conscious understanding of representation (which is not ‘a more or less immediate rendition of experience into words’) to the analytic ability of Chartist rhetoric to grasp the idea of property as common to middle and working classes (‘The Language of Chartism’, p. 6). But the idea of property for the working man must be bound up with the notion of equivalence. Clive Behagg, ‘An Alliance with the Middle Classes: The Birmingham Political Union and Early Chartism’, in James Epstein and Dorothy Thompson, eds., *The Chartist Experience: Studies in Working-Class Radicalism and Culture, 1830–1860*, London and Basingstoke: Macmillan, 1982, pp. 59–86, p. 70, quotes Henry Watson, one of the organizers of the Midland Union of the Working Classes: ‘labour was not only the mine of real wealth, but that mine was the sole property of those who toiled. *No man had a right to another man’s property without equivalent*’ (emphasis added). The PREFACE to the *Rules of the Sheet Glassmakers’ Association*, Dromgoolf, St Helens, 1874 (the Association was founded in 1870) embodies the notion of equivalence as a foundational element of its constitution. ‘Therefore it behoves every working man to protect, to the utmost of his power, the only source of his wealth, viz.—his labour; so that he may command a fair day’s wage for a fair day’s work, and enable him to make some provision against the time when old age or infirmity may come upon him like a thief in the night, for where is the man that can say—‘I stand secure, and fear not the approach of poverty or distress!’ Experience has taught us the useful lesson, that unity is strength.’ Interestingly there is a hostile letter about the wisdom of investing union funds in property (real estate) in 1858. *FGMM*, 36 (July 1858), pp. 192–7.
 18. ‘The Cribs of London’, *FGMM*, 36 (July 1858), pp. 197–200.
 19. T. C. Barker, *The Glassmakers. Pilkington: The Rise of an International Company*, London: Weidenfeld & Nicolson, 1977, p. 92.
 20. E. W. J. Hobsbawm, ‘The Labour Aristocracy in Nineteenth-Century Britain’, in J. Saville, ed., *Democracy and the Labour Movement*, London: Lawrence & Wishart, 1954.
 21. Webb and Webb, *History of Trade Unionism*, p. 379. The Webbs described the Flint Glass Makers’ Friendly Society as one of the ‘new model’ unions, more concerned with industrial welfare than confrontation. They cite the FGMFS as one of the ‘powerful’ societies that displaced Chartist agitation in the late 1840s (p. 181), quote the journal’s advocacy of power through education rather than the ‘reckless aggression’ of strike action—‘Let us earnestly advise you to educate; get intelligence instead of alcohol’ (quoted from no. 1, Opening Address, p. 198), note its adoption of the principle of the law of supply and demand, and its campaign for emigration to solve the problem of surplus labour (p. 201). Matsumura agrees that the Society put a heavy emphasis on high benefits, sick and death benefits, superannuation and unemployment allowance, in the 1860s accumulating funds of twice the amount per capita of the Amalgamated Engineering Union, and insisting on ‘Defence not Defiance’ (Matsumura, *The Labour Aristocracy Revisited*, p. 117). But he modifies the Webbs’ position. The Society always recognized the possibility of strikes, but hoped to contain them. Alastair J. Reid, both in his history of trade unionism, *United We Stand*, London: Allen Lane, 2004, p. xi, and his co-edited book with Eugenio F. Biagini, *Currents of Radicalism*, Cambridge: Cambridge University Press, 1991, pp. 1–19, argues that trade unionism belongs to a history of radicalism rather than having affiliations with socialism. This is a context in which the FGMFS can be situated.
 22. Interestingly an editorial of *FGMM* on Superannuation describes this as an important addition to benefits, a ‘modern’ feature, but admits that the prime aim of a union is ‘the protection of the rights of labour’, a policy which must include the possibility of strikes (*FGMM*, 35 (April 1858), p. 121).
 23. Behagg, *Politics and Production*, pp. 115–32; Matsumura, *The Labour Aristocracy Revisited*, pp. 89–91. Alastair J. Reid, *United We Stand*, p. ix, argues that trades unions were not homogeneous groups

- but 'cross-sections of the working population'. He sees craft unions such as FGMFS as societies for collective bargaining.
24. One letter in *FGMM* argues for a factory meeting to be convened every time a worker is discharged. The 'class' of his work would be collectively agreed upon and a recommendation for an appropriate level of employment sent to the Central Secretary for the register of workers. (To ensure poor workmen were not sent to positions beyond them and that good ones were.) *FGMM*, 38 (June 1859), pp. 339–41. The Sheet Glass Makers' Association was also organized around union replacement for vacancies.
 25. *FGMM*, 41 (November 1859), pp. 536–8. Such rhetoric was not unusual: campaigning for a Benevolent Fund after the strike, the first article of no. 39 (October 1859), opened: 'To feel with another in trouble—to relieve a brother in distress—to comfort the sorrowing—to soothe the bereft... are duties incumbent on all (p. 429).' It continues with an attack on war and misused power and wealth: 'Men have been and are still looked upon as mere chattels.'
 26. 'Secret organizations of trades', *Edinburgh Review*, 110 (1859), pp. 525–63.
 27. *FGMM*, 41 (November 1859), pp. 494–5.
 28. *FGMM*, 38 (June 1859), p. 338, on peace: the critique of hubris, p. 419, letter dated 16 July 1859.
 29. Matsumura, *The Labour Aristocracy Revisited*, p. 89.
 30. Eric Hopkins, 'An Anatomy of Strikes in the Stourbridge Glass Industry, 1850–1914', *Midland History*, 11 (1973–4), pp. 21–31, believes that the apprentice issue, since it focused on 'the employers' rights to train and employ' (p. 23) was the precipitating factor, but this is an employers' reading. Godfrey Lushington in his 'Account of the Strike of the Flint Glass Makers in 1858–9', commissioned by the National Association for the Promotion of Social Science in *Trades' Societies and Strikes*, 1860, pp. 105–14, makes it clear that the Midland Association of glass manufacturers were bent on 'the extinction of the union' (p. 109) and is relatively sympathetic to the masters' case. He traces a series of major concessions on both sides. His analysis accords with what Lawrence Goldman describes as the Social Science Association's 'cautious' approach to trade unions despite its recognition of the legality of organized labour. *Science, Reform and Politics in Victorian Britain*, Cambridge: Cambridge University Press, 2002, p. 229.
 31. Hopkins, 'An Anatomy of Strikes', pp. 23–4.
 32. *FGMM*, 38 (June 1859), pp. 345–7. It had also drawn attention to the inequities of the master and servant act in York before the strike in April 1858, pp. 125–6. I am assuming that the Glazebrook case was brought under the Master and Servant laws, though this is nowhere directly stated.
 33. For hatred of the repressive use of the acts in the Black Country, extensively used in the second quarter of the nineteenth century against union men, see Christopher Frank, 'Let but one of them come before me, and I'll commit him', *Journal of British Studies*, 44 (2005), pp. 64–91. See also Robert J. Steinfield, *Coercion, Contract, and Free Labour in the Nineteenth Century*, Cambridge: Cambridge University Press, 2001; Douglas Hay and Paul Craven, eds., *Masters, Servants and Magistrates in Britain and the Empire 1562–1955*, Chapel Hill, NC: University of North Carolina Press, 2004.
 34. Frank, 'Let but one of them', p. 72.
 35. *Ibid.*, pp. 72–4; Webb and Webb, *History of Trade Unionism*, pp. 183–4. Union financial and legal support did create resistance to these laws.
 36. For these cases see Matsumura, *The Labour Aristocracy Revisited*, pp. 86–8; John Corbett, *The Birmingham Trades Council 1866–1966*, London, Lawrence & Wishart, 1966, pp. 29–30. Also Clive Behagg, 'Custom, Class and Change: The Trade Societies of Birmingham', *Social History*, 4 (1979), pp. 455–80. Note that Pilkington regularly and successfully prosecuted for breach of contract (Barker, pp. 83–9). Pilkington, unlike Chance, outlawed strikes and did not formally recognize unions until 1917 (Barker, pp. 178, 247). The firm developed a strategy of offering contracts that expired at different times so that only small numbers of men could strike at any one time without breaking their contracts. Barker notes that *The American Glassworker* contrasted the 'tyrannical' policy of Pilkington with Chance (p. 180).
 37. Matsumura, *The Labour Aristocracy Revisited*, p. 140.
 38. Hopkins, 'An Anatomy of Strikes', p. 24.
 39. Dennis Smith, *Conflict and Compromise: Class Formations in English Society 1830–1914. A Comparative Study of Birmingham and Sheffield*, London: Routledge, 1982, p. 98. He claims that the alliances between Liberal leaders and artisans forged in the 1840s and earlier were revived and strengthened over the 1850s and 1860s so that liberal leaders fostered working-class organizations.
 40. These poems were published respectively in *FGMM*, 36 (July 1858), pp. 226; 41 (November 1859), p. 496; 42 (January 1860), p. 554; 39 (October 1859), p. 442; 35 (April 1858), p. 157; 37 (October 1858), p. 307.
 41. *FGMM*, 39 (October 1859), pp. 441–2.
 42. *FGMM*, 35 (April 1858), p. 157.
 43. *FGMM*, 35 (April 1858), p. 307.
 44. *FGMM*, 39 (October 1859), pp. 432–5.
 45. James Epstein, *Radical Expression: Political Language, Ritual and Symbolism in England, 1790–1850*, Oxford: Oxford University Press, 1995, p. 87.
 46. It is hard to know what was the emblematic meaning of the rat: attacks on the union? 'black' non-unionized labour? It is difficult to believe that it meant nothing. Ian Haywood has warned against the tendency to 'de-intellectualise radical culture' and its visual signs; 'George W. M. Reynolds and

- the Trafalgar Square Revolution: Radicalism, the Carnivalesque and Popular Culture in mid-Victorian England', *Journal of Victorian Culture*, 7 (2002), pp. 23–59; p. 48. The same goes for the unions.
47. *FGMM*, 41 (November 1859), p. 532. Woolley writes as if the Emblem was a new design. It may have been the one illustrated here, although a note in the Richardson archive, Black Country Record, Cosely (D7/P2/1), dates it from 1849 and ascribes its design to Benjamin Richardson, which seems unlikely.
 48. After terrorist acts in Sheffield and Manchester, the Birmingham Trades Council was inaugurated to defend unions and campaign for the vote for working men. It played a strong part in the Brookfields Demonstration of Easter Monday 1867, attracting over a quarter of a million people. Corbett, *The Birmingham Trades Council*, pp. 27–8.
 49. Thomas Wilkinson represented the Birmingham Trades Council at the first Trade Union Congress in 1868 and was President of the TUC at its second in 1869. The question of apprentice regulation was an issue at this congress. Corbett, *The Birmingham Trades Council*, pp. 30–1. Joseph Leicester (1825–1903) had a formidable reputation as glassworker at Powell (where he remained for thirty-five years), as a reviewer of glass at international exhibitions, and as a Trade Unionist and temperance campaigner by 1868. He became a Labour MP in 1885. *Dictionary of Labour Biography*, vol. iii.
 50. Dr George Lloyd: Lloyd and Summerfield's glass was regularly discussed by the *Journal of Design*. The firm exhibited at the Exhibition of 1851 and their glass is represented in the *Art Journal Illustrated Catalogue*, p. 92. He was Chairman of the Midlands Association of Glass Manufacturers at the time of the hearing.
 51. Frederic Harrison's radical affiliations are discussed by Margot Finn, *After Chartism: Class and Nation in English Radical Politics, 1848–1884*, Cambridge: Cambridge University Press, 1993, pp. 199–202. Other members were: Chairman, Sir William Erle, the Earl of Lichfield, Lord Elcho, James Booth, and William Matthews.
 52. Despite Lloyd's hesitancy it does seem as if the Midland Association, of which he was Chair during the strike, was an offshoot of a larger national body. In the Richardson archive now held at Cosely, Birmingham, a typed list of 48 national members of the Flint Glass Manufacturers' Association of 1856 (two years before the strike) lists his firm among several prominent midland glass manufacturers (D7/X3/2). His association did also appear to have funds. Jason Ellis, *Glassmakers of Stourbridge and Dudley, 1612–2002*, privately published, 2002, p. 459, records that Thomas Webb, the smallest firm in the thirteen-member Midland Association, claimed from the 'manufacturers' defence fund' after the 1859 lockout. What is interesting, therefore, is Lloyd's discomfort at being aligned with trade unions.
 53. Apsley Pellatt, *Curiosities of Glassmaking*, understood the complexity of the Chair and its task-based payments. He remarked (p. 72), that it was essential for a Manager to display skill and fairness in allocating tasks to prevent jealousy among Chairs given lower paid 'moves'.
 54. See Keith McLelland in *Defining the Victorian Nation*, pp. 100–4, for the paradigm of the sober respectable workman in liaison with middle-class values.
 55. T. C. Barker, *An Age of Glass*, London: Boxtree, 1994, p. 82.

Conclusion

1. Walter Benjamin, *Selected Writings 1927–1934*, 4 vols., trans. Rodney Livingstone et al., Cambridge, Mass. and London: The Belknap Press of Harvard University Press, 1999, vol. ii, p. 734.
2. *FGMM*, 37 (October 1858), p. 296.
3. Robert B. Pippin, *Modernism as a Philosophical Problem*, 2nd edn., Oxford: Blackwell, 1999, p. xiv.
4. *Ibid.*, p. xvii.
5. Karl Marx, *Capital. A Critical Analysis of Capitalist Production* (1867), 2 vols., trans. S. Moore and Edward Aveling, ed. Frederick Engels, London: Lawrence & Wishart, 1974, vol. i, p. 47.

5. Reflections, Translucency, Aura, and Trace

NB In this chapter I refer to many familiar nineteenth-century novels, which today appear in many editions. I have referenced these by chapter. Where I have given page references I have chosen a reliable recent edition. Unfamiliar texts are fully documented.

1. See Part III, pp. 283. John Tyndall is a typical theorist of the reflection. 'A ray of light striking as a perpendicular against a reflecting surface will travel back along the perpendicular; it simply retraces its own course. If it strikes the surface obliquely, it is reflected obliquely.' 'The rays enter the eye as if they came from an object behind a mirror.' *Notes on a Course of Six Lectures on Light*, 2nd edn., London: Longmans, Green, & Co., 1870, pp. 8, 13. Pre-modern physics presupposed that the image came from the mirror itself. See Margaret J. M. Ezell, 'Looking Glass Histories', *Journal of British Studies*, 43 (July 2004), pp. 317–38.

Halls of mirrors and mirror rooms date from the seventeenth century, but were reserved for the aristocracy and do not belong to the genre of public glass until the mid-nineteenth century, built, for example, in the Colosseum in Leicester Square. The wardrobe mirror belongs to the early nineteenth century, according to Serge Roche, *Mirrors* (1956), trans. Gerald

- Duckworth, London: Gerald Duckworth, 1957, p. 302. Even when the glass mirror became more common at the end of the seventeenth century, these were both expensive and small: it would have been rare for the whole body to have been seen reflected. Henry James's governess sees herself full-length for the first time in the mirrors of Bly in *The Turn of the Screw* (1898).
2. Michael Fried, *Manet's Modernism or, The Face Of Painting in the 1860s*, Chicago: University of Chicago Press, 1998, p. 434. See, for Paul and the spectacles, Charles Dickens, *Dombey and Son* (1848), chapter 12.
 3. George R. Sims, *Glances Back*, 2 vols., London: Jarrolds, 1917, p. 146.
 4. Edward Fitzball, *Thirty Five Years of a Dramatic Author's Life*, 2 vols., London: T. C. Newby, 1859, vol. i, p. v.
 5. James Robinson Planché, *Recollections and Reflections: A Professional Autobiography*, 2 vols., London: Sampson Low, 1872, vol. i, p. 127.
 6. Jane Moody, *Illegitimate Theatre in London, 1770–1840*, Cambridge: Cambridge University Press, 2000, p. 152.
 7. Horace Foote, *A Companion to the Theatres and Manual of the British Drama*, London: William Marsh & Alfred Miller, 1829, p. 74.
 8. The engraving of the Cobourg mirror is entitled 'Theatrical Reflection. Or a Peep at the Looking Glass Curtain at the Royal Coburg Theatre' (1822). London Metropolitan Archives.
 9. Foote, *Companion*, p. 75.
 10. Moody, *Illegitimate Theatre*, p. 154.
 11. *Ibid.*, p. 152.
 12. *Punch*, 20 (January–June 1851), 'Punch's Almanack', *The Haycocks in 1851*.
 13. Thomas Hardy, 'The Fiddler of the Reels', *The Fiddler of the Reels and other Stories 1888–1900*, London: Penguin Books, 2003, p. 201.
 14. Thomas Hardy, *Jude the Obscure*, 1896 (Part Third, chapter 8), ed. C. H. Sisson, Harmondsworth: Penguin, 1978, p. 236.
 15. Manet's painting has been discussed in detail by Michael Fried, *Manet's Modernism*, pp. 285–8. He critiques the political reading of T. J. Clark (*The Painting of Modern Life: Paris in the Art of Manet and his Followers*, rev. edn., Princeton: Princeton University Press, 1999), p. 587.
 16. Edward Burne-Jones, *The Baleful Head*, part of the unfinished *Perseus* series, painted between 1877 and 1888. Southampton Art Gallery.
 17. Elizabeth Barrett Browning, *Casa Guidi Windows*, ed. Julia Marcus, New York: The Browning Institute, 1977, ll. 60–1.
 18. Walter Benjamin, *The Arcades Project*, trans. Howard Eiland, Kevin Mc Laughlin, Cambridge, Mass. and London: The Belknap Press of Harvard University Press, 1999, pp. 537, 538, 537; Walter Benjamin, *Charles Baudelaire: A Lyric Poet in the Era of High Capitalism*, trans. Harry Zohn, London: Verso, 1969, pp. 48–54, 126–8. Edgar Allen Poe, 'The Man of the Crowd', *Great Short Stories*, ed. G. R. Thompson, New York: HarperCollins, 1970, p. 267.
 19. John Claudius Loudon, *The Suburban Gardener and Villa Companion*, London: privately printed, 1838, p. 102.
 20. Holman Hunt's *The Awakening Conscience*, 1854, was renamed *The Awakened Conscience* in 1856. Tate Gallery, London.
 21. For a fine discussion of mirror-imaging in this picture and other Pre-Raphaelite painters, including an account of scholarship it has attracted, see Michael Hancher, 'Hunt's Awakening Conscience', *Journal of Pre-Raphaelite Studies*, 4 (Fall 1995), pp. 27–39. This painting has also been discussed by Lynda Nead (*Myths of Sexuality*, Oxford: Blackwell, 1988) and Kate Flint (in Marcia Pointon, ed., *Pre-Raphaelites Re-Viewed*, Manchester: Manchester University Press, 1989).
 22. James Tissot, *La Demoiselle de Magasin*, 1883, Art Gallery of Ontario, Toronto, Canada.
 23. Jacques Lacan, *The Four Fundamental Concepts of Psychoanalysis*, ed. Jacques-Alain Miller, trans. Alan Sheridan, New York: W.W. Norton & Co., 1978, p. 17. Beatriz Colomina's writing is an early attempt to read Lacanian mirroring in architecture and domestic interiors. Beatriz Colomina, ed., *Sexuality and Space*, Princeton: Princeton University Press, 1992, pp. 83–91.
 24. *The Annotated Alice. Alice's Adventures in Wonderland and Through the Looking-Glass*, by Lewis Carroll, ed. Martin Gardner, rev. edn., Harmondsworth: Penguin Books, 1970, p. 181.
 25. George Eliot, *Middlemarch*, 1871–2 (book VI, chapter LXI), ed. Rosemary Ashton, London: Penguin Books, 1994, p. 615.
 26. John Ruskin, *The Library Edition of the Works of John Ruskin*, ed. E. T. Cook and Alexander Wedderburn, 39 vols., London: George Allen, 1903–12, vol. iii, *Modern Painters*, vol.i, part 2, p. 538.
 27. Edward Burne-Jones, *Venus' Mirror*, 1877. Museo Calouste Gulbenkian Foundation, Lisbon.
 28. Michel Foucault, 'Of Other Spaces (1967), Heterotopias', trans. Jay Miskowicz <http://foucault.info/documents/heteroTopia/foucault.heteroTopia.en.html>.
 29. Simon During, *Modern Enchantments: the Cultural Power of Secular Magic*, Cambridge, Mass., and London: Harvard University Press, 2002, pp. 147–8.
 30. F. Marion, *The Wonders of Optics*, trans. Charles W. Quinn, New York: Charles Scribner & Co., 1870, p. 276.
 31. Martin Heidegger, 'The Thing', *Poetry, Language, Thought* (1971), trans. Albert Hofstadter, New York: Harper & Row, 1975, p. 181.

32. Maurice Merleau-Ponty, 'Eye and Mind', *The Primacy of Perception*, ed. James M. Edie, Evanston, Ill.: Northwestern University Press, 1964, p. 168.
33. Mary Coleridge, 'The Other side of a Mirror', *Fancy's Following*, Oxford: Daniel, 1896; Algernon Charles Swinburne, 'Before the Mirror', *Poems and Ballads* (1866), new edn., London: Chatto & Windus, 1893; George Meredith, *Modern Love, and Poems of the English Roadside*, Sonnet XXII, London: Chapman & Hall, 1862; Thomas Hardy, 'The Lament of the Looking-Glass' (1922), 'The Cheval-Glass' (1914), 'Moments of Vision' (1917), *The Complete Poems*, ed. James Gibson, London: Palgrave, 2001; Dante Gabriel Rossetti, 'The House of Life' (1870), Sonnet XLIX (Sonnet 1 of 'Willowwood'), Sonnet LIII, 'Without Her', *Poetical Works*, ed. W. M. Rossetti, London: Ellis & Elvey, 1893; Michael Field (Katherine Harris Bradley, Edith Emma Cooper), 'A Portrait', *Sight and Song*, London: Elkin Matthews & John Lane, Bodley Head, 1892; Augusta Webster, 'By the Looking-Glass', *A Woman Sold, and other Poems*, London and Cambridge: Macmillan & Co., 1867; Christina Rossetti, 'A Royal Princess' (1866), *The Complete Poems*, ed. R. W. Crump and Betty S. Flowers, London: Penguin Books, 2001; Virginia Woolf, *To the Lighthouse*, 1927, part II, 'Time Passes', sect. 4.
34. Elizabeth Barrett Browning, 'The Prospect', *The Poetical Works of Elizabeth Barrett Browning*, ed. Ruth M. Adams, Boston: Houghton Mifflin, 1974, p. 199.
35. Charlotte Brontë, *Jane Eyre*, 1847 (chapter IV).
36. Harriet Martineau, *Household Words*, 5 (1852), p. 32.
37. Charles Baudelaire, 'Les Fenêtres', XXXV, *Petits Poèmes en Prose*, Paris: Editions Garnier Frères, 1962, pp. 173–4: 'Dans ce trou noir lumineux vit la vie, rêve la vie, souffre la vie'.
38. John Claudius Loudon, *The Suburban Gardener*, p. 43.
39. Bruno Reichlin, 'The Pros and Cons of the Horizontal Window: The Perret LeCorbusier Controversy', *Daidalos, Berlin Architectural Journal*, 13 (1984), pp. 65–78; p. 66.
40. Emerson, 'The Poet' (1844), *Selected Essays*, London: Penguin Books, 2003, p. 270.
41. Jeremy Bentham, *Panopticon; or, The Inspection-House*, 2 vols., Dublin and London: T. Payne, 1791, vol. ii, p. 16. For the visibility of cells see 'Panopticon Papers', *A Bentham Reader*, ed. Mary Peter Mack (New York: Pegasus (Western Publishing Co.), 1969), p. 194. Bentham's brother was stationed on the Potemkin estate, 'Prime Minister of Russia under Catharine [*sic*] the Second' (p. 196), imported as part of Catherine's modernizing drive. The avant-garde panopticon would have related to the monumental glasshouses of the Russian aristocracy, particularly the semicircular conservatory at the Tauride Palace at St Petersburg.
42. Michel Foucault, *Discipline and Punish: The Birth of the Prison* (1974), trans. Alan Sheridan, New York: Vintage, 1977. See part II, chapter 3, pp. 200–28.
43. *The Times*, 15 January 1851.
44. 'Glass Houses of Parliament', *Punch*, 19 August 1850, p. 81.
45. Ruskin, *Works.*, vol. ix, p. 232; he refers specifically to London houses.
46. Ruskin, *Works*, vol. i, p. 264.
47. Henri Lefebvre, *Rhythmanalysis. Space, Time and Everyday Life* (1992) trans. Stuart Eldon and Gerald Moore, London and New York: Continuum, 2004, p. 36.
48. Reichlin, 'The Pros and Cons', p. 71.
49. *Ibid.*, p. 73.
50. *Ibid.*, p. 77.
51. See Loudon's illustrations of 'dressed' windows in *An Encyclopaedia of Cottage, Farm and Villa Architecture*, 2nd edn., London: Longman, Brown, Green & Longmans, 1842, pp. 1075–7.
52. Henri Lefebvre, *The Production of Space* (1974), trans. Donald Nicholson-Smith, Oxford: Blackwell, 1991, p. 164. Dominated space is transformed and mediated by technology and is indivisibly linked with political power. 'Military architecture, fortifications and ramparts, dams and irrigation systems' all come under the rubric of domination.
53. Lefebvre, *The Production of Space*, p. 165. Appropriated space is a subtle category intended to come between Marx's simple opposition between dominated and 'private' space. It is predicated on ownership but the prime purpose of appropriation is to further the cultural needs of a group or individual.
54. C. W. Whall, *Stained Glass Work: A Text-Book for Students and Workers in Glass*, London: W. R. Lethaby, 1905, p. 94. Charles Winston, *An Enquiry into the Difference in Style Observable in Ancient Glass Paintings with Hints on Glass Painting*, 2 vols., Oxford: John Henry Parker, 1847, vol. i, p. 247.
55. 'glass is the most brilliant, and yet the cheapest; the most graceful and yet the strongest... To that which is ordinary it lends a grace; and to that which is graceful it gives a double lustre.' Anthony Trollope, *The Struggles of Brown, Jones and Robinson*, London: Smith Elder & Co., 1870, p. 37.
56. Charles Dickens, 'Gin Shops' (*Evening Chronicle*, February 1835), *Sketches by Boz* (1836–7), ed. Denis Walder, London: Penguin Books, 1995, p. 214.
57. Charles Knight, *Cyclopaedia of London*, 1851, p. 761.
58. *Ibid.*, p. 762.
59. *Ibid.*, p. 764.
60. John Everett Millais, *Mariana*, 1851. The Makins Collection.
61. There are 'window poems' too, notably Tennyson's 'Mariana', 'The Lady of Shallot', Robert Brownings'

'Up at a Villa—Down in the City'. Elizabeth Barrett Browning's 'The Poet's Vow', and *Casa Guidi Windows*. On the latter, see Isobel Armstrong, 'Casa Guidi Windows: Spectacle and Politics in 1851', in Alison Chapman and Jane Stabler, eds., *Unfolding the South: Nineteenth-Century Women Writers and Artists in Italy*, Manchester and New York: Manchester University Press, 2003, pp. 51–69. In her essay 'Melodrama Inside and Outside the Home', Laura Mulvey argues that the private interiority of the bourgeois self is gendered because women were guardians of the privacy of the home. This may be why the woman at the window trope is overdetermined at this time. Laura Mulvey, *Visual and Other Pleasures*, London: Palgrave Macmillan, 1989.

62. Mary E. Braddon, *Lady Audley's Secret*, 1862, vol. ii, chapter VIII; Elizabeth Gaskell, *North and South*, 1855, vol. i, chapter VI; Thomas Hardy, *Far from the Maddening Crowd*, 1874, chapter XXXI; Henry James, *The Princess Casamassima*, 1886, book 4, chapter XXIX, book 6, chapter XLVII; Charles Dickens, *Our Mutual Friend*, 1865, book 4, chapter IX; Henry James, *The Golden Bowl*, 1904, vol. i, chapter 1.
63. For further explorations see J. Hillis Miller, 'Microscopy and Semiotic in *Middlemarch*', *Nineteenth-Century Literature*, 50 (1996), pp. 501–24; Barbara Hardy, 'The Woman at the Window in *Middlemarch*', *Perspectives of Self and Community in George Eliot*, *Studies In British Literature*, 22, Lampeter: Edwin Mellen Press, 1997, pp. 2–32.
64. Charlotte Brontë, 'The Green Dwarf', 1833 (See *An Edition of the Early Writings of Charlotte Brontë*; 2 vols. [volume ii in 2 parts], ed. Christine Alexander, Oxford: Basil Blackwell, Shakespeare Head Press, 1987–91, ii/1, p. 158); *Jane Eyre*, 1847, chapter IV; Elizabeth Gaskell, *North and South*, 1855, vol. i, chapter V; vol. i, chapter XXII; George Eliot, *Middlemarch*, 1871–2, book 3, chapter XXVIII; Charles Dickens, *Bleak House*, 1853, chapter II; Ellen Wood, *East Lynne*, 1861, section 2, part 1, chapter IX; Wilkie Collins, *No Name*, 1862, the fourth scene, chapter XIII.
65. Wilkie Collins, *Armada*, 1866, book I, chapter V, book II, chapter III, last book, chapter I; Emily Brontë, *Wuthering Heights*, 1848, chapter III.
66. Wilkie Collins, *The Woman in White*, 1860, The Second Epoch, chapter IX, Section 1; Margaret Oliphant, 'The Library Window', 1882, Glacier, Mont.: Kessinger Publishing, 2004 (first collected in *Stories of the Seen and Unseen*, 1902); Henry James, *The Turn of the Screw*, 1898, sections 5, 9, 24, 10; George Eliot, *Middlemarch*, book 4, chapter XXXVI; book 8, chapter LXXX.
67. *Middlemarch*, book 1, chapter XI.
68. G. H. Lewes was revising his work on Hegel's *Phenomenology* for his new and very much altered chapter on Hegel in his *History of Philosophy*, 4th

edn., 2 vols, 1871, over the period of composition of *Middlemarch*.

69. Lefebvre, *Rhythmanalysis*, p. 11.
70. 'Beyond the Pale', *Plain Tales from the Hills* (1888), *Collected Works of Rudyard Kipling*, vol. i, New York: AMS Press, 1970. See Michel de Certeau, *The Practice of Everyday Life*, trans. Stephen Randall, Berkeley: University of California Press, 1988, p. 127.
71. Charles Dickens, *Dombey and Son*, 1848, chapter X.

6. Glassing London: Building Glass Culture, Real and Imagined

1. 'Falcon Glass Works', *The Busy Hives Around Us. A variety of trips and visits to the mine, the workshop and the factory*, illustrated by William Harvey, London: James Hogg & Sons, 1861, pp. 165–93.
2. Lynda Nead, *Victorian Babylon: People, Streets and Images in Nineteenth-Century London*, New Haven: Yale University Press, 2000.
3. Marshall Berman, *All that is Solid Melts into Air*, London: Verso, 1982.
4. Charles Knight, *Cyclopaedia of London*, 1851, p. 760.
5. *Ibid.*, p. 761.
6. Charles Eastlake, *Hints on Household Taste in furniture, upholstery and other details*, London: Longmans, Green and Co., p. 23. Henry-Russell Hitchcock's *Early Victorian Architecture in Britain*, 2 vols., London: Architectural Press, New Haven: Yale University Press, 1954, illustrates nearly a dozen large-windowed shop complexes dating from the 1840s in London and elsewhere. See figs. 5–7, 13, 15, 22–7, 29, chapter 12. The *Builder* regularly published accounts of new shop architecture and design. In 1851 both the *Builder* and the *Journal of Design* published the same engraving of a new, particularly ornate Piccadilly shopfront: in the same year *The Civil Engineer and Architect's Journal* (14, 13 September 1851, p. 486) gave nearly a full page to Ashpitel and Whichcord's elaborately pilastered, round-arched plate glass shopfronts in Maidstone. See Mark Wigington, *Glass in Architecture*, London: Phaidon, 1996, for the use of plate glass in nineteenth-century building. For the evolution of shop architecture see Kathryn A. Morrison, *English Shops and Shopping: An Architectural History*, New Haven and London: Yale University Press, 2003. Also N. Whittock, *On the Construction and Decoration of the Shopfronts of London*, London: Sherwood, Gilbert, & Piper, 1840. (Whittock writes of Ionic, Gothic, Italian Palladian, India/Oriental, and Louis XIV styles.) For a reading of the department store see Rachel Bowlby, *Just Looking: Consumer Culture in Dreiser, Gissing and Zola*, London: Methuen, 1985. See also Raymond McGrath's classic, *Glass in Architecture*

- and Decoration, *London: The Architectural Press, 1937.*
7. William Gaspary, *Tallis's Illustrated London in Commemoration of the Exhibition of 1851*, 2 vols., London and New York: T. Tallis & Co., 1851.
 8. *Tallis's Illustrated Plan of London and its Environs*, London and New York, 1851.
 9. Albert Smith, Marcus Fall, et al., *Sketches of London Life and Character*, 2 vols., London: Tinsley Brothers, 1888, p. 117.
 10. George Augustus Sala, Henry Fairfield, *Twice Round the Clock, or The Hours of the Day and Night in London*, London: Houston & Wright, 1859, p. 77.
 11. Henry Mayhew, *Morning Chronicle*, 14 December 1849, Letter XVII.
 12. 'Gin Palaces', Charles Dickens, *Sketches by 'Boz', Illustrative of Every-Day Life and Every-Day People* (1836–7, 1839), ed. Denis Walder, London: Penguin Books, 1995, p. 217.
 13. Knight, *Cyclopaedia of London*, p. 760.
 14. For the Pantheon see Knight, *Cyclopaedia of London*, p. 762; George Augustus Sala, *Twice Round the Clock, or the hours of the day and night in London*, p. 177. Morrison, *English Shops and Shopping*, p. 95, classifies the Pantheon as a bazaar because it was on several floors (cf. the Soho, Queen's, and Crystal Palace Bazaars) rather than an arcade (cf. Lowther and Burlington Arcades), but its top-lit galleries, part-glazed barrel-vaulted roof, multi-level floors, combined with its circular refreshment room, and conservatory at its rear, Marlborough Street, entrance suggest a hybrid space.
 15. Max Schlesinger, *Saunterings in and about London*, trans. Otto Wenckstern, London: Nathaniel Cooke, 1853, p. 39. For Moses & Son and its many gas flames see p. 17.
 16. Charlotte Brontë, *An Edition of the Early Writings of Charlotte Brontë 1826–1832*, 2 vols., ed. Christine Alexander, Oxford: Shakespeare Head Press, Basil Blackwell, 1987–91, vol i, p. 158. Bentham's 'Panopticon Hill Villages' were designed with fountains, coloured lights, and gardens for the recreation of reformed prisoners. *A Bentham Reader*, ed. Mary Peter Mack (New York: Pegasus (Western Publishing Co., 1969)).
 17. See May Woods, *Glass Houses*, London: Aurum Press, 1988, p. 131.
 18. Georg Simmel, 'The Metropolis and Mental Life' (1903), *Georg Simmel: On Individuality and Social Forms*, ed. Donald Levine, Chicago: Chicago University Press, 1971, p. 325.
 19. Kate Colquhoun, *A Thing in Disguise: The Visionary Life of Joseph Paxton*, London: Fourth Estate, 2003, pp. 19–20 (Loddiges), p. 39 (Knight); Georg Kohlmaier and Barna von Sartory, *Houses of Glass: A Nineteenth-Century Building Type*, trans. John C. Harvey, Cambridge Mass.: MIT Press, 1986, pp. 251–3 (W. and D. Bailey). For the evolution of the conservatory see John Hix, *The Glasshouse*, London: Phaidon, 1996.
 20. 'Back Street Conservatories' *Household Words*, 2 (1850–1), pp. 271–5; p. 274. Ward published an account of his cases in 1842. Nathaniel Bagshaw Ward, *On the Growth of Plants in Closely Glazed Cases*, London: John Van Voorst, 1842. For a meticulously detailed account of these cases (including Loudon's interest in them), which sometimes reached a height of elaboration as small conservatories and representations of Tintern Abbey, see Margaret Flanders Darby, 'Unnatural History: Ward's Glass Cases', *Victorian Literature and Culture*, 35 (2007), pp. 635–207.
 21. Kohlmaier and von Sartory, *Houses of Glass*, p. 229.
 22. *Sharp's London Magazine*, 14 (1851), p. 250.
 23. *The Times*, 15 January 1851.
 24. *The Times*, 2 May 1851, p. 4. The quotation is from a celebratory May Day poem by William Makepeace Thackeray.
 25. *Sharp's London Magazine*, 14 (1851), p. 250.
 26. *Athenaeum*, 10 May 1851, pp. 500–1; p. 500.
 27. Charles Knight, *Household Words*, 3, 3 May 1851, pp. 121–4; p. 121.
 28. William Whewell, 'The General Bearing of the Great Exhibition on the Progress of Art and Science', Inaugural Lecture, 25 November 1851, p. 6.
 29. John Milton, *Paradise Lost*, book 1, C. 711.
 30. Knight, *Household Words*, 3, 3 May 1851, p. 121. He was at pains to establish the reality principle of labour. 'In 1837 there was a difficulty in making glass of the length of three feet, at all; but, during last year, there were produced in a few months nine hundred thousand cubic feet of sheet glass, each pane being forty-nine inches in length. The weight of this glass is four hundred tons. In the first year of this century there were less than three thousand tons of window-glass used in the whole of England; hence, the Crystal Palace has consumed as much glass as one-eighth of Great Britain consumed in 1801. If Science had not been at work in every direction for the last fifty years—Political, as well as Chemical and Mechanical Science—the four hundred tons of sheet glass could not have been produced' (p. 121).
'The principle of the whole building—that of a succession of similar parts upon a uniform plan—allowed the very utmost amount of union of forces. Every piece of iron, or wood, or glass, that went to form a whole, was one of many pieces of similar dimensions. There was no measuring or cutting. Machinery was employed... But the amount of manual labour, in the actual putting together of these materials, was enormous, to have accomplished such a result in six months' (p. 122).
 31. *Sharp's London Magazine*, 13 (1851), pp. 61–2.
 32. *The Illustrated London News*, 18 January 1851, p. 42.
 33. Sigfried Giedion, *Space, Time and Architecture: The Growth of a New Tradition*, 5th rev. edn., Cambridge, Mass.: Harvard University Press,

- 1967, p. 229. See *Transactions*, of the Institute of British Architects, 1 (1836), pp. 44–6. The design, p. 45.
34. *Westminster Review*, 55 (July 1851), pp. 346–94; p. 360.
 35. 'A London Railway Station', Charles Manby Smith, *The Little World of London*, Arthur Hall, Virtue, & Co., 1857, pp. 93–101; p. 94. The *Illustrated London News*, one of the first illustrated papers aimed at the liberal middle class, persistently portrayed stations through the idea of the reassuring overarching glass canopy (see its engravings, 6 October 1849; 7 September 1850, p. 201). The Queen's visits to York in 1849 and Newcastle in 1850, not unexpectedly, insist upon this iconography. Rituals were established round her arrivals and departures as a new public space for royal display and nationhood. The Crystal Palace itself was frequently presented as if it were a station, a vast soaring arch drawn to give the reader the illusion of being actually under the glass roof itself, pulled into a virtual reality created by the engraving process. The same perspectival sleight of eye is present in the *Civil Engineer and Architect's Journal* (see its illustration, vol. 14, March 1851, p. 198) when Paxton's design for the Royal Exchange was reproduced. A necessity for the rich and a luxury for the poor, the *Illustrated London News* described the railways in 1850 in its leading article (21 September), inadvertently giving the lie to the democratic argument despite its belief that at last 'cheap and ready means of transit' are available to the poor. Historic developments such as Robert Stephenson's Euston of 1835, and his trijunct station at Derby (1839), pointed the way to utilizing glass and iron, as did Brunel's Paddington (1838) and Bristol Temple Meads (1839). A massive roof span was the ambition, even more pronounced when it came to exhibitions. Hector Horeau's unbuildable design for the Grandes Halles (1849) had a 300 foot span.
 36. Ruskin, Architectural Association, 1857.
 37. *Illustrated London News*, 3 May 1851.
 38. Whewell, *The General Bearing*, p. 6.
 39. *Punch*, 18 (January–June 1850), p. 90.
 40. Smith, Fall, et al., *Sketches of London Life*, pp. 116, 117.
 41. Charles Manby Smith, 'Romance of a Shop Window', *The Little World of London*, p. 331.
 42. *The Morning Chronicle*, 2 May 1851, p. 2.
 43. 'A Journey Round the World in the Crystal Palace', *Sharpe's London Magazine*, 14 (1851), pp. 250–6; pp. 315–20; pp. 255, 252.
 44. *Fraser's Magazine* (August 1851), pp. 119–32; p. 120.
 45. *Dublin University Magazine*, 38 (1851), pp. 617–28; p. 627.
 46. Theodor Adorno, *Aesthetic Theory* (1970). Isobel Armstrong, *The Radical Aesthetic*, Oxford: Blackwell, 2000, p. 180.
 47. *Sharpe's London Magazine*, 14 (1851), p. 250.
 48. *Chambers' Edinburgh Journal*, 31 May 1851, pp. 336–340; p. 337.
 49. *North British Review*, 15 (August 1851), pp. 529–68; p. 534.
 50. *Illustrated London News*, 3 May 1851.
 51. 'Professor Cowper's Illustrations of the scientific construction of the Palace of International Industry' (31 December 1850), *Illustrated London News*, 4 January 1851, p. 9.
 52. Quoted by Marshall Berman and Wolfgang Schivelbusch (*The Railway Journey*). Lothar Bucher's words were first quoted by Sigfried Giedion, *Space, Time and Architecture*, pp. 253–4, who compares them with Turner's 'Simplon Pass'.
 53. Hitchcock, *Early Victoria Architecture*, p. 542.
 54. *Household Words*, 3 May 1851, pp. 121–4; p. 122.
 55. *Sharpe's London Magazine*, 14 (1851), p. 250.
 56. *Chambers' Edinburgh Journal*, 1 March 1851, p. 129; 31 May 1851, pp. 336–40; p. 337.
 57. *Civil Engineer and Architects' Journal*, 14 (1851), pp. 253–4; p. 254.
 58. *Ecclesiologist* (1851), pp. 269–70, 272, 386.
 59. Charles Winston, *An Inquiry into the Difference Observable in Ancient Glass Paintings*, 2 vols., Oxford: John Henry Parker, 1847; William Warrington, *The History of Stained Glass from the earliest period to the present time*, London, 1848. For a discussion of the controversy round these writers, and the repudiation of their aesthetic principles by the *Ecclesiologist*, see Jim Cheshire, *Stained Glass and the Victorian Gothic Revival*, Manchester: Manchester University Press, 2004, pp. 17–21. See Martin Harrison, *Victorian Stained Glass*, London: Barrie & Jenkins, 1980, for a discussion of design principles and materials in the period.
 60. Cheshire, *Stained Glass*, p. 12.
 61. *Sharpe's* and *Chambers'* were populist 'modernizing' periodicals. As monthlies their coverage of the Exhibition could be more frequent and extensive than the high journalism of the quarterlies.
 62. D. G. Rossetti, quoted by Harrison, *Victorian Stained Glass*, p. 40.
 63. *The Builder*, 13, 15 December 1855, pp. 603–4. Subsequent page references in text.
 64. *Minutes of Evidence taken before the Select Committee on Metropolitan Communications*, 7 June 1855, p. 81. Funded adequately, Paxton claimed, the Crystal girdle would become an adjunct of colonial policy, staunching the exodus of surplus moneys created by the investment imperialism practised by Britain's economic rivals, Russia and France (p. 93). See Lynda Nead, *Victorian Babylon*, pp. 27–9.
 65. *Minutes of Evidence*, 7 June 1855, p. 80. Further page references in text.
 66. *What is to Become of the Crystal Palace?* London: Bradbury & Evans, 1851, p. 4. Further page references in text.
 67. Gye, the *Builder*, 13, 15 December 1855, p. 603.

68. Raymond McGrath, *Glass in Architecture and Decoration* (1937), rev. edn., London: Architectural Press, 1961, p. 139, describes the *Builder's* plan for a Prospect Tower 1,000 feet high, put forward by C. Burton. The *Builder* was critical of the Crystal Palace architecture, complaining that it leaked. It disliked what it described on 10 May 1856 as the 'mania' for glass and glass shopfronts, consistent with its radical anti-consumerism.
69. *Household Words*, I, 20 July 1850, pp. 388–92.
70. Institution of Civil Engineers, *Minutes of Proceedings*, 10 (1850–1), pp. 127–92. Matthew Digby Wyatt's presentation on the construction of the Exhibition building, 14 January 1851. Turner's intervention, pp. 66–70.
71. Horace Horeau, *Projet Pour La Deuxième Exposition Universelle de London*, London, 1859.
72. Ebenezer Howard, *Garden Cities of Tomorrow* (1898), 2nd edn., London: Swan Sonnenschein & Co., 1902, p. 23.
73. Marshall Berman, *All that is Solid Melts into Air*, p. 244.
74. Hannes Meyer, 'Project for the Palace of the League of Nations' (Geneva, 1926–7), *Buildings, Projects and Writings*, London: Alec Tiranti, 1965, pp. 32–3.
75. David Button, 'From the Static to the Dynamic Glass Envelope', *Future Bauhaus*, Stuttgart: Deutsche Verlags-Anstalt GmbH, 1994, p. 138.
76. Walter Gropius, *The New Architecture and the Bauhaus* (1935), trans. P. Morton Shand, Museum of Modern Art, New York and London: Faber & Faber, 1937, pp. 17, 27. Further page references in text.
77. Le Corbusier—*The City of Tomorrow and Its Planning*, trans. Frederick Etchells (from the 8th French edn. of *Urbanisme*), London: The Architectural Press, 1947, p. 13.
78. Gropius, *The New Architecture*, p. 21.
79. Button, 'From the Static to the Dynamic', p. 138.
80. Gropius, *The New Architecture*, p. 22. Hisham Elkadi, *Cultures of Glass Architecture*, Aldershot and Burlington: Ashgate, 2006, pp. 57–83, considers the technological potential of the curtain wall as reactive skin, controlling and responding to thermal and solar energy, transmitting and absorbing energy in new ways.
81. Gropius, *The New Architecture*, p. 23.
82. Jonathan Beecher, *Charles Fourier: The Visionary and his World*, Berkeley and Los Angeles: University of California Press, 1986, p. 244.
83. *Notes from Underground* (1864), trans. Jane Kentish, Oxford and New York: Oxford University Press, 1991, p. 35.
84. Yevgeny Zamyatin, *We* (1920), trans. Bernard Guilbert Guerney, intro. Michael Glenny, Harmondsworth: Penguin Books, 1972, p. 88.
85. Paul Scheerbarth, *Glass Architecture*, trans. James Palmes, ed. Dennis Sharp, New York and Washington: Praeger Publishers, 1972, p. 41.
86. Bruno Taut, *Alpine Architecture*, trans. Shirley Palmer, ed. Dennis Sharp, New York and Washington: Praeger Publishers, 1919, section 16.
87. Benjamin, *Arcades*, p. 540.
88. *Ibid.*, p. 4.
89. *Westminster Review*, 55 (July 1851), pp. 346–94; p. 347.

7. Politics of the Conservatory: Glasshouses, Republican and Populist

1. John Claudius Loudon, *Sketches of Curvilinear Hot-houses*, London: D. Redman, 1818, p. 1.
2. Quoted in Melanie Louise Simo, *Loudon and the Landscape. From Country Seat to Metropolis*, New Haven and London: Yale University Press, 1988, p. 162.
3. *The Times*, 15 July 1850.
4. Readings of the Exhibition of 1851 have been directed towards commodity fetishism (Marx), the society of spectacle (Walter Benjamin and Guy Debord), and, following on Edward Said's writings on orientalism and colonialism, empire and imperialism: a later phase owes much to Anne McClintock's *Imperial Leather: Race, Gender and Sexuality in the Colonial Contest*, New York: Routledge, 1995. See Paul Greenhalgh, *Ephemeral Vistas: The Expositions Universelles, Great Exhibitions and World's Fairs, 1851–1939*, Manchester: Manchester University Press, 1988; Thomas Richards, *The Commodity Culture of Victorian Britain: Advertising and Spectacle, 1851–1914*, London: Verso, 1991; Andrew H. Miller, *Novels behind Glass. Commodity Culture and Victorian Narrative*, Cambridge: Cambridge University Press, 1995; Louise Purbrick, ed., *The Great Exhibition of 1851. New Interdisciplinary Essays*, Manchester: Manchester University Press, 2001; Lara Kriegel, 'The Pudding and the Palace: Labor Print Culture, and Imperial Britain in 1851', in Antoinette Burton, ed., *After the Imperial Turn. Thinking with and Through the Nation*, Durham, NC: Duke University Press, 2003, pp. 230–40; Paul Young, *Globalization and the Great Exhibition. The Victorian New World Order*, London: Palgrave-Macmillan, 2008. See also Joseph Bizup, *Manufacturing Culture: Vindications of Early Victorian Industry*, Charlottesville, Va.: University of Virginia Press, 2003. John Robert Gold, *Cities of Culture: Staging International Festivals and the Urban Agenda 1851–2000*, Aldershot: Ashgate, 2005. Clare Pettit, *Patent Inventions: Intellectual Property and the Victorian Novel*, Oxford: Oxford University Press, 2004, resists accounts of commodity and reads the Exhibition in terms of production. See Sabine Clemm on *Household Words* and the Exhibition, *Nineteenth-Century Contexts*, 27 (Sept. 2005), 207–30. James Buzard, Joseph W. Childers, and Eileen

- Gillooly, eds., *Victorian Prism. Refractions of the Crystal Palace*, ed. Charlottesville and London: University of Virginia Press, 2007, and Gillooly's impressive 'Rhetorical Remedies for Taxonomic Troubles. Reading the Great Exhibition', pp. 23–39.
5. See Simo, *Loudon and the Landscape*, and John Gloag, *Mr. Loudon's London: The Life and Work of John Claudius Loudon and his Influence on Architecture and Furniture Design*, Newcastle Upon Tyne: Oriol Press, 1970. Loudon married the feminist novelist and writer Jane Webb in 1830. He reviewed with great respect her futuristic novel (which predicted air travel and modern communications), *The Mummy. A Tale of the Twenty-Second Century* (1827) in his *Gardener's Magazine* in 1829 (vol. 3). Jane Loudon wrote an impressive series of gardening books for women, including *Instructions in Gardening for Ladies* (1840), *The Ladies' Companion to the Flower Garden* (1841), *Botany for Ladies* (1842).
 6. Loudon was present at Southwood Smith's dissection of Bentham's body, Gloag, *Mr. Loudon's London*, p. 219 (Jane Loudon's biography). He belonged to a network of radical Utilitarians in the 1830s, including William Johnson Fox and William Bridges Adams.
 7. Both grappled with the administration and planning of a public botanical garden. Loudon's engagement with the Committee of the Birmingham Botanical Gardens in 1831, Paxton's membership of the public enquiry into the derelict state of the Royal Garden at Kew in 1838, which helped to re-establish Kew as a national experimental botanical garden funded by the state, disclosed the problems of the uncharted territory of public finance (C. R. Fay, *Palace of Industry, 1851: A Study of the Great Exhibition and its Fruits*, Cambridge: Cambridge University Press, 1951, pp. 26–7; Kate Colquhoun, *A Thing in Disguise: The Visionary Life of Joseph Paxton*, London: Fourth Estate, 2003, pp. 85–6—for the Royal Gardens). Loudon's earliest writings addressed the need for the 'lung' of green spaces in London. He campaigned for replanting and greening city squares with Plane trees, and hypothesized concentric green belts in London. Loudon designed the Derby arboretum, opened in 1840 (Simo, *Loudon and the Landscape*, pp. 194–8). Paxton designed the Prince's Park in Liverpool, opened in 1844 (Colquhoun, *A Thing in Disguise*, pp. 115–18). Edwin Chadwick's sanitary report of 1842 extracted Loudon's report on the Derby Arboretum as an appendix (Simo, *Loudon and the Landscape*, p. 194). Both addressed the civic problem of the extramural cemetery, one of the most pressing health hazards of the time, as city graveyards overflowed with putrefying bodies. Loudon designed the layout of cemetery grounds at Southampton and wrote on plans for the modern cemetery. Paxton advised Chadwick on the form, architectural (he recommended glass buildings) and financial, that National Cemeteries would take by raising loans for development, when Edwin Chadwick was working on his *Report on a General Scheme for Extramural Sepulture* (1850). This plan was finally quashed by the government. See George F. Chadwick, *The Works of Sir Joseph Paxton 1803–1865*, London: The Architectural Press, 1961, p. 206).
 8. Thanks to Nick Fisher for help with Loudon. *Gardener's Magazine*, 14 (1838), p. 175.
 9. The strawberry epitomized luxury: *Reynolds's Weekly News* reported on 1 December 1850 that Queen Victoria ate strawberries at 40 guineas an ounce while the poor starved. *Remarks on the Construction of Hothouses*, printed for J. Taylor, London: Architectural Library, 1817, p. 49, for Russia.
 10. He recorded his first visit in the *Gardener's Magazine*, 12 (1831), pp. 375–7, and his second in the *Gardener's Magazine*, 17 (1841), pp. 450–2. In 1839 he noted improvements and praised the massive new cathedral-like tropical plant house (*Gardener's Magazine*, 15 (1839), p. 450), but in 1841 he censured its vast expense (*Gardener's Magazine*, 17 (1841)).
 11. *Gardener's Magazine*, 12 (1831), p. 395. Subsequent page references in text.
 12. He recommends Kewley's steam heating in *Remarks on the Construction of Hothouses*, p. 51 and Loddige's artificial rain, in *The Suburban Gardener and Villa Companion*, 1838, pp. 111–12. For Loudon's technological innovations and their originality, see, Georg Kohlmaier and Barna von Sartory, *Houses of Glass: A Nineteenth-Century Building Type*, trans. John C. Harvey, Cambridge, Mass.: MIT Press, 1986, pp. 47–9, 157 *et seq.*
 13. Paxton replied, arguing for the cheapness of his methods, in his own *The Horticultural Register*, in 1831. See Violet Markham, *Paxton and the Bachelor Duke. A Study of the Relations between Sir Joseph Paxton and William G. S. Cavendish*, London: Hodder & Stoughton, 1935, p. 337. See Simo, *Loudon and the Landscape*, p. 111 for Loudon's Russian experiences.
 14. Markham, *Paxton and the Bachelor Duke*, p. 337: 'Conservatories connected with a building are barely to be tolerated.'
 15. Loudon's account of the Derby Arboretum in the *Gardener's Magazine* for 1840 (vol. 16), stressed the need to give different kinds of 'meaning' to straight and winding walks (p. 73). He writes of children 'scampering round the walks' (p. 96) and people of all classes converging on the 'public garden', which he distinguished sharply from a common pleasure ground (p. 72). See also his *Hints on the Formation of Gardens and Pleasure Grounds*, 1812. See also Simo, *Loudon and the Landscape*, pp. 194–8.
 16. See Colquhoun, *A Thing in Disguise*, pp. 115–18.
 17. He published his first work on the hothouse in 1805, when he was in his early twenties. In 1817

- appeared his great scholarly and technologically innovative work, *Remarks on the Construction of Hothouses*. This was followed in 1818 by his pamphlet, *A Comparative View of the Common and Curvilinear Modes of Roofing Hothouses*. In the same year he published *Sketches of Curvilinear Hothouses, with a description of the various Purposes in Horticultural and General Architecture, to which a Solid Iron Sash Bar (lately invented) is Applicable*. In 1824 *The Green-House Companion* appeared. *The Encyclopaedia of Gardening* was published in 1822. *The Cottager's Manual* (1834), *The Suburban Gardener and Villa Companion* (1838), *An Encyclopaedia of Architecture* (1825) are among his prolific writings. It is rare to find any Loudon publication without a discussion of the conservatory.
18. The *Illustrated London News* carried an account of the lily feat on 17 November 1849. *Household Words*, 2, 18 January 1851, pp. 385–91, prefaced an account of the 'Palace of Glass' (by W. H. Wills) with the story of the Victoria Regia lily. This familiar story of Paxton's virtuosity is told in most detail by Colquhoun, *A Thing in Disguise*, pp. 156–61, who adds the presence of Mark Lemon, editor of *Punch*.
 19. *Illustrated London News*, 16 November 1850, p. 385.
 20. Markham, *Paxton and the Bachelor Duke*, pp. 178, 179.
 21. The *Illustrated London News* does not name Paxton's daughter. Colquhoun, *A Thing in Disguise*, p. 159, gives the detail of the tray.
 22. Markham, *Paxton and the Bachelor Duke*, p. 181.
 23. Specialist gardeners and Peers visited the lily, and copies of it appeared subsequently in specially created aquaria and grottos in Kew and in great houses, according to Weale, *London Exhibited*, 1851, pp. 474, 510. *Weale's London in 1852* (London: J. Weale), p. 535, returned to the lily and its habitat. Paxton intuitively understood the contemporary fascination with aqueous growths and the need to interact with them.
 24. The Porchester Terrace house appeared in *The Suburban Gardener and Villa Companion*, p. 334, as well as in the *Gardener's Magazine*. See Gloag, *Mr. Loudon's London*, p. 75. George Meredith's *One of Our Conquerors* (1891), describes Victor Radnor's new mansion and its quarter of a mile conservatory suite, academically Loudonesque. Isobel Armstrong, 'Technology and Text: Glass Consciousness and Nineteenth-century Culture', in Kate Flint and Howard Morphy, eds., *Culture, Landscape and the Environment*, Oxford: Oxford University Press, 2000, pp. 164–7.
 25. Kohlmaier and von Sartory, *Houses of Glass*, p. 157 *et seq.*
 26. Until it was demolished in 1832 Bretton Hall was the largest glass building in England. Called 'the wonder of the age' by the authoritative Charles Macintosh in *Book of the Garden* (London and Edinburgh: William Blackwell & Sons, 1853) it was balanced on 16 cast-iron columns whose capitals formed plants. Its cast-iron framework was constructed only of slender wrought iron sash bars with a cross-shaped section. The glazing participated in the load-bearing structure and stabilized the frame. The upper part of the dome changed shape: the inside concave curve of the bottom half of its barrel vaulting changed over to a convex profile and terminated with a circular ventilation opening. The ribs of the dome weighed only a pound per foot. Kohlmaier and von Sartory comment on the boldness of this structural concept—'the ratio of the greatest span (56 feet) to the thickness of the iron sash bars (2 inches) was 1 : 36. A chicken's egg has 1 : 100 in this respect' (Kohlmaier and von Sartory, *Houses of Glass*, p. 204).
 27. For Loudon's plans (the Botanical Society erected a smaller conservatory on grounds of expense) see Phillada Ballard, *An Oasis of Delight: The History of the Birmingham Botanical Gardens*, London: Duckworth, 1983, pp. 17–24.
 28. Kohlmaier and von Sartory, *Houses of Glass*, p. 229.
 29. Loudon is also cited as the authority on garden planning in garden literature. His categories are followed. See Charles Macintosh, *The Book of the Garden*, 2 vols., Edinburgh and London: William Blackwell & Sons, 1853, vol. i, chapter 7 in particular. In his popular books on garden management Samuel Orchard Beeton followed Loudon's principles and recommended a construction firm, E. W. Godwin, that carried out Loudonesque designs. See Messenger & Co., *Artistic Conservatories, and other Horticultural Buildings*, London: Batsford, 1880. *Beeton's Illustrated Book of the Garden*, London: Ward, Lock & Co., 1889–91, absorbed earlier editions, from 1861, of *The Book of Garden Management and Rural Economy*.
 30. Simo, *Loudon and the Landscape*, pp. 167–72, for the aesthetic of the fictive space and the influence of Quatremère de Quincy. Loudon edited the *Architectural Magazine and Journal of Improvement in Architecture, Building, Furniture etc.* from 1834. In his introduction to the first volume he stressed that architecture was the universal art because all men and women have to inhabit buildings. *Architectural Magazine*, 1 (March 1834), p. 1.
 31. *Illustrated London News*, 16 November 1850.
 32. *Gardener's Magazine*, 1 (1826), Preface. The magazine cost 5s. and sold well until undercut by Paxton's cheaper *Magazine of Botany*, which appears to have started at 2s. 6d. For the politics of gardening magazines see Ray Desmond, 'Victorian Gardening Magazines', *Garden History*, 5 (1977), pp. 47–66 (pp. 55–60 for the Loudon–Paxton relationship). Elsewhere Desmond records that the Tory *Blackwood's Magazine* lampooned Loudon's belief in the education of gardeners. 'Loudon and Nineteenth-century Horticultural Journalism', in Elizabeth B. MacDougall, ed., *John Claudius Loudon*

- and the Early Nineteenth Century in Great Britain, Washington: Dumbarton Oaks, trustees for Harvard University, 1980, pp. 77–97; p. 89.
33. In an open letter written in 1830 to the editor of the *Morning Advertiser*, he wrote: 'nothing will satisfy me short of a fair Representation of the people; Election by Ballot; the gradual, but entire Appropriation by Government of the revenues of the National Church, of the Woods and Forests, and of other Crown Lands; entire Freedom of Trade, and the Abolition of all Monopolies; a National Education Establishment substituted for the National Church Establishment; the abolition of the law of Primogeniture and of Hereditary Titles; the pensioning off of all the branches of the Royal Family once and forever; and a fixed income set apart for the king, or by whatever name or title the chief magistrate of the country may be distinguished.' (*The Great Objects to be Attained by Reform. In a Letter to the Editor of the Morning Advertiser*, London: Printed for John Milton, Great Marylebone Street, 1830.)
 34. *Paxton's Magazine of Botany*, 1 (1834), p. 2.
 35. *Gardener's Magazine*, 1 (1826), p. 147. The correspondence continued from March to August.
 36. 'Design for forming Subscription Gardens in the Vicinity of Large Commercial Towns', *Paxton's Magazine of Botany*, 1 (1834), pp. 211–13.
 37. *Horticultural Register*, 1 (1831), pp. 171–7. A fold-out plan indicates separate areas for Asia, Europe, Africa, America, allocated to 'each of the different quadrants of the globe' (p. 173). The *Register* was particularly hostile to Loudon. It campaigned for wood-framed conservatories and attacked the *Gardener's Magazine*—a recent issue contained 'little useful information' (p. 114).
 38. *The Suburban Gardener and Villa Companion*, London, 1838, p. 112.
 39. *Encyclopaedia of Gardening*, 1822, p. 113. For pernicious apathy see *Encyclopaedia of Agriculture*, 3rd edn., London: Longman, Rees, Orme, Green & Longman, 1835, p. 1225. Commodity culture could be utilized to promote desire. Andrew H. Miller, quoting Baudrillard, evokes the 'ideological genesis of needs' in commodity culture as capital's compulsive multiplication of redundant material wants, already an accelerating tendency in Loudon's world: for the Benthamite this was an energizing principle and defeated subsistence culture. (Andrew H. Miller, *Novels Behind Glass: Commodity Culture and Victorian Narrative*, Cambridge: Cambridge University Press, 1995, p. 86.) Still in touch with the Enlightenment economics of Adam Smith, where ethics and luxury came together, Loudon characteristically recast this economics in an emancipatory way by including the dispossessed in its reckoning. Mobilizing desire went along with a bracing understanding of self-improvement.
 - Loudon's understanding of the collective was not socialist. A man may be 'left to rise or sink in wealth and respect, according to his personal merits' (*An Encyclopaedia of Cottage, Farm and Villa Architecture*, 2nd edn., London: Longman, Brown, Green & Longmans, 1842, p. 113).
 40. *Middlemarch* (1872), chapter 3. Loudon's more influential *Encyclopaedia of Cottage, Farm and Villa Architecture*, London: Longman, 1833, was too late for George Eliot's time scheme.
 41. Simo, *Loudon and the Landscape*, p. 227.
 42. *Suburban Gardener*, pp. 104, 108. Subsequent page references in text.
 43. For Loudon's interest in glass cases (which could also house animals) in 1834 see David E. Allen, *The Naturalist in Britain: A Social History*, London: Penguin Books, 1976, p. 134.
 44. *Remarks on the Construction of Hothouses*, p. 50.
 45. *Suburban Gardener*, p. 398.
 46. *Ibid.*, p. 414.
 47. *Ibid.*, p. 111.
 48. *Remarks on the Construction of Hothouses*, p. 2. Subsequent page references in text.
 49. *Suburban Gardener*, p. 400.
 50. *Remarks on the Construction of Hothouses*, p. 10: 'if 1000 rays fall upon a surface of glass at an angle of 75°, 299 of these rays are reflected; consequently in little more than an hour after each mid-day, in spring and autumn, nearly one third of the effect of the sun is lost on all hothouses with parallelogram base and common sloping roof fronting the south.' Paxton repeated this in 1850. The weakest sunlight of early morning and evening can be made to fall perpendicular to the glass, whereas at midday 'they present themselves more obliquely to the glass', thus preserving and equalizing heat and light (*Illustrated London News*, 16 November 1850, p. 385, verbatim report of lecture).
 51. Christina Rossetti, *Goblin Market*, 1862, l. 15.
 52. Colquhoun, *A Thing in Disguise*, p. 58.
 53. *Ibid.*, p. 105.
 54. William Whewell, 'The General Bearing of the Great Exhibition on the Progress of Art and Science', Inaugural Lecture, 25 November 1851, p. 6, p. 7.
 55. Fay, *Palace of Industry, 1851*, p. 30. For the arrangement with Cook, see G. F. Chadwick, *The Works of Sir Joseph Paxton*, London: Architectural Press, 1961, p. 244.
 56. Fay, *Palace of Industry, 1851*, p. 30.
 57. Chadwick, *Works of Sir Joseph Paxton*, pp. 238–49 for Paxton's railway interests.
 58. Wolfgang Schivelbusch, *The Railway Journey: The Industrialization and Perception of Time and Space in the Nineteenth Century*, new edn., Leamington Spa: Berg, 1986, pp. 54–8.
 59. *Chambers' Edinburgh Journal*, 15, 21 June 1851, pp. 393–5; p. 393.

60. Colquhoun, *A Thing in Disguise*, p. 79.
61. Simo, *Loudon and the Landscape*, p. 247.
62. *Gardener's Magazine*, 1 (1826), p. 62. Review of Horticultural Society Transactions (1824).
63. Colquhoun, *A Thing in Disguise*, pp. 67–79.
64. *The Green-House Companion*, London: Harding, Triphook, & Lepard, 1824, p. 101.
65. *Remarks on the Construction of Hotheuses*, p. 49.
66. *Green-House Companion*, p. 7. Subsequent page references in text.
67. Simo, *Loudon and the Landscape*, p. 173.
68. Max Müller's *Lectures on the Science of Language* (1861), adapted from Grimm and Bopp, exemplify the association of race and language through the idea of the morphological root.
69. The radical reading of Herder emphasized the importance of popular feeling in culture. See Isobel Armstrong, *Victorian Poetry. Poetry, Politics and Poetics*, London: Routledge, 1993, pp. 130–1.
70. Simo, *Loudon and the Landscape*, p. 166.
71. *Arboretum et Fruticetum Britannicum or, the trees and shrubs of Britain*, 8 vols., London: Longman, 1838, vol. i, p. 418.
72. William Blake, *The Marriage of Heaven and Hell* (IV, Pl. 11, ll. 1–5), *The Poems of Blake*, ed. W. H. Stevenson and David V. Erdman, London: Longman, 1971.
73. *The Times*, 18 October 1849.
74. *The Times*, 22 March 1850.
75. Ibid. See Eugenio Biagini and Alastair J. Reid, eds., *Currents of Radicalism. Popular Radicalism, Organised Labour and Party Politics in Britain, 1850–1914*, Cambridge: Cambridge University Press, 1991, pp. 1–15, for a discussion of the redirection of radicalisms after 1850. They argue that not only a non-homogeneous working-class culture created different currents of radicalism, but that there was a genuine shift in both upper-class and working-class perceptions of their relationship after 1850. Certainly nothing else could explain the conciliatory speeches towards the working man in the three Mansion House meetings (the Earl of Carlisle roasted 'the festival of the working man and the working woman' in response to Prince Albert). There *was* intense radical critique of the Exhibition (see my next chapter), but the language of difference in unity and unity in difference was a powerful force.
76. *Sharpe's London Magazine*, 14 (1851), p. 250.
77. Patrick Beaver, *The Crystal Palace 1851–1936. A Portrait of Victorian Enterprise*, London: Hugh Evelyn, 1970, p. 35.
78. *Illustrated London News*, 23 March 1850, p. 187.
79. *Westminster Review*, 55 (1851), pp. 346–94. Further page references in text. It had argued for a glass and iron Exhibition conservatory in April 1850 (vol. 53, pp. 85–100; p. 92). William Bridges Adams.
80. *The Friend of the People*, 10 May 1851, p. 3.
81. 'The Monster Exhibition of 1851', *Reynolds's Weekly News*, 4 August 1850.
82. Henry Morley, 'The Catalogue's Account of Itself', *Household Words*, 3, 23 August 1851, pp. 519–23; p. 519.
83. 'Fifteen Thousand Authors and their Book', *Chambers' Edinburgh Journal* (1851), pp. 391–93; p. 391. The fullest discussion of the Exhibition itself, about which the journal was cautious ('misexpenditure of money', p. 338) is pp. 336–40.
84. William Whewell, *The General Bearing of the Great Exhibition*, p. 11.
85. *Household Words*, 3, 23 August 1851, p. 520.
86. *Chambers' Edinburgh Journal* (1851), p. 391.
87. *Household Words*, 3, 23 August 1851, p. 520.
88. Robert Hunt, *Hand-book to the Official Catalogue*, 2 vols., London: Spicer Bros and W. Clowes, 1851. Raymond Baubles, 'Of stoves—and clothes—and carriages—of catalogues and things', presented an excellent paper on the available catalogues at the Science Museum Conference, 'Locating the Victorians', 2001.
89. Hunt, *Hand-book*, vol. i, p. 2; p. 89.
90. Ibid., vol. i, p. 85, vol. ii, p. 477.
91. 'The Great Exhibition and the Little One', Charles Dickens, Richard Hengist Horne, *Household Words*, 3, 5 July 1851, pp. 356–60; p. 357.
92. Dolf Sternberger, *Panorama of the Nineteenth Century*, trans. Joachim Neugroschen, New York: Urizen Books; Oxford: Blackwell, 1977, p. 25. He instances the interaction between the energy of the sun and the hydraulics of the steam engine (p. 28).
93. Whewell, *The General Bearing of the Great Exhibition*. Subsequent page references in text. In the French Exposition of 1834, the following inconsistent divisions were adopted: 'alimentary, sanitary, vestimentary, domiciliary, locomotive, sensitive, intellectual, preparative, social'. In 1849, 'mineral, mechanical, mathematical, chemical, fine arts, ceramic and miscellaneous' formed equally random classes.
- In his account of the compilation of the Descriptive catalogue, which reflexively formed part of its prefatory matter, Robert Ellis stressed first, the exclusion of critical matter from the catalogue, and secondly, its credentials not only in 'industrial experience' but also in 'higher knowledge, the teaching of natural and experimental philosophy' (vol. i, p. 85).
94. *Dublin University Magazine*, 38 (1851), pp. 612–28; p. 626.
95. *Fraser's Magazine*, 44 (1851), pp. 119–32; p. 124.
96. *Ecclesiologist*, 12 (1851), pp. 384–9; p. 386. The journal published two other critical pieces: pp. 269–70; pp. 271–3.
97. *Blackwood's Edinburgh Magazine*, 70 (1851), pp. 142–53; p. 152. William Henry Smith.
98. *Dublin University Magazine*, 38 (1851) pp. 619–20.
99. *Chambers' Edinburgh Journal* (1851), p. 338.

100. *Westminster Review*, 55 (1851), p. 385.
101. *Sharpe's London Magazine*, 14 (1851), p. 316.
102. *Westminster Review*, 55 (1851), p. 390. *Tait's Edinburgh Magazine*, 22 (old series), 18 (new series), (May 1851), pp. 261–6; p. 265. G. S. Venables (probably).
103. *Sharpe's London Magazine*, 14 (1851), p. 316.
104. *Fraser's Magazine*, 44 (1851), p. 122.
105. *Punch*, 18 (1851), p. 145.
106. *Sharpe's London Magazine*, 14 (1851), p. 251.
107. *Chambers' Edinburgh Journal*, (1851), p. 338.
108. *The Crystal Palace and its Contents. An Illustrated Cyclopaedia of the Great Exhibition*, p. 91; *Tait's Edinburgh Magazine*, 22 (old series), 18 (new series), (May 1851), p. 165.
109. Nikolaus Pevsner, *High Victorian Design: A Study of the Exhibits of 1851*, London: Architectural Press, 1951. Pevsner's work belongs to a substantial literature on the 1851 Exhibition. Though his work is explicitly concerned with design, most studies consider the exhibits. See Christopher Hobhouse, *1851 and the Crystal Palace* (1937), London: J. Murray, 1950; Yvonne Ffrench, *The Great Exhibition of 1851*, London, 1950; Fay, *Palace of Industry*; Beaver, *The Crystal Palace 1851–1936*; John R. Davis, *The Great Exhibition*, Stroud: Sutton, 1999; Jeffrey Auerbach, *The Great Exhibition and Historical Memory*, New Haven: Yale University Press, 2001; Louise Purbrick, ed., *The Great Exhibition of 1851*, Manchester: Manchester University Press, 2001; David Bosbach, ed., *The Great Exhibition and its Legacy*, Prinz-Albert Studien, 20, Munich: K. G. Saur, 2002.
110. *Civil Engineer and Architect's Journal*, 14 (1851), p. 531.
111. *Chambers' Edinburgh Journal* (1851), p. 338.
112. *North British Review*, 15 (1851), pp. 529–68; p. 534. David Brewster.
113. *Blackwood's Edinburgh Magazine*, 70 (1851), p. 147.
114. *Tait's Edinburgh Magazine*, 22 (old series), 18 (new series), (May 1851), p. 265.
115. Giorgio Agamben, *Stanzas. Word and Phantasm in Western Culture*, trans. Ronald L. Martinez, Minneapolis and London: University of Minnesota Press, 1993, p. 39.
116. Susan Barton, *Working-Class Organisations and Popular Tourism*, Manchester: Manchester University Press, 2005, p. 68. Her analysis of the importance of the Crystal Palace to working men extends Audrey Short's classic essay, 'Workers under Glass I 1851', *Victorian Studies*, 10 (1966), pp. 193–202.
117. The Exhibition's modernizing agenda is the theme of Davis, *The Great Exhibition* (n. 109).
118. See Toshio Kusamitsu, 'Great Exhibitions before 1851', *History Workshop*, 9 (1980), pp. 70–89. See Barton, *Working-Class Organisations*, pp. 44–9,

who argues that working-class associations took advantage of the Exhibition to regroup and revive radical organization.

119. Auerbach, *The Great Exhibition and Historical Memory*, p. 14.

Note: I have said little about the politics and readership of the journals and magazines reviewing the Exhibition. This is because their readings were not predictable, and do not always align themselves with the supposed politics and programmes of individual journals. Though the *Westminster* is predictably radical and Benthamite, its Tory opposite, *Blackwood's*, was arguably more searching in its social critique. It was inconsistent, maintaining a fierce protectionist position to begin with, but producing one of the most serious readings of the Exhibition subsequently. *Sharpe's* (associated with Samuel Carter Hall) and *Chambers'* (associated with Robert Chambers, the author of *Vestiges*) both family magazines, according to *The Waterloo Directory* (the latter priced at one and a half pence), and aimed at the upper end of skilled artisan and shopkeeper readership, were highly varied and sophisticated in their content. Beyond that they were not affiliated to particular religious bodies, that they were ethical and populist, it is not possible to generalize their positions.

8. Mythmaking: Cinderella and her Glass Slipper at the Crystal Palace

1. M. R. Cox, *Cinderella, Three Hundred and Forty Five Variants*, Introduction Andrew Lang, London: published for the Folklore Society, David Nutt, 1893.
2. Iona and Peter Opie, *Classic Fairy Tales*, Oxford: Oxford University Press, 1974, p. 121.
3. These figures are taken from the British Library Catalogue, that is, the figure represents those versions captured by the system.
4. *The History of Cinderella and her Glass Slipper*, London: Orlando Hodgson, 1830[?], p. 22 (BL callmark, 12431.a.26.(2)).
5. *The Amusing History of Cinderella; or, the Little Glass Slipper*, London, 1850 [?], p. 5 (BL callmark, 12835.d.5).
6. George Cruikshank, *Cinderella and the Glass Slipper*, London: D. Bogue, 1854, p. 14 (BL callmark, C. 70.b.69).
7. *Cinderella and the Glass Slipper*, London: J. Bysh, 1861, p. 6 (BL callmark, 12805.d.5).
8. *Cinderella; or, the Little Glass Slipper*, London: Dean & Son, 1870 (BL callmark, 12807 h 49).
9. *Cinderella; or, the little glass slipper*, London: Dean & Son, 1876, p. 7 (BL callmark; 12809 g 21).
10. Carlo Ginzburg, *Ecstasies: Deciphering The Witches' Sabbath*, London: Hutchinson Radius, 1990, p. 243.
11. *The History of Cinderella*, 1830, p. 17.
12. Cruikshank, *Cinderella*, 1854, p. 8.

13. *The Glass and the New Crystal Palace*, London: J. Cassell, 1853.
14. Charlotte Brontë, *An Edition of the Early Writings of Charlotte Brontë*; 2 vols. (vol. ii in two parts), ed. Christine Alexander, Oxford: Basil Blackwell, with Shakespeare Head, 1987, vol. i, p. 71. I have written extensively about this story in *Charlotte Brontë's City of Glass*, The Hilda Hulme Lecture, University of London, 1993, pp. 14–16.
15. Christina Rossetti, *Time Flies: A Reading Diary*, London: Society for Promoting Christian Knowledge, 1885, p. 134.
16. Charles Dickens, *Dombey and Son*, 1848, chapter 3.
17. *Armada* (1866), book II, chapter 4; *Vixen* (1879), chapter 15; *The Mill on the Floss* (1860), book VI, chapter 10; *Middlemarch* (1872), book 1, chapter 6.
18. Martin Mortimer, *The English Glass Chandelier*, Woodbridge: Antique Collectors' Club, 2000, p. 75. Swinging drops appeared in the mid-eighteenth century. Rococo influences in the latter part of the century added further shapes and ornament to the structure.
19. Elizabeth Hilliard, *Chandeliers*, London: Mitchell Beazley, 2001, p. 198, illustrates forty drops out of 'hundreds of different styles of drops'.
20. Mortimer, *The English Glass Chandelier*, p. 162. Osler supplied the Mansion House with chandeliers. See pp. 156–62 for Osler glass.
21. Mortimer, *The English Glass Chandelier*, p. 140.
22. Emily Brontë, *Wuthering Heights* (1847), chapter 6.
23. Charlotte Brontë, *Villette* (1853), chapter 20.
24. Mortimer, *The English Glass Chandelier*, p. 128.
25. *Illustrated London News*, 16, 2 February 1850, p. 73.
26. Mortimer, *The English Glass Chandelier*, p. 140. *Journal of Design*, 5 (1851), p. 30.
27. 'Glass', Class 24, *Official Catalogue*, vol. ii, pp. 698–707. Osler (20), J. Powell (31), Joseph Green (32), Apsley Pellatt (33), Perry (36), Hancock (46).
28. *Household Words*, 3, 5 July 1851, p. 359.
29. Jones (11) exhibited 'Cut-glass cornucopias, on plinths, chased, and water gilt, mounted complete with shades and gilt stands'. Catchell (12) exhibited a forty-piece 'Etagère' or centrepiece for a banquet table.
30. For flower stands see Barbara Morris, *Victorian Table Glass and Ornaments*, London: Barrie & Jenkins, 1978, pp. 149–58; Hugh Wakefield, *Nineteenth-Century British Glass* (1961), 2nd rev. edn., London: Faber & Faber, 1982, pp. 120–1.
31. *Mrs Beeton's Book of Household Management* (1861), ed. Nicola Humble, Oxford: Oxford University Press, 2000, p. 303.
32. Morris, *Victorian Table Glass*, pp. 81, 114. See also Charles R. Hajdamach, *British Glass 1800–1914*, Woodbridge: Antique Collector's Club, 1991, pp. 103–13.
33. *The Works of John Ruskin*, 39 vols., ed. E. T. Cook and Alexander Wedderburn, London: George Allen, 1903–12, vol. x, *Stones of Venice* (1853), vol. ii, p. 456.
34. Morris, *Victorian Table Glass*, pp. 97–9.
35. Christopher Dresser, *Principles of Decorative Design*, London: Cassell, Petter, & Galpin, 1873, pp. 26–9.
36. Owen Jones, *The Grammar of Ornament. Illustrated by Examples from various Styles of Ornament*, London: Day & Son, 1856. This lavish study is not paginated. The statement is from Owen's chapter on Moresque Ornament as the second principle of successful ornament and relates to the eleventh rule of his 37-point 'Grammar', set out at the beginning of his book, affirming that all lines should flow out of a parent stem.
37. I am grateful to Caroline Arscott, Courtauld Institute, for introducing me to this debate.
38. See Peter Fuller, *Theoria. Art, and the Absence of Grace*, London: Chatto & Windus, 1988, pp. 77–9, on the cult of the water lily. Henry Balfour argued, against Goodyear's lotus origin theory, that all decoration was residual, derived from the 'degradation of designs representing the human form'. Alfred Cort Haddon, while he did not dispute the symbolic possibility of the lotus, preferred to think of its structural adaptation in textile, clay, or stone. For this dispute see W. H. Goodyear, *The Grammar of the Lotus. A New History of Classic Ornament as a Development of Sun Worship*, London: Sampson Low, 1891, pp. 9, 4; Henry Balfour, *The Evolution of Decorative Art*, London: Percival & Co., 1893, p. viii; Alfred Cort Haddon, *Evolution in Art, as illustrated in the life-histories of design*, London: Walter Scott, 1895, p. 137.
39. *Illustrated Exhibitor*, 2 (1852), pp. 15, 16.
40. Ruskin, *Stones of Venice*, vol. ii, p. 196.
41. Jones, *Grammar of Ornament* (unpaginated), discussion of body painting, chapter I.
42. Shelagh Wilson, 'Monsters and Monstrosities: Grotesque Taste and Victorian Design', in David Amigoni, Colin Trodd, and Paul Barlow, eds., *Victorian Culture and the Idea of the Grotesque*, Aldershot: Ashgate, 1999, pp. 143–73; p. 150.
43. *Ibid.*, p. 151.
44. Immanuel Kant, *The Critique of Judgement*, trans. James Creed Meredith, Oxford: Clarendon Press, 1952, para. 23, p. 91.
45. Jones, *Grammar of Ornament*, critique of the Exhibition, chapter XII, India.
46. *Blackwood's Magazine*, 70 (1851), p. 147.
47. Martin Heidegger, *Being and Time*, trans. John Macquarrie, Edward Robinson, Oxford: Blackwell, 1962, p. 129. See pp. 120–48 for Heidegger's discussion of the Thing. In a *Critical Inquiry* special issue on 'Things', Bill Brown reminds us of two salutary aspects of the thing. Its disjunction from language means that it at once possesses a 'semantic reducibility of things to objects, coupled with the semantic irreducibility of things to objects'. So our apparent nearness

to things only suggests how far we are away from them. Secondly, naming the thing really means naming a particular subject–object relationship. *Critical Inquiry*, 28 (Autumn 2001), p. 3.

48. Henry Mayhew, 'George Cruikshank, 1851: Or The Adventures of Mr and Mrs Sandboys and Family, who came up to London to "enjoy themselves", and to see the Great Exhibition', London: George Newbold, 1851, p. 238. Fold-out engraving.
49. Tony Bennett notes that the taxonomy of the museum in the nineteenth century became dynamic, 'progressive', and evolutionary, moving from a structure of comparison, of like with like, to a genetic history that registered the transition from the simple to the complex, a pattern implicitly or explicitly mapped onto national progress. The Exhibition's categories of raw materials, machines, and manufactured articles to some extent mimic the taxonomy of the museum, but the heterogeneity of objects, and the contradiction that machines themselves *were* manufactured objects, as well as the transitory nature of Exhibition objects, fundamentally disturbed the Exhibition's order of things. Tony Bennett, *The Birth of the Museum: History, Theory, Politics*, London and New York: Routledge, 1995, p. 76. What Ruth Hoberman has recently called the 'Museal aura' is the fine art aura sought by the Museal exhibit. The non-Museal exhibit has a much harder time in finding a context, which does not belong either to the Museum or to the aesthetic of the art gallery or to the category of the department store. See Ruth Hoberman, 'In Quest of Museal Aura: Turn of the Century Narratives about Museum-Displayed objects', *Victorian Literature and Culture*, 31 (2003), pp. 467–82.
50. 'This dominating discourse often has the manic, jubilatory, and incantatory form that Freud assigned to the so-called triumphant phase of mourning work . . . like any animistic magic'. Jacques Derrida, *Specters of Marx*, trans. Peggy Kamuf, New York and London: Routledge, 1994, pp. 51–2. This work of mourning manifests itself in the extremes of triumphalist Exhibition rhetoric and incipiently in all those responses of mixed pleasure and dread that were the commonest responses to the Exhibition's sensory overload. It is as if the illusory social cohesion and the triumph of commodity that it betokened was at once asserted and mourned as impossible in complex ways. Derrida, of course, is writing of the mood of hegemonic liberal capitalism after the fall of Soviet Russia.
51. Charles Babbage, *The Exposition of 1851: or, Views of the Industry, the Science, and the Government of England*, London: John Murray, 1851.
52. As with Agamben in the last chapter there is a tendency among critics of the 1851 Exhibition to take Marx's account of commodity as a foregone

conclusion that requires no discussion. That is, things become self-sustaining entities, able to interrelate with one another and to create coercive political and linguistic meanings that organize human experience, and not the other way round. Arjun Appadurai, however, reminds us that commodity exchange is embedded in a social praxis and is ideologically constructed. The commodity is not abstract, freestanding, and nor is exchange uni-directional, as the Marx of commodity fetishism appeared to believe. He quotes Georg Simmel, for whom exchange is the source of value because it is relativized by desire: the measure of objects is not to be understood in terms of production or a labour theory of value, but in terms of desire: 'We call those objects valuable that resist our desire to possess them'. Arjun Appadurai, *The Social Life of Things*, Cambridge: Cambridge University Press, 1986, p. 3. (For Simmel's reading of the relativity of exchange value see, in particular, *The Philosophy of Money*, 2nd enlarged edn. 1907, trans. Tom Bottomore and David Frisby, London and New York: Routledge, 1990, pp. 67–94.) Simmel brings us closer to the Marx of the early writings rather than the Marx of commodity fetishism. Money, the third term of mediation, turns imagination into reality and reality into imagination by radically reversing categories. Famously he wrote that money can 'turn *imagination into reality* and *reality into mere imagination*, [and] similarly turns *real human and natural powers* into purely abstract representations, and therefore *imperfections* and tormenting phantoms, just as it turns *real imperfections and phantoms*—truly impotent powers which exist only in the individual's fantasy—into *real essential powers and abilities*'. Karl Marx, *Early Writings*, trans. Rodney Livingstone and Gregor Benton, Harmondsworth: Penguin Books 1975, p. 378. *Desire* and the sensuous object of desire, come to the fore. This in turn leads us to Walter Benjamin, who redefined this insight when he envisaged the nineteenth century as a dreaming collective. He elaborated the dialectic of imagination and reality by positing Surrealism's oneiric farce as *critical* forms of the dream. The constantly unstable and culturally made relation between sensuous objects and desire comes into being because the dream is the repository of wish images as well as of immanent critique. Fantasy is not a deprivation for Benjamin, as its phantom longings are for Marx. In this and the following chapter I adopt this reading of artefacts.

9. Glass under Glass: Glassworld Fictions

1. Elizabeth Barrett Browning, *Casa Guidi Windows*, ed. Julia Markus, New York: The Browning Institute, 1977, section 2, ll. 610–12.

2. *The Art Journal Illustrated Catalogue of the Industry of all Nations* consistently praised the complex workmanship and purity of glass articles. See *The Great Exhibition. A Facsimile of the Illustrated Catalogue of London's 1851 Crystal Palace Exposition*, ed. George Palmer Blake, New York: Gramercy Books, 1995: Bacchus and Sons' large vase with 'lozenge-shaped ornaments of deep ruby colour, cased with white enamel, and the wreaths of green ivy', was highly praised (p. 32); 'the patterns are cut with extreme minuteness' in W. Naylor's glass (p. 70); Green's 'purest crystal' was 'engraved in the most elaborate and artistic style' (p. 91); the 'bold relief' of Summerfield's glass brings out 'the colour of the glass in an exceedingly brilliant style' (p. 92); the 'purest crystal' of Richardson's glass has 'lozenge-shaped cuttings [that] bring out the prismatic colours with exceeding brilliancy' (p. 139).
3. Charles Lock Eastlake, *Hints on Household Taste* (1868), Introduction by John Gloag, New York: Dover Publications, 1969, p. 241.
4. Explanatory catalogue quoted by Barbara Morris, *Victorian Table Glass and Ornaments*, London: Barrie & Jenkins, 1978, p. 17
5. H. W. Woodward, *Art, Feat and Mystery. The Story of Thomas Webb and Sons, Glassmakers*, Stourbridge: Mark & Moody, p. 39.
6. Morris, *Victorian Table Glass*, p. 145.
7. *Ibid.*, p. 142.
8. Christopher Driver, *Principles of Decorative Design*, London: Cassell, Petter, & Galpin, p. 127, celebrates the plastic 'hollow sphere of glass' and its subtlety.
9. Morris, *Victorian Table Glass*, p. 137 (T. J. Wilkinson), p. 145 (Joseph Leicester).
10. See Charles Hajdamach, *British Glass 1800–1914*, Woodbridge: Antique Collectors' Club, 1991, pp. 84–90.
11. 'Glass', Class 24, *Official Illustrated Catalogue to the Great Exhibition of 1851*, 4 vols., Spicer & Clowes, 1851, vol. ii, pp. 697–707; p. 697. 'Beautiful' is the preferred epithet of the report of the Juries. *Exhibition of the Works of Industry of All Nations*, vol. ii, pp. 521–37. See the *Journal of Design*, 4 (1850), p. 15.
12. Ian Wolfenden, 'Decorative Art and the Consumer: The Nineteenth-Century English Glass Table Service', *Bulletin John Rylands Library*, 77 (1995), pp. 39–47; p. 42, charts the move from elite dessert sets for aristocratic use to more varied and cheaper sets by the mid-1850s. Mrs Beeton describes the shift in dining etiquette from a three to a multiple course meal by this time, when servants served wine in specialized glasses for each course, as opposed to the host, who performed this task earlier with fewer types of glass. *Mrs Beeton's Book of Household Management*, ed. Nicola Humble, Oxford: Oxford University Press, 2000, p. 368. But this changed relationship was not always sustained. Mrs M. J. Loftie, *The Dining Room*, London: Macmillan 1878, p. 97, disparages sets and recommends the use of 'simple, ordinary inexpensive' odd glasses distinguished by beauty of form. The acute self-consciousness about the glass as *thing* and its mediating function is what is important here.
13. William Morris, 'The Lesser Arts of Life. A Lecture Delivered in Support of the Society for the Protection of Ancient Buildings', *Lectures on Art and Industry* (1877), in *The Collected Works of William Morris*, vol. xxii, London: Routledge, Thoemes Press; Tokyo: Kinokuniya Co., 1992, pp. 235–69, p. 247.
14. *The Works of John Ruskin*, 39 vols., ed. E. T. Cook and Alexander Wedderburn, London: George Allen, 1904, vol. x, *Stones of Venice*, pp. 197, 199.
15. Robert Hunt, *Hunt's Hand-book to the Official Catalogues*, 2 vols., London: Spicer Brothers and W. Clowes & Sons, 1851, vol. i, p. 584: 'Another branch of the glass trade tells a curious tale of morality. The Venetians for a long period manufactured glass beads, which were highly valued by the Africans; and the Arabs traded largely in these articles. Similar beads are now extensively made in this country, their destination being the Western Coast of Africa, their use the purchase of slaves.' This dry comment occurs in the account of section XXIV—Glass, pp. 573–94.
16. Ruskin, *Stones of Venice*, pp. 192, 193. This phrase from the famous chapter on 'The Nature of Gothic' is the first of a number of discussions in which Ruskin explicitly uses glass as the exemplary material of industrial violation. The editors point out that he began drafting this chapter over 1851–2, the year of the great Exhibition. Ruskin regarded diamond cutting and glass cutting as analogous crimes: a person who wears cut jewels for ostentation is 'a slave-driver' (p. 198). 'We ought to be ashamed' of our 'exquisitely pure', accurately cut glass (p. 199). In 1898 Adolf Loos associated England specifically with geometrical glass cutting: 'It was from England that the new glass cutting technique came: straight or curved lines with prismatic cross-sections form geometric decoration over the whole glass.' Like Ruskin he thinks of this as a form of 'Greek' slavery. Adolf Loos, *Ornament and Crime: Selected Essays*, ed. Adolf Opel, trans. Michael Mitchell, Riverside, Calif.: Ariadne Press, 1998, p. 71.
17. Morris, *Victorian Table Glass*, p. 79.
18. Christina Rossetti, entry for 13 July, *Time Flies*, London: Society for the Promotion of Christian Knowledge, 1885, p. 134.
19. *North British Review*, 15 (1851), p. 542. Most readers of material culture were only just beginning to follow Ruskin: 'Lastly, *Read* the sculpture. Preparatory to reading it, you will have to discover whether it is legible.' *Works*, vol. x, p. 269. Ruskin refused to go to the opening of the Great Exhibition.

He added a postscript to *Modern Painters* in 1851: 'The populace of England rolls by to weary itself in the great bazaar of Kensington, little thinking that a day will come when those veiled vestals and prancing amazons and goodly merchandise of precious stones and gold will all be forgotten as though they had never been.' A million Koh-i-noors, he said, could not rekindle the dead light of art in England. *Works*, vol. iii, p. 631. He also termed the Palace a giant conservatory (vol. xii, p. 419) and a giant cucumber frame (vol. xxxv, p. 47).

20. Tallis's *History and Description of the Crystal Palace*, 3 vols., London and New York: John Tallis & Co., 1851, vol. i, p. 81 (steel engravings by Beard, Mayall).
21. Judy Rudoe, 'Jewellery at the Great Exhibition', *The Great Exhibition and Its Legacy*, Munich: Prinz-Albert Studien, 20, K.G.Saur, 2002, p. 72; Eastlake, *Hints on Household Taste*, p. 267; *Illustrated London News*, 19, 23 August 1851, p. 242.
22. *Westminster Review*, 55 (1851), p. 391.
23. *Official Descriptive and Illustrated Catalogue of the Great Exhibition of the Works of Art and Industry of all Nations 1851*, London: Spicer Bros, W. Clowes & Son, 1852, vol. iv (Supplement), plate 306. See p. 1503.
24. *Ibid.*, p. 1504.
25. *Ibid.*
26. See Hunt, *Hunt's Hand-book*, vol. i, pp. 30–2. 'In valuing diamonds, either rough or cut, the practice is to take the weights in carats, to square that rate, and then to multiply the product by such a rate of price as may correspond to the weight and quality of the stone' (p. 29).

The diamonds bring out what Benjamin thought of as the historical object of consumption, a 'monadological structure in which history was congealed'. Quoted in Susan Buck-Morss, 'Dream World of Mass Culture: Walter Benjamin's Theory of Modernity and the Dialectics of Seeing', *Modernity and the Hegemony of Vision*, ed. David Michael Levin, Berkeley and Los Angeles: University of California Press, 1993, pp. 309–38; p. 321. Buck-Morss's succinct and comprehensive exposition of Benjamin's account of the dreaming collective pre-dates her later more specific study of the Arcades project. The shock of the dialectical image, blasted from history, lies in its essentially contradictory nature. At one and the same time it intimates redemptive utopian longing, a longing with the force of myth, and registers critically 'the failure to fulfill that longing' (p. 316). This socio-psychological theory, assembled, as Buck-Morss points out, from Marx, Freud, Proust, and Surrealism, is open to criticism as all theories of a mass political unconscious are. However, the importance of this reading is that 'it takes mass culture seriously' (p. 316). It is defensible to 'read' objects, and, as I

suggest, to see them as signifiers of desire. See Susan Buck-Morss, *The Dialectics of Seeing. Walter Benjamin and the Arcades Project*, Cambridge, Mass. and London: MIT Press, 1991, pp. 218–19, 260–1, 274–5, for an account of the dialectical image and the dream as both slumber and critique.

27. *Sharpe's London Magazine*, 14 (1851), p. 316.
28. Rice Harris's Bohemian glass is given a full-page illustration in the *Official Catalogue* (vol. iv., see n. 23). Bohemian glass is also illustrated in colour in Matthew Digby Wyatt, *The Industrial Arts of the Nineteenth Century. A series of illustrations of the choicest specimens produced by every nation at the Great Exhibition of the Work of Industry 1851*, London, 1851.
29. For 'fervent' adoption of Bohemian styles see Hadjamach, *British Glass 1800–1914*, pp. 81–90.
30. Caption to engraving of mirror, *Official Catalogue*, vol. iv (Supplement).
31. W. M. Clark, *The Crystal Palace and its Contents. An Illustrated Cyclopaedia of the Great Exhibition of 1851*, London, 1852, p. 407. The illustration in the official catalogue is signed 'Jarvis'. This name does not appear in any of the recognized indexes of nineteenth-century engravers. According to Nick Fisher, for whose advice I am grateful, 'Jarvis' may have been the name of a company rather than of an individual, a firm of house artists employed by Spicer & Clowes, publishers of the catalogue. He reminds me that 'Page 145 of the First Report, included in the Supplement, mentions £6000 spent on engravings, with 200 persons employed'. The illustration in the *Cyclopaedia* is also unsigned and differs from that in the Catalogue—there is more drapery on the left nymph, as well as a different version of the Latin tag.
32. Tallis's *History and Description of the Crystal Palace*, 3 vols., London, 1851, vol. ii.
33. *Reynolds's Weekly Newspaper*, 20 October 1850. I am indebted to Ian Haywood's fine study of the radical strategies of Reynolds's writing for this account of Reynolds, whom Haywood defends as a committed radical rather than the designing populist featured in some characterizations. Ian Hayward, 'George W. M. Reynolds and the Radicalization of Victorian Serial Fiction', *Media History*, 4 (1998), pp. 121–39.
34. *Journal of Design*, 2 (September 1849), p. 66. For the grotesque see vol. 3 (1850), p. 116. He was also praised for a *tazza* anticipating the material of the mirror in vol. 1 (1849), p. 10. Potts wrote *A System of Ventilation invented and patented by W. Potts*, Birmingham, 1868. He specialized in gas lighting. For the modernity of gas lighting in the form of chandeliers see Sarah Milan, 'Refracting the Gasolier: Understanding Victorian Responses to Domestic Gas Lighting', in Inga Bryden and Janet Floyd, eds., *Domestic Space. Reading the nineteenth-century interior*, Manchester and New York: Manchester

- University Press, 1999, pp. 84–102. In the same volume see Anne C. Colley, ‘Bodies and Mirrors: The Childhood Interiors of Ruskin, Pater and Stevenson’, pp. 40–57. Potts’s Birmingham origin is an indicator of the significance of Birmingham in the Exhibition. Henry Cole’s *Journal of Design* ran an extensive article on Birmingham industry in 1849, just before the city’s industrial Exhibition, held to coincide with the meeting of the British Association in Birmingham. It predicted the success of Birmingham in 1851. *Journal of Design and Manufactures*, 2 (1849), pp. 1–17.
35. H. G. Adams, *Cyclopaedia of Female Biography*, London: George Routledge & Sons, 1869, p. 726. See also *The Portrait Gallery of Distinguished Females, Including Beauties of the Courts of George IV and William IV. With memoirs by John Burke, Esq.*, 2 vols., London: Edward Bull, 1833.
 36. Shelagh Wilson, ‘Monsters and Monstrosities: Grotesque Taste and Victorian Design’, in David Amigoni, Colin Trodd, and Paul Barlow, eds., *Victorian Culture and the Idea of the Grotesque*, Aldershot: Ashgate, 1999, p. 151.
 37. *Reynold’s Weekly Newspaper*, 4 May 1851, p. 5.
 38. The *Illustrated Cyclopaedia* wrongly describes the mirror’s Latin as the Duchess of Sutherland’s motto. See the Clan Sutherland website: <http://www.clansutherland.org.uk/main.htm>. Thanks to Erik Grey for interpreting this motto. Thanks to Professor John Burrow for drawing my attention to ‘the old proverb, Better bow than break’ (as in Chaucer’s *Troilus*). ‘Frangas Non Flectes’ was the Rossetti family motto. See also Charles Dickens, *Little Dorrit*, chapter 2, where Clenham describes himself as ‘broken, not bent’.
 39. *Reynold’s*, 4 May 1851, p. 5.
 40. Karl Marx, ‘The Duchess of Sutherland and Slavery’, *The People’s Paper. The Champion of Political Justice and Universal Right*, no. 45, 12 March 1853.
 41. *Punch*, 45, 4 July 1863, p. 5.
 42. Charlotte Brontë, *Villette* (1853), ed. Margaret Smith and Herbert Rosengarten, Oxford World’s Classics, Oxford and New York: Oxford University Press, 1998, p. 208. Subsequent page references to the novel are given in the text of this section.
 43. ‘Duchesses were there by the score, and amongst them the great and beautiful Duchess of Sutherland, the Queen’s Mistress of the Robes’. Letter of 30 May 1851 to Revd Patrick Brontë, *The Brontës. Life and Letters*, 2 vols., ed. Clement Shorter, London: Hodder & Stoughton, 1908, vol. i, p. 213.
 44. *Ibid.*, 2 June 1851, p. 214.
 45. *Ibid.*, 7 June 1851, p. 216.
 46. For an earlier discussion of *Villette* and the Crystal Palace, see my *Charlotte Brontë’s City of Glass*, The Hilda Hulme Lecture, University of London, 1992, pp. 20–9. Charlotte Brontë’s insight into the politics of spectacle, the ideology of the Exhibition, and the forms of middle-class leisure in the mid-century is remarkable. There have been many excellent readings of this novel. See, for example, Sally Shuttleworth, *Charlotte Brontë and Victorian Psychology*, Cambridge: Cambridge University Press, 1999; Heather Glen, *Charlotte Brontë: The Imagination in History*, Oxford: Oxford University Press, 2002; see also her *Cambridge Companion to the Brontës*, 2002.
 47. See Dora Greenwell, *On the Education of the Imbecile. Reprinted from the North British Review. . . and edited for the Royal Albert Idiot Asylum*, Lancaster, London, 1869.
 48. For instance, Jane Loudon, *Gardening for Ladies* (1843); *The Ladies’ Flower Garden of Ornamental Greenhouse Plants* (1848).
 49. Bill Brown, *Critical Inquiry*, 28 (Autumn 2001), p. 16. In this special issue on ‘Things’ Bill Brown moves away from a purely economic reading of things and makes two salutary observations: first, the ‘thing’s’ disjunction from language means that it at once possesses ‘a semantic *reducibility* of things to objects, coupled with the semantic *irreducibility* of things to objects’. So our apparent nearness to things only suggests how far we are away from them. Secondly, naming the thing really means naming a particular subject–object relationship (p. 3).
 50. Charlotte Brontë had discussed her friend’s interest in mesmerism sceptically in the same year she travelled to the Exhibition; 15 January 1851, Letter to James Taylor, *Letters*, pp. 192–3.
 51. Harriet Martineau, *Letters on Mesmerism*, 2nd edn., London: Edward Moxon, 1845, p. 8.
 52. Consider Paxton’s account of the conservatory’s therapeutic agency in Joseph Paxton, *What is to Become of the Crystal Palace?* London: Bradbury & Evans, 1851.
 53. Rule 4 of Owen Jones’s thirty-seven principles in his *Grammar of Ornament* affirms that architecture as the ‘material expression’ of a culture’s needs and aspirations (rule 2), must produce a ‘repose’ that persuades against desire – the eye, the intellect, and the affections, are satisfied from the absence of any want’.
 54. Armstrong, *Charlotte Brontë’s City of Glass*, pp. 28–9.
 55. Charles Dickens, *Letters of Charles Dickens*, the Pilgrim Edition, 10 vols., ed. Graham Storey and Kathleen Tillotson, Oxford: Clarendon Press, 1981–93, vol. vi, p. 449.
 56. *Ibid.*, p. 428.
 57. *Bleak House* (1853), ed. Nicola Bradbury, London: Penguin Books, 1996, p. 749.
 58. See Philip Landon, ‘Great Exhibitions: Representations of the Crystal Palace in Mayhew, Dickens, and Dostoevsky’, *Nineteenth-Century Contexts*, 20 (1997), pp. 27–59.
 59. R. H. Horne, ‘The Wonders of 1851’, *Household Words*, 1, 20 July 1850, pp. 388–92; p. 388.
 60. W. H. Wills, ‘The Private History of the Palace of Glass’, *Household Words*, 2, 18 January 1851, pp. 385–91; p. 390.

61. Charles Dickens and W. H. Wills, 'The Great Exhibition and the Little One', *Household Words*, 3, 5 July 1851, pp. 356–60; p. 358.
62. 'Mr Molony's Account of the Crystal Palace', *Punch*, 20 (1851), p. 171.
63. *Tallis's History and Description of the Crystal Palace*, vol. iii, p. 1, illustrates the continual recirculation of what we might term Crystal Palace affect: 'Fountains were sparkling and flashing in the subdued sunlight: in living sculpture were suddenly seen the grand, the grotesque, the terrible, the beautiful; objects of every form and colour imaginable, far as the eye could reach, were dazzlingly intermingled; and there were present sixty thousand sons and daughters of Adam, passing and re-passing, ceaselessly; bewildered charmingly; gliding amidst bannered nations—through country after country renowned in ancient name, and great in modern: civilized and savage. From the far East and West, misty in distance, faintly echoed martial strains, or the solemn anthem! The soul was approached through its highest senses, flooded with excitement; all its faculties were appealed to at once, and it sank for a while, exhausted, overwhelmed.'
64. Charles Dickens, *Our Mutual Friend* (1864–5), ed. Stephen Gill, London: Penguin Books, 1971, p. 585.
2. Silvanus Thompson, *Light Visible and Invisible*, New York: Macmillan Company; London: Macmillan 1897, p. 50. Also Royal Institution lectures.
3. Stephen Herbert, *A History of Pre-Cinema*, 3 vols., London and New York: Routledge, 2000, regards all optical toys as the history of pre-cinema. See Mark Gosser, *Selected Attempts at Stereoscopic Moving Pictures and their Relationship to the Development of Moving Picture Technology 1852–1903*, New York: Arno Press, 1977.
4. Charles Baudelaire, 'The Painter of Modern Life' (1863), *The Painter of Modern Life and Other Essays*, London and New York: Phaidon Press, 1964, p. 10.
5. David Brewster, *A Treatise on the Kaleidoscope*, Edinburgh: Archibald Constable & Co.; London: Longman, Hurst, Rees, Orme, & Brown, 1819, p. 7. Brewster says he invented the kaleidoscope in 1814, p. 1.
6. Richard A. Proctor, *The Expanse of Heaven. A Series of Essays on the Wonders of the Firmament* (1873), New York: D. Appleton & Co., 1877, p. 209. Hereafter *Expanse*.
7. *Ibid.*, p. 277.
8. Baudelaire, 'The Painter of Modern Life', p. 10.
9. The crossover between research and entertainment is exemplified in Charles Wheatstone, 1802–75, who began life in the musical instrument trade (he invented the accordion) but whose work on acoustics, sound transmission (he pioneered the electric telegraph) and the stereoscope (1838) took place when he was Professor of Physics at King's College, London. Joseph Plateau (1801–83), invented the phenakistiscope in 1836, a double rotating disk with radial slits that disclosed images as if in movement, also worked on capillary action and surface tension. David Brewster (1781–1868) invented the kaleidoscope in 1814 and his lenticular stereoscope (1849) took forward Wheatstone's invention. His lighthouse technology (his researches on optics were in the areas of polarization, diffraction, and refraction) anticipated Fresnel. There was a similar crossover in works that made serious pedagogical use of optical toys to explain the principles of optics. See, for example, J. A. Paris, *Philosophy in Sport Made Science in Earnest. Being an Attempt to Illustrate the First Principles of Natural Philosophy by the Aid of Popular Toys and Sports*, 3 vols., London, 1827; F. Marion, *The Wonders of Optics*, trans. Charles W. Quin, New York: Charles Scribner & Co., 1870. Hereafter *Wonders*.
10. Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century*, Cambridge, Mass.: MIT Press, 1990. This pioneering study of vision in the nineteenth century argues that the creation of a form of automated sight severed the classical dualism of the subject and object and released the subject into a kind of autovisuality that could be duped into passivity. Crary was the first to make a serious study of optical devices in the nineteenth century.

Note: Relevant to the Grotesque addressed here are two traditions. The phenomenological tradition of Maurice Merleau-Ponty (particularly *The Visible and the Invisible*, ed. Claude Lefort, trans. Alphonso Lingis, Evanston, Ill.: Northwestern University Press, 1968) insists on the jointure of seeing and seen. The work of Gilles Deleuze and Felix Guattari offers a more anarchic model that takes account of the grotesque body. We might want to backdate from the twentieth to the nineteenth century the reading of the monstrous body created by technoscientific culture made by Deleuze and Guattari. A reimagining of the body as process is crucial, but unlike the Victorian Grotesque, they do not build in any possibilities for dealing with this state. Gilles Deleuze, Felix Guattari, *A Thousand Plateaus. Capitalism and Schizophrenia*, London and New York: Athlone Press, 1988, p. 273.

10. The Lens, Light, and the Virtual World

1. John Tyndall, *Notes on a Course of Nine Lectures on Light*, 2nd edn., London: Longmans, Green & Co., 1870, p. 22. These Royal Institution lectures of 1869 were vested with institutional authority: Michael Faraday had made these lectures to an elite general public a tradition. The Royal Institution, founded in 1799, was an educational body devoted to scientific research. See Iwan Rhys Morus, *Michael Faraday and the Electrical Century*, Cambridge: Icon Books, 2004, pp. 35–8, 104–5.

11. Hermann von Helmholtz, 'The Recent Progress of the Theory of Vision' (1868), *Science and Culture: Popular and Philosophical Essays*, ed. with introduction David Cahan, Chicago and London: University of Chicago Press, 1995, pp. 127–203; p. 198. Subsequent page references in text.
12. William Herschel writing of his discovery of the planet Uranus (1781). Quoted by Michael J. Crowe, *Modern Theories of the Universe From Herschel to Hubble*, New York: Dover Publications, 1994, p. 74. For more recent accounts of visual cognition see Bruno Latour, 'Visualization and Cognition: Thinking with Eyes and Hands', *Knowledge and Society*, 6 (1986), pp. 1–40; Krzysztof Pomian, 'Vision and Cognition', in Caroline A. Jones and Peter Galison, eds., *Picturing Science, Producing Art*, New York and London: Routledge, 1998, pp. 211–31.
13. Svetlana Alpers drew attention to the importance of the lens in seventeenth-century painting: *The Art of Describing: Dutch Art in the Seventeenth Century*, Chicago: University of Chicago Press, 1988. The study of ludic devices and optical spectacle has branched out in many ways since Richard Altick's *The Shows of London*, Cambridge, Mass., and London: Belknap Press of Harvard University Press, 1978. See Barbara Maria Stafford, *Body Criticism: Imaging the Unseen in Enlightenment Art and Medicine*, Cambridge, Mass.: MIT Press, 1991. Also, with Frances Terpak, *Devices of Wonder*, Los Angeles: Getty Publications, 2002; William H. Galperin, *The Return of the Visible in British Romanticism*, Baltimore: Johns Hopkins University Press, 1993; Sarah Kofman, 'Camera Obscura of Ideology', *Public* (Toronto, Ont.), 7 (1993), pp. 153–70; Terry Castle, *The Female Thermometer: Eighteenth-Century Culture and the Invention of the Uncanny*, Oxford: Oxford University Press, 1995; Jenny Uglow and Frances Spufford, *Cultural Babbage. Technology, Time and Invention*, London: Faber & Faber, 1996; Jonathan Crary, *Suspensions of Perception. Attention, Spectacle, and Modern Culture*, Cambridge, Mass.: MIT Press, 1990; Stephen Herbert, *A History of Pre-Cinema*, 3 vols., London and New York: Routledge, 2000; David Robinson et al., *Encyclopaedia of the Magic Lantern*, London: Magic Lantern Society, 2001; Simon During, *Modern Enchantments: The Cultural Power of Secular Magic*, Cambridge, Mass.: Harvard University Press, 2002; *Eyes, Lies and Illusions*, London: Hayward Gallery in association with Lund Humphries, 2004; James Lyons and John Plunkett, eds., *Multimedia Histories: From Magic Lantern to the Internet*, Exeter: University of Exeter Press, 2007; Eileen Gilleooly et al., eds., *Victorian Prism*, Charlottesville, Va.: University of Virginia Press, 2007.
14. Martin Meisel, *Realisations*, Princeton: Princeton University Press, 1983, pp. 27, 61. Most of the devices in the first two groups are well known. The third group, its constructed etymologies typical of all optical toys, were: the Thaumatrope (Charles Babbage, 1825) ('Thauma', miracle; 'tropos', speed), two images on each side of a disk when whirled at speed are superimposed; Phenakistiscope or 'wheel of life' (Joseph Plateau, 1832) ('phenakizein', to deceive by false reflections; 'skopeo', see)—a disc with radial slits attached to a rod and rotated will show, in a mirror, the sequential images painted on its reverse side, as moving pictures—for example, bricklayers passing bricks. Later this could be achieved with two disks rotating at different speeds and no mirror. A relative is the Anorthoscope (1836) ('anortho', to correct), two disks fixed on a single axis but rotating in opposite directions—the figure seen through the slits stands still; Zoetrope or wonder drum (William George Horner, 1834) ('zoe', live; 'trope', turn), a drum with slits in its wall, a sequence of images on its inner wall, rotated on axis, and viewer sees internal images moving through a vertical slit, for example, leap frog; Praxinoscope (Emile Reynaud, 1877), a central column of mirrors reflect the images of the inner drum as it rotates—early projection by magic lantern.
15. See John Plunkett, 'Depth, Colour, Movement: Embodied Vision and the Stereoscope', *Multimedia Histories*, pp. 117–31, on stereo moving pictures combined with the phenakistiscope; for a thorough account of panorama and diorama, see Olive Cook, *Movement in Two Dimensions*, comprising vol. iii of Stephen Herbert, ed., *A History of Pre-Cinema*, pp. 23–95, on the moving panorama, the hybridization of diorama and panorama.
16. Quotations from Christina Rossetti, *The Complete Poems*, ed. R. W. Crump and Betty S. Flowers, London: Penguin Books, 2001; Thomas Hardy, *The Complete Poems*, ed. James Gibson, Basingstoke: Palgrave, 2001.
17. *The Mirror of Literature, Amusement and Instruction*, 12 February 1842, p. 98. In Herbert, *A History of Pre-Cinema*, vol. ii, p. 234.
18. *Blackwood's Edinburgh Magazine*, 52 (July 1842), p. 26.
19. Edmund H. Wilkie, writing in the *Magic Lantern Journal*, April 1894, quoted in Dennis Compton, David Henry and Stephen Herbert, eds., *Magic Images: The Art of Hand-Painted and Photographic Lantern Slides*, London: Magic Lantern Society, 1990, p. 89.
20. One form of the panorama was an extensive scene, often hundreds of metres long, scrolled past stationary viewers (shown by Robert Barker in 1792 at his rotunda, Leicester Square). Another was a circular structure (for example the panorama of London from St Pauls at the Leicester Square Colosseum), where the viewer was mobile. The Colosseum also included a Hall of Mirrors lit by chandeliers

(faithful to the nineteenth-century idiom) where the spectators created their own moving panorama. This outer-directed form, since it did not depend on the lens or mediated light, is not germane to this study, though it hybridized with the more interior diorama. The backlit Phantasmagoria, introduced to post-revolutionary France by Etienne Gaspard Robertson in 1793, specializing in spectres and mirages that reworked the traumatic material carnage of the revolution in immaterial and satanic images, was transported to England and the Lyceum Theatre by Paul de Philipsthal in 1793. He commissioned a double lantern that incorporated devices for lowering the wick of one and raising the other. The classic dissolve is of two kinds: Louis Daguerre's Paris diorama (1822) reached the Regent's Park Diorama in 1823 (and subsequently major British and continental cities). Painted on linen with translucent and opaque paints, and by 1833 on both sides (the 'double effect'), it was back and front-lit by natural light, modulated by moving screens, to effect transformation of light, and seen in darkness by an audience of 350 who were winched round from picture to picture (each 45 by 71 feet). The gigantic magic lantern projections of the Polytechnic Institution of the 1840s (where Edmund Wilkie's painted glass slides were famous) emerged from a long history of religious and secular illusionism. Henry Langton Childe projected dissolves as early as the 1830s, and commissioned the Biscenoscope, a sophisticated double objective system lit by limelight, in the late 1830s. The lantern dissolve, though produced by structurally different means, was analogous to that of the diorama ('through', 'see'; 'dia', 'horama'). Stafford and Terpak, *Devices of Wonder*, provides a succinct account of the diorama (pp. 99–102, 325–9) and the Phantasmagoria (pp. 84–90). See David Robinson, 'Shows and Slides', *Magic Images*, pp. 5–8, for slide history and the dissolving view. The *Magic Lantern Journal* carried a controversy about the origin of the dissolve across 1893. Notable are the contributions of practitioners and professionals, Edmund H. Wilkie, 'On the Invention of Dissolving Views'; W. R. Hill, 'The Original Dissolve', *Magic Images*, pp. 10, 11.

21. Thomas De Quincey, *Tait's Edinburgh Magazine*, 17 (September 1846), pp. 566–79; pp. 571, 572.
22. F. Marion, *The Wonders of Optics*, trans. Charles W. Quin, New York: Charles Scribner & Co., 1870, p. 180. Subsequent page references in text.
23. Harriet Martineau, quoted in Herbert, *The History of Pre-Cinema*, vol.iii, pp. 19–20. See Marina Warner, *Phantasmagoria*, Oxford: Oxford University Press, 2006, pp. 147–56, for the effects of the Phantasmagoria.
24. Marjorie Levinson associates optical culture with (following Cray) the daydreamer's evacuation from the present, with (adapting Terry Castle) a materialization of the insubstantial, and a state where the acceleration of production and consumption creates an illusory sense of being. 'Object-Loss and Object-Bondage: Economies of Representation in Hardy's Poetry', *English Literary History* 73 (2006), pp. 549–80. The ideology of the dissolve's suspension of representation is amenable to a number of readings. I argue below for an active mediation of the image.
25. *Magic Images*, p. 95.
26. John Heaviside Clark, *The Portable Diorama*, London: Samuel Leigh, 1826. See 'Transparent Painting', pp. 61–6. Earlier (1811) Clark had been associated with Edward Orme, and the production of transparent prints. His 1826 manual advertised his 'Myriorama', a form of plane dissolve, in which a landscape cut into segments could be rearranged indefinitely. The Bill Douglas Centre, University of Exeter, holds a Clark's diorama. Item 46153.
27. Kevin Salatino, *Incendiary Art: The Representation of Fireworks in Early Modern Europe*, Los Angeles: Getty Research Institute for the History of Art and Humanities, 1997, p. 12, for Louis XIV.
28. Bill Douglas Centre, University of Exeter, Item 70585. See also Sims, *Glances Back*, p. 158.
29. Gilles Deleuze, *Cinema* (1983), vol. i, trans. Hugh Tomlinson and Barbara Habberjam, London: Athlone, 1986, p. 5.
30. John Pringle Nichol, *Views of the Architecture of the Heavens. In a Series of Letters to a Lady*, Edinburgh: William Tait, 1837, pp. 123, 124. He repeated this description in *Thoughts on Some Important Points Relating to the System of the World*, Edinburgh: William Tait; London: Simpkin Marshall & Co., 1846, Preface, p. vi. See also 'Nebulae', 'Nebular Hypothesis', in Nichol's edition of *A Cyclopaedia of the Physical Sciences*, 3rd edn., London: Charles Griffin & Co., 1868, pp. 603–13. He argued that the nebular hypothesis remained unaltered whether Nebulae were resolved into stars or not.
31. Robert Chambers, *Vestiges of the Natural History of Creation and other Evolutionary Writings* (2nd edn., 1844), ed. James A. Secord, Chicago and London: University of Chicago Press, 1994, p. 20.
32. William Whewell, *Of the Plurality of Worlds: An Essay* (1853), 2nd edn., London: John W. Parker, 1854, p. 209.
33. Richard A. Proctor, *The Mysteries of Time and Space*, London: Chatto & Windus, 1883, pp. 334, 336.
34. Agnes Clerke, *Popular History of Astronomy During the Nineteenth Century*, Edinburgh: Adam & Charles Black, 1885, p. 35.
35. George Eliot, *The Lifted Veil*, ed. Sally Shuttleworth, London: Penguin Books, 2001 p. 23.
36. John Tyndall, *Six Lectures on Light*, 2nd edn., New York: D. Appleton & Co., 1877, p. 27.
37. Tyndall, *Notes on Light*, p. 42.

38. John Herschel, 'Light', *Encyclopedia Metropolitana* (1831), London, 1845, vol ix, pp. 341–586; p. 405. This influential entry was composed in 1827 and reprinted in several issues of the *Encyclopedia*. Hereafter, 'Light'.
39. Mary Somerville, *On the Connexion of the Physical Sciences* (1834), 9th edn., London: John Murray, 1858, p. 162. Hereafter, *Connexion*. This book was published under the auspices of Brougham's radical/utilitarian Society for the Diffusion of Useful Knowledge, a deliberate attempt at popular education.
40. Marion, *Wonders* p. 85.
41. Thompson, *Light Visible*, pp. 74–5.
42. In his 1869 series of Royal Institution lectures on light, John Tyndall began his exposition showing that light travels in straight lines by dramatizing rectilinear motion in terms of shutter and screen. 'In a dark room let a small hole be made in a window-shutter, and let the sun shine through the hole. A narrow luminous beam will mark its course on the room and the track of the beam will be perfectly straight' (*Notes on Light*, p. 2). He went on to demonstrate the formation of images through small apertures 'received upon a white screen placed in the dark room'. An inverted image of a candle flame filtered through a pinhole pricked in tin foil, a primitive lens, and thrown upon a screen, demonstrated the crossing of rays at the aperture. Tyndall's demonstration of the principle of diffraction has the same starting point (p. 50). Such experiments combined the foundational Newtonian elements for demonstrating the spectrum, with the principle of the camera obscura, an inverted image transmitted by a lens in a darkened space. Typical is M. F. Marion, whose *The Wonders of Optics* was translated in 1870.
43. James Clerk Maxwell's 'Experiments on Colour as Perceived by the Eye' was published in 1855, and 'On the Theory of Compound Colours and the Relations of the Colours of the Spectrum', 1860.
44. See Walter Benjamin on the trace, Conclusion to Part 1 above. See Theodor Adorno on individualism, 'Lyric Poetry and Society', in *Critical Theory and Society: A Reader*, ed. Stephen Eric Bronner, New York and London: Routledge, 1989, pp. 157–8. See Terry Castle, 'Phantasmagoria and the Metaphors of Modern Reverie', chapter 9 of her *The Female Thermometer: Eighteenth-Century Culture and the Invention of the Uncanny*, New York and Oxford: Oxford University Press, 1995, pp. 140–67.
45. Marion, *Wonders*, p. 86.
46. Gustav Kirchhoff and Robert Bunsen collaborated between 1854 and 1859 on spectrum analysis and published the results in 1859. See also Tyndall, *Notes on Light*, pp. 40–2. See Clerke, *Popular History*, p. 168, Richard A. Proctor, *The Spectroscope and Its Work*, London: Society for Promoting Christian Knowledge, 1877. SPCK was a broad educational affiliation—Christina Rossetti also published under its aegis.
47. Herschel, 'Light', p. 343.
48. Ibid. See Somerville, *Connexion*, p. 31. Herschel, 'Light', p. 344. 'Light moves with a velocity of 192,500 miles in a second of time. It travels from the sun to the earth in seven minutes and a half. It moves through a space equal to the circumference of our globe in the 8th part of a second, flight which the swiftest bird could not perform in less than three weeks.' David Brewster, *A Treatise on Optics* (1831), new edn., rev. A. D. Bache (1844), Philadelphia: Blanchard & Lea, 1854, p. 12.
49. See Somerville, *Connexion*, p. 30; Herschel, 'Light', p. 343; Tyndall, *Notes on Light*, pp. 6–7; Marion, *Wonders*, pp. 78–9. See Alan W. Hirshfeld, *Parallax: The Race to Measure the Cosmos*, New York: Henry Holt & Co., 2001, p. xii ('Parallax is the apparent shift in an object's position when viewed alternately from different vantage points') and pp. 171–91, on William Herschel and Parallax.
50. Marion, *Wonders*, p. 79.
51. Somerville, *Connexion*, p. 30.
52. Herschel, 'Light', p. 343.
53. Tyndall, *Notes on Light*, p. 7.
54. Tyndall, *Six Lectures*, p. 22. Tyndall points out, quoting William Whewell on Bradley, that a boat changing its course will, in just the same way, find that the direction of the wind appears to change with it.
55. John Herschel, *Outlines of Astronomy* (expanded from the *Treatise on Astronomy*, 1833), Philadelphia: Lea & Blanchard, 1849, pp. 47–8. 'The apparent change of objects with respect to one another, arising from a motion of the spectator, is called a *parallactic motion*' (p. 59).
56. Clerke, *Popular History*, p. 20.

11. Dissolving and Resolving Views: From Magic Lantern to Telescope

1. *Magazine of Science* (1840), p. 107. In Stephen Herbert, ed., *A History of Pre-Cinema*, 3 vols., London and New York: Routledge, 2000, vol. ii, p. 215.
2. John Tyndall, *Notes on a Course of Nine Lectures on Light*, 2nd edn., London: Longmans, Green & Co., 1870, p. 35. Hereafter *Notes on Light*.
3. David Brewster, *A Treatise on Optics* (1831), new edn., rev. A. D. Bache (1844), Philadelphia: Blanchard & Lea, 1854, p. 251. Hereafter *Treatise*.
4. Johann Wolfgang Goethe, *Theory of Colours*, trans. Charles Lock Eastlake (1840), ed. Deane B. Judd, Cambridge, Mass.: MIT Press, 1970, p. 10. Hereafter *Theory of Colours*. Subsequent page references in text.

5. Arthur Schopenhauer, *On Vision and Colours*, trans. E. F. J. Payne, ed. David E. Cartwright, Oxford: Berg Publishers, 1994, p. 38.
6. Richard A. Proctor, *The Expanse of Heaven. A Series of Essays on the Wonders of the Firmament* (1873), New York: D. Appleton & Co., 1877, pp. 230–1.
7. John Tyndall, *Notes on Light*, pp. 46–7.
8. C. W. Whall, *Stained Glass Work. A Text-Book for Students and Workers in Glass, The Artistic Crafts Series of Technical Handbooks*, ed. W. R. Lethaby, London: John Hogg, 1905, p. 198.
9. Negretti and Zambra's *Encyclopaedic Illustrated and Descriptive Reference Catalogue*, p. 365. Undated Catalogue, University of Exeter: Bill Douglas Centre, pp. 363 ff. they advertised a series of dissolving view lanterns.
10. Goethe, *Theory of Colours*, pp. 34–5.
11. *Herschel at the Cape: Diaries and Correspondence of Sir John Herschel, 1834–1838*, ed. David Evans, Terence J. Deeming, Betty Hall Evans, and Stephen Goldfarb, Austin: University of Texas Press, 1969, p. 144.
12. *Blackwood's Edinburgh Magazine*, 52 (July 1842), pp. 23–6; p. 26.
13. John Ruskin, *Modern Painters* (1843), vol. i, *The Works of John Ruskin*, 39 vols, ed. E. T. Cook and Alexander Wedderburn, London: George Allen, 1903–12, vol. iii, p. 288. 'I could not call it colour, it was conflagration', Ruskin said, of a sunset (p. 279).
14. Bill Douglas Centre, University of Exeter, Item 64139.
15. Bill Douglas Centre, University of Exeter, Item 64459. These are not actually a pair but indicate how double images worked.
16. Three lanterns could independently produce the basic scene, steam of a kettle, and flickering fire; the alignment of rain and lightening on a black background with the 'foundation view' in double glass plates was a matter of great skill. Dennis Compton, David Henry and Stephen Herbert, eds., *Magic Images: The Art of Hand-Painted and Photographic Lantern Slides*, London: Magic Lantern Society, 1990, pp. 88, 96.
17. Vesuvius Protean View, Bill Douglas Centre, University of Exeter.
18. Goethe, *Theory of Colours*, pp. 23, 24. Subsequent page references in text.
19. Jim Cheshire, *Stained Glass and the Victorian Gothic Revival*, Manchester and New York: Manchester University Press, 2004, pp. 43, 171. *Journal of Design*, 5 (1851), p. 116 ('a true Adrianople red'); *Journal of Design*, 6 (1851), p. 170 ('brilliance and intensity' of scarlet cloth).
20. Hermann von Helmholtz, 'The Recent Progress of the Theory of Vision', *Science and Culture: Popular and Philosophical Essays*, ed. David Cahan, Chicago: University of Chicago Press, 1995, p. 163. hereafter *Science and Culture*.
21. Maurice Merleau-Ponty, *The Visible and the Invisible, Followed by Working Notes* (1964), ed. Claude Lefort, trans. Alphonso Lingis, Evanston, Ill.: Northwestern University Press, 1968, p. 131.
22. Gillian Beer has pointed out Hopkins's interest in spectroscopy. 'Helmholtz, Tyndall, Gerard Manley Hopkins: Leaps of the Prepared Imagination', *Comparative Criticism*, 13 (1991), pp. 117–45.
23. Sigmund Freud, 'Screen Memories' (1899), *The Standard Edition of the Complete Psychological Works*, vol. iii, trans. James Strachey, London: The Hogarth Press, 1953–74, pp. 301–22.
24. Poems are from the following editions: Robert Browning, *Robert Browning. The Poems*, 2 vols., ed. John Peggrew, vol. i, Harmondsworth: Penguin Books, 1981; *The Poems of Gerard Manley Hopkins* (1918), 4th edn., ed. W. H. Gardner and N. H. Mackenzie, Oxford: Oxford University Press, 1970; Felicia Hemans, *Poems of Felicia Hemans*, ed. Susan Wolfson, Princeton: Princeton University Press, 2000; William Morris, *The Defence of Guenevere and Other Poems*, reprinted from 1858 edn., London and New York: Longman's, Green & Co., 1896; Christina Rossetti, *The Complete Poems*, ed. R. W. Crump and Betty S. Flowers, London: Penguin, 2001; Alfred Tennyson, *The Poems of Tennyson*, 2nd edn., ed. Christopher Ricks, 3 vols., London: Longman, 1987.
25. 'A Child's View of Colour', Walter Benjamin, *Selected Writings*, vol. i: 1913–1926, ed. Marcus Bullock and Michael W. Jennings, Cambridge, Mass., and London: Belknap Press of Harvard University Press, 1996, pp. 50–1; p. 50. Subsequent page references in text.
26. See also Philip Fisher, *Wonder, the Rainbow, and the Aesthetics of Rare Experience*, Cambridge, Mass.: Harvard University Press, 1998. Ruskin, *Works*, vol. iii, *Modern Painters*, vol. i, p. 161.
27. Famously in 1845 Browning compared his prismatic poetry to Elizabeth Barrett Browning's 'pure white light', a trope that continued throughout his poetry. See the Pope in *The Ring and the Book* (1869): 'Untwist heaven's pure white from the yellow flare'.
28. John Herschel, 'Light', *Encyclopedia Metropolitana*, London, 1845, vol. ix, pp. 341–586; p. 342. Hereafter 'Light'.
29. John Tyndall, *Six Lectures on Light*, 2nd edn., New York: D. Appleton and Co., 1877, p. 10.
30. Herschel, 'Light', p. 341.
31. Tyndall, *Notes on Light*, p. 2.
32. Silvanus Thompson, *Light Visible and Invisible*, New York and London: Macmillan, 1897, p. 9, on waves.
33. Brewster *Treatise*, p. 12.
34. Herschel, 'Light', p. 342.
35. Tyndall, *Notes on Light*, p. 1.
36. The velocity with which an electromagnetic disturbance is propagated in space, Maxwell commented, 'is

- so nearly that of light, that it seems we have strong reason to conclude that light itself (including radiant heat, and other radiations, if any) is an electromagnetic disturbance in the form of waves propagated through the electromagnetic field according to electromagnetic laws' (quoted in Thompson, *Light Visible*, p. 232). Maxwell saw that an electromagnetic wave consisted of two mutually reinforcing displacements, an electrostatic and magnetic wave at right angles to one another. Light, magnetism, and electricity thus came under the same law, but in demonstrating the manner in which waves were propagated Maxwell made sure that the elastic solid account of light was superseded by an account of light in terms of the propagation of energy. He also prepared the way for eliminating the ether as the medium of light. Though Tyndall abandoned the Newtonian theory (the theory then firmly but now less exclusively attributed to Newton) of light as minuscule particles projected through space, and adopted the wave theory of light, he did not abandon a notion of corporeality and a materialist account of light. But, light is motion, not matter, Mary Somerville argued early in the century, opting for the move towards wave theory. Despite the universal assumption of the existence of a material ether it was still possible to think of light itself as immaterial. Philosophers of the highest authority, she wrote, concur in accepting the existence of the ether in the celestial regions, 'whose particles are capable of receiving the vibrations communicated to them by self-luminous bodies, and of transmitting them to the optic nerves, so as to produce the sensation of light' (*On the Connexion of the Physical Sciences* (1834), 9th edn., London: John Murray, 1858, p. 168). Brewster, on the other hand, a theorist of particle propulsion, expressed the definition of light ambiguously—'Light is an emanation, or something which proceeds from bodies, and by means of which we are enabled to see them by the eye' (p. 11). A physical emanation or not? Thompson, confident of the truth of the undulatory theory, simply described light through its structure—waves (*Light Visible*, p. 2). The behaviour of waves of water, in which the wave but not the water moves, was a recurrent model and prompted innumerable wave similes. The periodicity of water waves in space and time, and their transverse 'march' at right angles to the direction of travel was a constant analogy. Though John Herschel pointed out that the impulse of sound waves makes air 'advance and recede'; the 'luminous impulse', however, propagates a motion that must 'tremble laterally'. (Arthur Fine, ed., *A Preliminary Discourse on the Study of Natural Philosophy* (1830), Chicago and London: University of Chicago Press, 1987, p. 261). The ripples made by a stone thrown into water stood in for the evanescent and unseen agency of light.
37. Tyndall, *Notes on Light*, a 'something', p. 29; motion, p. 72.
 38. Herschel, 'Light', p. 341.
 39. Tyndall, *Notes on Light*, p. 72.
 40. Fine, *A Preliminary Discourse on the Study of Natural Philosophy*, p. 260.
 41. See Thompson, *Light Visible*, pp. 24–8, and pp. 27, 28, figs. 15,16. See Tyndall, *Notes on Light*, p. 22; Brewster, *Treatise*, p. 31. Six types of lens were commonly listed: the first class, Double convex, Plano-convex, Concavo-convex, are converging lenses. These form an inverted or 'real' image of an object in the air behind the lens. When the principal focus is passed, and the object comes between the focus and the lens, an erect and 'virtual' image appears. The second class, Double concave, Plano-concave, and Convexo-concave, can only form erect and virtual images: the rays are produced backwards and intersect on the same side of the lens as the object itself. The curvature of *reflective convex and concave mirrors* turns back light and does not refract it. Therefore convex mirrors produce virtual, concave mirrors, real images. Magnified and diminished real images can be produced in the latter if an object is placed between or beyond the principal focus respectively. The point is not only that images can be *moved* by adjusting focus, but that their swelling or contracting size is the product of a manipulated relation between an observer, an object, a focus, and a reflective or refractive medium. See n. 44.
 42. Tyndall, *Notes*, p. 12.
 43. Herschel, 'Light', p. 394.
 44. Brewster, *Treatise*, p. 48.
 45. Tyndall, *Notes on Light*, p. 13.
 46. Lewis Carroll, *Alice through the Looking-Glass* (1871), *The Annotated Alice*, rev. edn., ed. Martin Gardner, Harmondsworth: Penguin Books, 1970, p. 181.
 47. Michel Foucault, *Of other Spaces. Heterotopias* (1967), <http://foucault.info/documents/heteroTopia/foucault.heteroTopia.en.html>; Jacques Lacan, *The Four Fundamental Concepts of Psychoanalysis*, trans. Alan Sheridan, New York: W.W. Norton & Co., 1978, p. 17: 'I am that wretch comparable with mirrors | That can reflect but cannot see.' See above chapter 5.
 48. Brewster, *Treatise*, p. 47, fig. 34.
 49. Herschel, 'Light', p. 401. For an account of the lens and its function in the telescope (focal length, chromatic and spherical aberration, light gathering and resolving power), and the history and principles of the reflecting telescope, the type used by William Herschel in his 40-foot telescope with 48-inch reflector, see Michael J. Crowe, *Modern Theories of the Universe from Herschel to Hubble*, New York: Dover Publications, 1994, pp. 6–14. Lord Rosse's 'Leviathan' reflecting telescope, 54 foot with a reflector of 72-inch aperture, completed in 1845 at Parsonstown, remained the largest in the world until 1917. John Herschel gave a succinct account of the refracting telescope in *Outlines of Astronomy*,

- 2nd edn., Philadelphia: Lea & Blanchard, 1849, pp. 85–128, explaining the principle of the line of collimation, the formation of images and the use of cross hairs.
50. Brewster, *Treatise*, p. 265.
 51. Søren Kierkegaard, *Either/Or: A Fragment of Life*, ed. and trans. Howard V. Hong and Edna H. Hong, 2 vols., Princeton: Princeton University Press, 1987, vol. i, pp. 315–16; *Repetition: A Venture in Experimenting Psychology*, trans. Howard V. Hong and Edna H. Hong, Princeton: Princeton University Press, 1983, pp. 151–2. For Michael Fried, writing of Menzel's 'Balcony Room' (1845), the mirror's doubling at this time conveyed the 'aura' of the Kantian 'I think', 'the embodied and reflective subject'. Menzel's *Realism: Art and Embodiment in Nineteenth-Century Berlin*, New Haven and London: Yale University Press, 2002, p. 87.
 52. For editions of poems see above, n. 24. Charles Dodgson, *Phantasmagoria and other Poems* (1869), 1911 (no publisher); Thomas Hardy, *The Complete Poems*, ed. James Gibson, London: Palgrave Macmillan, 2001. For a discussion of the shade and shadow in Hardy's poetry, see Catherine Maxwell, 'Vision and Visuality in Victorian Poetry', Richard Cronin et al., eds., *A Companion to Victorian Poetry*, Oxford: Blackwell, 2002, pp. 510–25.
 53. Immanuel Kant, *Critique of Pure Reason* (1781), trans. Norman Kemp Smith, London: Macmillan, 1970, A297–298/ B 353–354, pp. 299–300. I am indebted to Rei Terada for drawing my attention to Kant's account of appearance.
 54. John Herschel, *Outlines of Astronomy*, pp. 90–9.
 55. John Ruskin, *Works*, vol. iii, *Modern Painters*, vol. i, p. 102. The imitation can extend to 'cut glass, but not the rainbow'.
 56. Hermann von Helmholtz, *Science and Culture*, p. 197. Subsequent page references in text.
 57. Kant, *Critique of Pure Reason*, p. 300.
 58. 'Money', 'Economic and Philosophical Manuscripts' (1844), Karl Marx, *Early Writings*, trans. Rodney Livingstone, ed. Lucio Colletti, Harmondsworth: Penguin Books, 1975, pp. 375–9.
 59. Helmholtz, *Science and Culture*, p. 136.
 60. Brewster, *Treatise*, p. 248.
 61. Tyndall, *Notes on Light*, p. 24.
 62. *Ibid.*, p. 26; Marion, *Wonders*, p. 36.
 63. John Ruskin, *Modern Painters*, vol. i, p. 330. Subsequent page references in text.
 64. Bill Douglas Centre, University of Exeter, Item 70567 D707.
 65. Simon During, *Modern Enchantments: The Cultural Power of Secular Magic*, Cambridge, Mass., and London: Harvard University Press, 2002, p. 103.
 66. *Negretti and Zambra, Catalogue*, p. 360.
 67. John Ruskin, *Modern Painters*, vol. i, pp. 364–5.
 68. The dissolve's transformation scene, in a Benjaminian reading, would become the compensatory pleasures of spectacle for the wound of capital, which are themselves an illusion. Among endless negative readings one might think of a feminist reading of the subjugated, passive gaze, forced to project fantasy onto the dissolve: a psychoanalytic reading might want to associate the dissolve with mourning, the consuming loss imposed by consumption in which we *consume* loss; or with a Lacanian split between the eye and the gaze, that experience of phallic loss and loss of mastery. It is interesting that so few readers associate optical scenes with cognitive enjoyment, epistemophilia. An exception is Adorno, who associated the aesthetic with radiance, lustre, and incandescence. The dissolve might signify the moment of promise for a world that could be otherwise. Cognate with the dissolve are fireworks (back to Vesuvius). These are one of his instances of the aesthetic; they are empirical and transcend the empirical, artefactual and actual, are neither substitutes, copies, or representations. They shine independently of exchange value.
 69. Marion, *Wonders*, pp. 231–2. It is important to remember that the magic lantern was used not only for entertainment but for laboratory purposes in astronomical research. It was instrumental, for example, in the development of the photometer, and in measuring the brightness of stars, where lantern images of artificial stars were used as controls to determine the brightness of actual stars. Klaus B. Stauber, 'Making Stars: Projection Culture in Nineteenth-Century German Astronomy', *British Journal of Historical Science*, 34 (2001), pp. 439–51.
 70. Herbert, *History of Pre-Cinema*, vol. iii p. 40.
 71. Marion, *Wonders*, p. 235.
 72. Martin Heidegger, *Being and Time*, trans. John Macquarrie, Edward Robinson, Oxford: Basil Blackwell, 1962, pp. 482–3.
 73. For editions of the poems see above, nn. 24, 52.
 74. Michael J. Crowe, *Modern Theories of the Universe*, p. 181. Huggins showed that some nebulae produced bright-line spectra, indicators of glowing gases. Attempts were made to classify the shapes of the nebulae: the spiral, the dumb bell, elliptical flat rings, annular, lenticular structures. But one class appeared structureless: 'No drawing can give an idea of the boundaries of such nebulae' (Mary Somerville, *Connexion*, p. 408). Edwin Powell Hubble produced a classification in 1926 based on ellipticals, spirals, barred spirals, and irregular forms.
 75. This description was quoted by John Pringle Nichol and Lord Rosse: Nichol, *Views of the Architecture of the Heavens*, p. 125; *The Scientific Papers of William Parsons Third Earl of Rosse 1800–1867*, ed. Charles Parsons and Percy Lund, London: Humphries & Co., 1926, p. 202.

76. 15 May 1837, *Herschel at the Cape*, p. 304. Herschel set out for the Cape to conduct a survey of the southern skies in 1833, returning in 1838. He investigated 1,708 nebulae. Steven Ruskin quotes a 'verbal painting' of cloud by Humboldt. *John Herschel's Cape Voyage: Private Science, Public Imagination and the Ambitions of Empire*, Aldershot and Burlington, vt.: Ashgate, 2004, p. 23.
77. See Simon Schaffer, 'The Leviathan of Parsonstown: Literary Technology and Scientific Representation', *Inscribing Science: Scientific Texts and the Materiality of Communication*, ed. Timothy Lenoir, Stanford, Calif.: Stanford University Press, 1998, pp. 183–222.
78. Rosse, *Scientific Papers*, p. 146.
79. *Ibid.*, p. 119.
80. Agnes M. Clerke, *The Herschels and Modern Astronomy*, London: Cassell & Co., 1895, p. 64. Clerke's is one of the clearest accounts of William Herschel's theories (pp. 63–74).
81. On the nebulae see Crowe, *Modern Theories*, pp. 79–91, 162–4, 168–72, 185–9; Simon Schaffer, 'The Nebular Hypothesis and the Science of Progress', in James R. Moore, ed., *History, Humanity, and Evolution*, Cambridge: Cambridge University Press, 1984, pp. 131–64.
82. In his 1789 paper William Herschel insisted that 'Youth and age are comparative expressions', and compared the universe to a 'luxuriant garden' simultaneously in a state of 'fecundity' and 'fading'. In his 1791 paper he described luminous matter 'in a state of modification' (Crowe, *Modern Theories*, pp. 123, 124, 130).
83. Thomas De Quincey, 'System of the Heavens as Revealed by Lord Rosse's Telescope', *Tait's Edinburgh Magazine*, ns 13 (1846), p. 568. Review of John Pringle Nichol, *Thoughts on Some Important Points Relating to the System of the World*, Edinburgh: William Tait; London: Simpkin & Marshall, 1846. See Jonathan Smith, 'De Quincey's Revisions to "The System of the Heavens"', *Victorian Periodicals Review* (Winter 1993), pp. 203–12.
84. Clerke, *The Herschels*, p. 69.
85. John Ruskin, *Modern Painters*, vol. v, p. 59; Thomas Hardy, *Two in a Tower* (1882), ed. Sally Shuttleworth, London: Penguin Books, 1999, p. 29. It was common for William's son to remark on 'blank spaces' in the heavens: 'not a star', 'Nothing!' in his sweeps of the Southern skies (*Herschel at the Cape*, p. 144). Richard A. Proctor, in an assessment of John Herschel, credited him with furthering this understanding. 'Sir John Herschel as a Theorist in Astronomy', *Essays in Astronomy*, London: Longmans, Green & Co., 1872, pp. 8–23. Hardy read Proctor. See Hardy, *Two in a Tower*, ed. Shuttleworth, p. xx.
86. Richard A. Proctor, *Mysteries of Time and Space*, London: Chatto & Windus, p. 352; hereafter *Mysteries of Time and Space*.
87. Agnes M. Clerke, *The System of the Stars*, London: Longmans, Green & Co., 1890, p. 272.
88. *Edinburgh Review*, 87 (1848), pp. 170–229; p. 170.
89. De Quincey, 'System of the Heavens', p. 574.
90. Proctor, *Expanse*, p. 305.
91. *Ibid.*, p. 160.
92. Proctor, *Mysteries of Time and Space*, p. 5.
93. Proctor, *Expanse*, p. 208.
94. *Ibid.*, pp. 150, 160.
95. Proctor, *Mysteries of Time and Space*, p. 343.
96. DeQuincey, 'System of the Heavens', p. 568. Subsequent page references in text.
97. For editions of texts, see notes 24, 52, 73 above. On *In Memoriam*, see Anna Henchman, "'The Globe we groan in"; Astronomical Distance and Stellar Decay in *In Memoriam*', *Victorian Poetry*, 41 (2003), pp. 29–45.
98. Marion, *Wonders*, p. 232.
99. *Ibid.*, p. 180.
100. *Magazine of Science*, 1839, Herbert, *History of Pre-Cinema*, vol. ii, p. 214. This volume devotes pp. 165–498 to the magic lantern.
101. William Isaac Chadwick, *The Magic Lantern Manual*, London: F. Warne & Co., 1878, p. 82.
102. *Magazine of Science*, 1840, Herbert, *History of Pre-Cinema*, pp. 106–7.
103. *Magazine of Science*, 1839, Herbert, *History of Pre-Cinema*, p. 214.
104. *Mirror of Literature*, Herbert, *History of Pre-Cinema*, p. 234.
105. *Magazine of Science*, 1839, Herbert, *History of Pre-Cinema*, p. 214.
106. John Herschel, *A Preliminary Discourse on the Study of Natural Philosophy*, ed. Arthur Fine, Chicago and London: University of Chicago Press, 1830, p. 215.
107. John Herschel, *Results of Astronomical Observations Made During the years 1834, 5, 6, 7, 8 at the Cape of Good Hope*, London: Smith, Elder & Co., 1847, p. 26.
108. See Simon Schaffer, 'On Astronomical Drawing', in Peter Galison and Caroline Jones, eds., *Producing Art, Picturing Science*, London: Routledge, 1988, pp. 441–74; p. 450.
109. See Alex Soojung-Kim Pang, 'Victorian Observing Practices, Printing Technology and Representations of the Solar Corona', *Journal for the History of Astronomy*, 25 (1994), pp. 249–74; p. 251.
110. Herschel, *Results of Observations*, p. 26. Herschel described the observation of systematically segmented zones of 3 degrees breadth in polar distance (the occasional narrowing to 1 degree when unusual objects sighted) at any one time (p. xiv), and the temporal constraints of this technique. He set out systematically the technical and meteorological impediments to clear vision in his introduction, including the mediating telescope

- itself. The flexure of the reflecting mirror when not moving freely on its base produced distortions. (The degree of distorting deviation was doubled in reflecting mirrors in comparison with refracting lenses—it produced, for example, triangular stars (p. xi)) Herschel polished his own mirrors to correct and prevent surface abrading by the atmosphere. The heat of the African planes caused atmospheric aberration—displacement of light, dilation of the image, and ‘vorticose’ motion (p. xv). Even dew or breath on the eye piece (p. xvii) produced aberration.
111. ‘Observations on Some of the Nebulae’, 1844, Rosse, *Scientific Papers*, p. 106. Subsequent page references in text.
 112. Schaffer, ‘On Astronomical Drawing’, p. 442.
 113. Rosse, *Scientific Papers*, p. 119.
 114. Herschel’s 1837 drawing is in *Results of Astronomical Observations* . . . London: Smith, Elder & Co., 1847; Hunter’s drawing, Schaffer, ‘Astronomical Drawing’, p. 464, is in 1868 *Philosophical Transactions of the Royal Society*. John Herschel’s 1825 drawing is reproduced by Nichol in *Thoughts on some important points relating to the history of the world*, 1846—It is not clear to me where the earliest plate comes from in *Views of the Architecture of the Heavens* (1837) (Orion Nebula, plate XII, facing p. 123). ‘Forrester and Nichol’ is the attribution. It is more granular and diffuse than the later engraving by Herschel; see Schaffer, ‘Astronomical Drawing’, p. 456.
 115. Christina Rossetti’s astronomical knowledge was considerable. See Linda E. Marshall, ‘Astronomy of the Invisible: Contexts for Christina Rossetti’s Heavenly Parables’, in Mary Arseneau, Antony Harrison, and Lorraine Janzen Kooistra, eds., *The Culture of Christina Rossetti: Female Poetics and Victorian Contexts*, Athens, Oh.: Ohio University Press, 1999.
 116. For editions of texts see above, see nn. 24, 52, 73.
 117. January 1835, *Herschel at the Cape*, p. 131–2.
 118. *Paradise Lost*, book 2, ll. 727–814: De Quincey, ‘System of the Heaven’, p. 571.
 119. John Herschel was hostile to the imperialist frontier war at the Cape (1834–5) (see Steven Ruskin, *John Herschel’s Cape Voyage*, pp. 55–7, on the politics of the expedition). In contrast to De Quincey he became anti-racist. See Elizabeth Green Musselman, ‘Swords into Ploughshares: John Herschel’s Progressive View of Astronomical and Imperial Governance’, *British Journal for the History of Science*, 31 (1998), pp. 419–36.
 120. Nichol, *Views of the Architecture of the heavens*, p. 197: ‘the heavens are not stable!’, (Nichol repeated these words in the preface of *Thoughts* (p. vi: the earth is ‘ever and anon changing beneath my feet’, p. 180)).
 121. Mary Somerville, who was connected with the radical Brougham through the publication of *Connexion*, kept an open mind about the origin of the volcano but refers to John Herschel’s work. *Connexion*, pp. 234–5.
 122. Nichol, *Views of the Architecture of the Heavens*, p. 122.
 123. Adrian Desmond, *The Politics of Evolution: Morphology, Medicine, and Reform in Radical London*, Chicago and London: University of Chicago Press, 1989; Simon Schaffer, ‘The Nebular Controversy’; James A. Secord, *A Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of Vestiges of the Natural History of Creation*, Chicago: University of Chicago Press, 2000. Most of the scientific establishment refuted the volcanic theory, e.g., in addition to Herschel and Whewell, Henry Sedgwick, David Brewster. Herbert Spencer (1858) supported evolutionary readings of the universe but insisted on the non-resolvable nature of the nebulae. Proctor (*Mysteries*, 1883) followed him.
 124. John Pringle Nichol wrote ‘State of Discovery and Speculation concerning the nebulae’, *London and Westminster Review*, 25, NS 3 (1836), pp. 390–409.
 125. William Whewell, *The Philosophy of Inductive Sciences* (1840), 2 vols., ed. Andrew Pyle, London: Routledge, Thoemmes Press, 1996, vol. i, p. 111. Subsequent page reference in text.
 126. Herschel, *Preliminary Discourse on the Study of Natural Philosophy*, p. 286.
 127. Whewell, *Inductive Science*, p. xxii.
 128. In order to close down a universe of flux it was necessary *either* to argue that all nebular matter was resolvable (the Rosse group) *or* that nebular matter was absolutely distinct from stars (Whewell). This sometimes meant that evolutionary radicals (Spencer) and conservatives (Whewell) believed in the categorical distinctness of the nebulae for different ideological and scientific reasons.
 129. Negretti and Zambra Catalogue, undated, p. 360.
 130. Goethe: *Travels in Italy* (1816–17). See *Elective Affinities* (1809). Dickens: *Pictures from Italy* (1846). Faraday: Iwan Rhys Morus, *Michael Faraday and the Electrical Century*, Cambridge: Icon Books, 2004, p. 50; John Herschel: Clerke, *The Herschels*, p. 150. *Illustrated Exhibitor and Magazine of Art*, 1 (1852), p. 344.
 131. Charles M. Doughty, *Travels in Arabia Deserta*, ed. Edward Garnett, New York: Dover Publications, 2003, pp. 116–18.
 132. Bent Sorensen, ‘Sir William Hamilton’s Vesuvian Apparatus’, *Apollo*, May 2004, pp. 50–7; p. 50. The eruption of 1771 by Pietro Fabris was also created for Hamilton as another (probably) interchangeable transparency.
 133. Richard Altick, *The Shows of London*, Cambridge, Mass., and London: Belknap Press of Harvard University Press, 1978, p. 124.
 134. Kevin Salatino, *Incendiary Art: The Representation of Fireworks in Early Modern Europe*, Los Angeles:

- Getty Research Institute for the History of Art and the Humanities, 1997, p. 54.
135. As well as painting Hamilton's transparencies, Pietro Fabris painted firework displays. See Salatino, *Incendiary Art*, p. 77, for details of firework and crowd paintings by Fabris, Piranesi (son of Giovanni Battista), Francesco Panini, and Louis le Coeur.
 136. See Simon Bainbridge, *Napoleon and English Romanticism*, Cambridge: Cambridge University Press, 1995, p. 44; see Max Schlesinger, *Saunterings in London*, 2nd edn., pp. 39–40, for fireworks and spectacle at Vauxhall Gardens representing the 'volcanic' political crises around Napoleon, the burning of Moscow, Waterloo (and the Queen 'burning in gas', p. 37). Warwick Wroth, *Cremorne and Later London Gardens*, London: Eliot Stock, 1907, gives a list of incendiary spectacles at Surrey Gardens, p. 86.
 137. For slide of Napoleon, see Compton, Henry, and Herbert, *Magic Images*, p. 16.
 138. Michael Sanders, 'Poetic Agency: Metonymy and Metaphor in Chartist Poetry', *Victorian Poetry*, 39 (Summer 2001), pp. 111–35; p. 116.
 139. In the cosmic life of the universe the volcano became the paradigm of the sun's activity. It was also seen as the residuum, what would remain when the sun died. 'Our earth would be a silent abode of darkness and death, the stillness only interrupted by the occasional noise produced by volcanic explosion, and the darkness by the occasional lurid glare in some few places of lava streams issuing from a volcano.' (G. G. Stokes, *Burnett Lectures on Light. In Three Courses*, London and New York: Macmillan & Co., 1887, p. 283. 'Condition of the earth without light', Lecture II of 3rd course.) When photographic transparencies for lantern slides became available, images of 'the bowels of the earth' and 'portraits of the sun, with the vast protuberance surrounding his edge, and the dark spots which travel across his face', they continued to consolidate this paradigm (*The Magic Lantern Manual*, p. 83).
 140. Andy Warhol, *Vesuvius by Warhol*, ed. Francesco Durante, Naples: Fondario Amelie-Electa, 1985, p. 35.
 141. Ruskin, *Works*, vol. xxvi, p. 262. For an industrial Vesuvius see vol. i, p. 258.
 142. Gaston Bachelard, *The Psychoanalysis of Fire* (1938) trans. Alan C. M. Ross, Boston: Beacon Press, 1964, p. 16.
 143. See Ann Bermingham, *Landscape and Ideology. The English Rustic Tradition, 1740–1860*, London: Thames & Hudson, 1987, whose Althusserian premise is that landscape painting represents an imagined account of a real environment, ignoring its contradictions.
 144. Kant, *Critique of Pure Reason*, p. 27.
 145. Jacques Lacan, *Four Fundamental Principles*, p. 103. Subsequent page references in text.
 146. Henri Bergson, *Matter and Memory* (1910) trans. N.M. Paul and W.S. Palmer, New York: Zone Books, 1991, p. 38.
 147. See above, Chapter 10, n. 20.
 148. Freud, 'Screen Memories', pp. 313, 314.
- ## 12. Microscopic Space
1. *Through the Looking-Glass, The Annotated Alice*, ed. Martin Gardner, rev. edn. Harmondsworth: Penguin Books, 1971, p. 218. I am indebted to Gillian Beer's work on Alice and to her readings of Carroll's science in the Northcliffe lectures of 1998, an extension of the pioneering work of her *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot and Nineteenth-Century Fiction*, London: Routledge & Kegan Paul, 1983.
 2. Joseph Jackson Lister refined the microscope in 1826. His compound microscope evolved a combination of lenses in the objective glass that reduced chromatic and spherical distortion. By 1851 microscopes could be purchased for as little as £5. The Exhibition jury commended 'low-priced instruments' exhibited by Ross, Smith, and Beck. 'Philosophical Instruments' (Class 10), *Exhibition of the Works of Industry of All Nations, 1851. Reports by the Juries on the Subjects in the Thirty Classes in to which the Exhibition was Divided*, London, 1852, p. 265. The Microscopical Society of London was founded in 1839, and specialist magazines began to appear, for example the *Monthly Microscopical Journal*, 1844. William Carpenter's *The Microscope and its Revelations*, London: John Churchill, 1856, was in its 8th edn. by 1901.
 3. William Whewell, *Of the Plurality of Worlds: An Essay*, 2nd edn., London: John W. Parker, 1854, p. 106.
 4. Catherine Wilson, *The Invisible World: Early Modern Philosophy and the Invention of the Microscope*, Princeton: Princeton University Press, 1995, p. 231. hereafter *The Invisible World*.
 5. Robert Browning, 'Mr Sludge, "The Medium"', *Dramatis Personae*, 1864, *Robert Browning. The Poems*, 2 vols., ed. John Pettigrew, Harmondsworth: Penguin Books, 1981, vol. i, pp. 821–60. For the Victorian obsession with the minuscule, see Marina Benjamin, 'Sliding Scales: Microphotography and the Victorian Obsession with the Minuscule', in Jenny Uglow and Francis Spufford, eds., *Cultural Babbage. Technology, Time and Invention*, London: Faber & Faber, 1996, pp. 99–122.
 6. John Tyndall, *Notes on a Course of Nine Lectures on Light*, 2nd edn., London: Longmans, Green, & Co., 1870, p. 29. David Brewster, *The Stereoscope. Its History, Theory, and Construction*, London:

- John Murray, 1856, p. 68. For relief effects see pp. 72–86.
7. Whewell, *Plurality*, p. 106.
 8. Charles Kingsley, *Glaucus; or, The Wonders of the Shore* (1854), 3rd edn., Cambridge: Macmillan & Co., 1856, p. 33.
 9. See *Eyes, Lies and Illusions*, Hayward Gallery in Association with Lund Humphries, London, 2004, p. 195.
 10. Sigmund Freud, *The Interpretation of Dreams, The Standard Edition of the Complete Psychological Works of Freud*, trans. and ed. James Strachey, London: Hogarth Press, 1953–74, vol. v, pp. 538–41. Freud's analogy is loose, but in describing a series of lenses grouped after the eye-piece that mediates perception, each correcting one another's distortions (each lens is a 'memory' of the other), Freud conveyed the abstraction of the dream image. In thinking of regression, the conversion of ideas into the raw material created by sensory stimuli, as moving in 'backward' direction, he was probably thinking of the way the object glass magnifies a specimen and reflects it back so that the image can form at a focus that the eyeglass can accept.
 11. Agnes Callow, *Drops of Water; Their Marvellous and Beautiful Inhabitants Displayed by the Microscope*, London: Reeve & Benham, 1851, pp. x–xi. Female writers on marine life are numerous. See in addition to the above: Anne Pratt, *Chapters on the Common Things of the Sea-Side*, London: Society for Promoting Christian Knowledge, 1850; Mary Roberts, *A Popular History of the Mollusca*, London: Reeve & Benham, 1851.
 12. John Ferguson, *The Microscope, its Revelations and Applications*, Edinburgh: Thomas Constable; London: Hamilton Adam & Co., 1858, p. 5. Hereafter *The Microscope*.
 13. Hon. Mrs Ward, *A World of Wonders Revealed by the Microscope*, London: Groombridge & Sons, 1858, p. 37. Thanks to Meegan Kennedy's NAVSA conference paper, 2005, for this reference.
 14. David Brewster, *Treatise on Optics* (1831), rev. A. D. Bache (1844), Philadelphia: Lea & Blanchard, pp. 285, 283. Hereafter *Treatise*.
 15. *Through the Looking-Glass*, p. 236. Carroll was alert to the evolutionary importance of bivalves.
 16. Wilson, *The Invisible World*, p. 176.
 17. Ferguson, *The Microscope*, quoting Chalmers, *Astronomical Discourses*, p. 6.
 18. Wilson, *The Invisible World*, p. 190. Kingsley, *Glaucus*, p. 83.
 19. Philip Henry Gosse, *Evenings at the Microscope: Or, Researches Among the Minuter Organs and Forms of Animal Life*, London: Society for Promoting Christian Knowledge, 1859, pp. 392–3. His work is stationed halfway between the microscope-led popular science of the autodidact, and the growing professionalization of the naturalist. His popular works include *The Aquarium* (1854), *The Ocean* (1854), *A Manual of Marine Zoology* (1856), *A Year at the Shore* (1865). He popularized and refined the aquarium, overseeing the construction and stocking of the London Zoo aquarium.
 20. George Henry Lewes, 'New Sea-Side Studies', *Blackwood's Edinburgh Magazine*, 82 (September 1827), pp. 345–57; p. 355. This is the second of two articles. The first appeared in *Blackwood's Edinburgh Magazine*, 80 (August 1826), pp. 184–97. Subsequent page references in text.
 21. *Through the Looking-Glass*, p. 223.
 22. For the difficulties of classifying marine invertebrates and their relation to Cuvier's embranchements, see Rebecca Stott, 'Darwin's Barnacles: Mid-Century Victorian Natural History and the Marine Grotesque', in Roger Luckhurst and Josephine McDonagh, eds., *Transactions and Encounters. Science and Culture in the Nineteenth Century*, ed. Manchester: Manchester University Press, 2002, pp. 151–81. See above, n. 20 for details of Lewes's articles. These articles were published with additions as *Sea-Side Studies at Ilfracombe, Tenby, the Scilly Isles and Jersey*, in 1858. See Adrian Desmond, *Huxley: From Devil's Disciple to Evolution's High Priest*, Harmondsworth: Penguin Books, 1997, p. 193, for an account of Huxley's attack on Lewes, published in the *Westminster Review*, 61 (1854), pp. 255–6.
 23. Darwin's meticulous enquiries of J. P. Hooker's drawing of a cirripede under the microscope indicate not only that he was fully aware of the microscope's visual ambiguities but that he was deconstructing the categories of Cuvierian taxonomy. *The Correspondence of Charles Darwin*, ed. Frederick Burkhardt and Sydney Smith, Cambridge: Cambridge University Press, 1985–, vol. iii, pp. 357, 366. See Isobel Armstrong, 'The Microscope', in Luckhurst and McDonagh *Transactions and Encounters*, pp. 30–54; p. 47.
 24. Desmond, *Huxley*, pp. 185–7.
 25. *Ibid.*, p. 188.
 26. Stott, *Transactions*, pp. 160–5.
 27. Adrian Desmond and James Moore, *Darwin*, London: Michael Joseph, 1991, p. 357.
 28. Harriet Ritvo, *The Platybus and the Mermaid and other Figments of the Classifying Imagination*, Cambridge, Mass., and London: Harvard University Press, 1997. See chapter 1, 'The Point of Order' (pp. 1–50), her Introduction. Her observations are confirmed in microscopy studies. Vol. 1 of the *Transactions of the Microscopical Society*, London: John Van Voorst, 1844, for instance, contains articles on the bat, falling disturbingly between the categories of bird and human, arguing that structurally its hair resembles both (John Quckett, pp. 58–61); on the mollusc shell (J. S. Bowerbank, pp. 123–52) arguing for the 'alliance' between it and bone (p. 133), another restructuring of categories that replaces the Cuvierian taxonomy with another.

29. Lankester, *Half-Hours with the Microscope: being a popular guide to the use of the microscope*, London, 1859, p. 44. By 1898 this work had reached its 20th edition.
30. Ferguson, *The Microscope, Its Revelations, and Applications*. Edinburgh: Thomas Constable, London: Hamilton Adam & Co, 1858. The lily–butterfly problem had a wide circulation. Ferguson quotes Trembley from Lewes’s *Sea-Side Studies*, p. 281.
31. Wilson, *The Invisible World*, p. 185.
32. Carroll, *Alice Through the Looking-Glass*, p. 261.
33. Brewster, *Treatise*, p. 240.
34. Brewster, *Treatise*, p. 396. Herman von Helmholtz, almost alone resisted this view. ‘Recent Progress of the Theory of Vision’, *Science and Culture: Popular and Philosophical Essays*, ed. David Cahan, Chicago and London: University of Chicago Press, 1995, pp. 127–203.
35. Tyndall, *Notes on Light*, p. 24.
36. Brewster, *Treatise*, p. 242.
37. Charles Darwin, *The Expression of Emotion in Man and Animals* (1872), Chicago and London: University of Chicago Press, 1965, pp. 24–5. Darwin celebrated the beauty and complexity of the eye, but in attacking analogies with technology, he also claimed that it was a product of adaptation—‘any sensitive nerve may be rendered sensitive to light’. Charles Darwin, *The Origin of Species by Means of Natural Selection* (1859), ed. J. W. Burrow, Harmondsworth: Penguin Books, 1968, p. 217.
38. The aqueous humour, the doubly refracting crystalline lens, and the vitreous humour were routinely described as a recessive series of chambers of refractive fluid with almost the refractive powers of water. Tyndall, *Notes on Light*, p. 23; Brewster, *Treatise*, p. 241; John Herschel, ‘Light’, *Encyclopedia Metropolitana*, London, 1845, p. 397.
39. Lankester, *Half-Hours*, p. 4.
40. Brewster, *Treatise*, p. 288.
41. Helmholtz, ‘Recent Progress of the Theory of Vision’, p. 141. On the eyes’ defects, pp. 137–44.
42. Henry James, *Glasses*, London: Martin Secker, 1916 pp. 66, 59. First published in 1897 as *Embarrassments*.
43. Lewes, ‘Sea-Side Studies’, *Blackwood’s* (1856), p. 192.
44. Stott, *Transactions*, p. 164.
45. Lankester, *Half-Hours*, p. 47.
46. Gosse, *Evenings*, p. 62.
47. Callow, *Drops of Water*, p. 88.
48. Kingsley, *Wonders of the Shore*, p. 88.
49. *Through the Looking-Glass*, p. 207.
50. Lewes, ‘Sea-Side Studies’, p. 185.
51. Wilson, *The Invisible World*, p. 255: See also Ian Hacking, ‘Do We See through a Microscope?’ *Pacific Philosophical Quarterly*, 63 (1981), pp. 305–22, who argues that few discoveries were made with the microscope even with twentieth-century techniques. We see with, not through, the microscope, which enables a form of mapping. James Krasner, *The Entangled Eye: Visual Perception and the Representation of Nature in Post-Darwinian Narrative*, New York: Oxford University Press, 1992.
52. René Descartes, *Discourse on Method, Optics, Geometry, and Meteorology* (1637), trans. Paul J. Olscamp, Indianapolis: Bobs-Merrill Co., 1965, p. 119.
53. Texts from the following editions: *Robert Browning. The Poems*, 2 vols., ed. John Pettigrew, Harmondsworth: Penguin Books, 1981; *The Poems of Tennyson*, 2nd edn., ed. Christopher Ricks, 3 vols., London: Longman, 1987; *Thomas Hardy. The Complete Poems*, ed. James Gibson, Basingstoke: Palgrave, 2001; Michael Field, ‘A Portrait’, *Sight and Song*, London: Elkin Mathews and John Lane, 1892; ‘Unbosoming’, ‘So jealous of your beauty’, ‘Your Rose is dead’, *Underneath the Bough. A Book of Verses*, London: G. Bell & Sons, 1893. ‘To the Winter Aphrodite’, *Wild Honey from Various Thyme*, London: T. Fisher Unwin, 1908.

13. Crystal philes, Anamorphobies, and Stereoscopic Volume

1. *Through the Looking-Glass, The Annotated Alice*, ed. Martin Gardner, Harmondsworth: Penguin Books, 1970, p. 219.
2. Charles Kingsley, *Glaucus; or, The Wonders of the Shore* (1854), 3rd edn., Cambridge: Macmillan & Co., 1856, p. 90.
3. George Henry Lewes, ‘Sea-Side Studies’, *Blackwood’s Magazine*, 80 (August 1856), p. 192: ‘New Sea-Side Studies’, *Blackwood’s Magazine*, 82 (September 1827), p. 345.
4. Agnes Callow, *Drops of Water; Their Marvellous and Beautiful Inhabitants Displayed by the Microscope*, London: Reeve & Benham, 1851, pp. 71, 110.
5. Philip Henry Gosse, *Evenings at the Microscope: Or, Researches Among the Minuter Organs and Forms of Animal Life*, London: Society for Promoting Christian Knowledge, 1859, p. 36. Subsequent page references in text.
6. Lewes’s first *Blackwood’s* article describes the glass jars and containers required in great detail. Revd J. G. Wood, *Common Objects of the Microscope*, London: Routledge, Warne, & Routledge, 1861, pp. 12–31, describes required equipment, and how to make a microscope with a magnifying glass. Lionel Beale, *How to Work with the Microscope*, London: John Churchill, 1857, pp. 40–1, describes the technologies for grinding, cutting, and perforating glass slides.
7. Catherine Wilson, *The Invisible World: Early Modern Philosophy and the Invention of the Microscope*, Princeton: Princeton University Press, 1995, p. 231. Hereafter *The Invisible World*.
8. *Ibid.*, pp. 218–50.
9. Lewes, ‘Sea-Side Studies’ p. 196.
10. Edwin Lankester, *Half-Hours with the Microscope: being a popular guide to the use of the microscope*,

- London: Robert Hardwicke, 1859, unpaginated pre-textual material.
11. Martin Heidegger, *Poetry, Language, Thought*, trans. Albert Hofstadter, New York: Harper & Row, 1975, p. 174. See also his distinction between the 'over-againstness of the object', and the nearness of 'thingness', p. 167 et seq.
 12. Gilles Deleuze, *Cinema 1. The movement—image*, trans. Hugh Tomlinson and Barbara Habberjam, London: Athlone Press, 1986, p. 98.
 13. Gosse, *Evenings at the Microscope*, p. 60. For an informed and sympathetic reading of Gosse's work, see Jonathan Smith's important study, *Charles Darwin and Victorian Visual Culture*, Cambridge: Cambridge University Press, 2006, pp. 77–91.
 14. Gosse, *Evenings at the Microscope*, pp. 160–2.
 15. Mary Roberts, *A Popular History of the Mollusca*, London: Reeve & Benham, 1851, pp. 4–5.
 16. See Ann Thwaite, *Glimpses of the Wonderful. The Life of Philip Henry Gosse 1810–1888*, London: Faber & Faber, 2002, pp. 204–27, for an account of his *Omphalos*, 1857, an attempt to refute geological evidence of evolution.
 17. *Ibid.*, pp. 129–30 for Gosse's deep respect for the intellectual powers of black helpers in Jamaica.
 18. *Sea-Side Studies at Ilfracombe, Tenby, the Scilly Isles and Jersey*.
 19. *Westminster Review*, 61 (1854), pp. 255–6.
 20. Lewes, 'Sea-Side Studies', p. 188. Subsequent page references in text.
 21. Wilson, *The Invisible World*, p. 251, and further discussion of Gaston Bachelard's anti-cognitive reading of the microscope, p. 251.
 22. Lewes, 'New Sea-Side Studies', p. 355.
 23. *Works of John Ruskin*, 39 vols., ed. E.T. Cook and Alexander Wedderburn, London: George Allen, 1903–12, vol. xxv, *Proserpina*, p. 469.
 24. *Through the Looking-Glass*, p. 241.
 25. The intensity of responses to the microscope and the incipient and often overt sexuality of accounts of microscopic imagery makes a psychoanalytical reading important. The reduction of space to the severed fragment prompts a reading of the fetish such as we see in some Marxist critics and in Giorgio Agamben (*Stanzas*) at which I glanced briefly in the previous section in connection with artefacts (See Part II, pp. 199–200). That is, castration anxiety and a reading of phallic lack in the mother's body forces the fragment into a metonymic but ambiguous relation with the body that results in its overvaluation and a fascination with its contradictory symbolic status. Here, in microbiology, this powerful psychic charge arises from the taxonomic uncertainty underlined by the microscope, which makes all the categories of kinship and reproduction fragile and insecure. There is no reason why the fetish should not follow from this, but as I argued earlier, it is not in itself explanatory.
 26. Ruskin, *Works*, vol. xxv, p. 469. See Smith, *Charles Darwin*, pp. 165–78, on Ruskin's Critique of Darwin and evolutionary biology.
 27. Ruskin, *Works*, vol. xxvi, p. 114.
 28. Ruskin, *Works*, vol. xi, *Stones of Venice*, vol. iii, p. 179.
 29. Ruskin, *Works*, vol. xxiii, 'Mornings in Florence' (1875–7), p. 329.
 30. *Ibid.* Comic slides of de-and re-capitated figures existed. See Bill Douglas Centre, University of Exeter.
 31. David Brewster, *The Stereoscope, Its History, Theory and Construction*, London: John Murray, 1856, pp. 76–82. See also p. 32 for rival theories of Wheatstone, Eliot, and Brewster. On the history of the stereoscope see John Plunkett, 'Depth, Colour, Movement: Embodied Vision and the Stereoscope', *Multimedia Histories. From the Magic Lantern to the Internet*, Exeter: Exeter University Press, 2006, pp. 117–131.
 32. Hermann Von Helmholtz, 'The Recent Progress of the Theory of Vision', in David Cahan, ed., *Science and Culture: Popular and Philosophical Essays*, Chicago, and London: University of Chicago Press, 1995, p. 175. Subsequent page references in text.
 33. *Through the Looking-Glass*, p. 181.
 34. Brewster, *The Stereoscope*, pp. 178–9.
 35. Brewster, *Treatise*, pp. 263, 262. Brewster wrote a separate study of the kaleidoscope, 1819.
 36. Jonathan Crary, *Techniques of the Observer. On Vision and Modernity in the Nineteenth Century* (1990), Cambridge, Mass., and London: MIT Press, 1995, p. 116.
 37. Editions of texts as above, Chapter 12, n. 53. Algernon Charles Swinburne, *Poems and Ballads* (1866), London: Chatto & Windus, 1893, pp. 146–9.
 38. I thank Elizabeth Prettejohn for the suggestion that the picture in the mirror is one of Whistler's Thames paintings of the 1860s. John Plunkett (see above n. 30), points out that pictures taken at a 'greater angle of separation' than the interocular distance produced a deeper three dimensional effect (p. 120). For a reading of Swinburne's poem see Catherine Maxwell, *Swinburne*, Tavistock: Northcote House, 2006.
 39. 'Tête à tête sombre et limpide | Qu'un coeur devenu son miroir! | Puit de vérite, clair et noir.' Charles Baudelaire, 'L'Irrémédiable', *The Flowers of Evil*, trans. James McGowan, ed. Jonathan Culler, Oxford: Oxford University Press, 1993, p. 160.

14. Coda: Fixing the Moving Image and Mobilizing the Fixed Image—Memory, Repetition, and Working Through

1. Søren Kierkegaard, *Repetition* (1843), trans. Howard V. Hong and Edna H. Hong, Princeton: Princeton University Press, 1983, pp. 131–2.

2. Friedrich Nietzsche, *Thus Spoke Zarathustra* (1883), trans. R. J. Hollingdale, revised edn., Harmondsworth: Penguin Books, 1969, p. 179.
3. Sigmund Freud, 'Remembering, Repeating, and Working-Through', *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, trans. James Strachey, London: The Hogarth Press, 1953–74, vol. xii, pp. 147–56; p. 150.
4. 'Recent Discoveries on Photography', *Illustrated Exhibitor and Magazine of Art*, 1 (1852), pp. 106–7; p. 107. The article described the successive coatings and immersions of the wet collodion process, where the photographic plate is moist. This was to become the preferred process. It had a shorter exposure time than the albumen process. See Helmut Gernsheim and Alison Gernsheim, *The History of Photography from the Camera Obscura to the Beginning of the Modern Era*, rev. edn., London: Thames & Hudson, 1969, pp. 197–9. For an account of early experiments with photography, see Geoffrey Batchen, *Burning with Desire: The Conception of Photography*, Cambridge, Mass.: MIT Press, 1999. For photography in the Victorian era, see Lindsay Smith, *Victorian Photography, Painting and Poetry: The Enigma of Visibility in Ruskin, Morris and the Pre-Raphaelites*, Cambridge: Cambridge University Press, 1995; Helen Groth, *Victorian Photography and Literary Nostalgia*, Oxford: Oxford University Press, 2003. See also Susan Sontag, *On Photography*, Harmondsworth: Penguin Books, 1979. An extensive review by David Brewster of the state of photography and its uses (the author identifies astronomical photography in particular) appeared in *The North British Review*, 36 (1862), 170–203. Of interest is Lewis Carroll's 'Hiawatha's Photographing', in *Phantasmagoria and other Poems*, London: Macmillan & Co., 1869. This pastiche of Longfellow uses the camera eye of the outsider to expose the 'Mystic' scientific ritual of photography, to deconstruct photographic conventions ('velvet curtains | Looped about a massy pillar'), and to parody bourgeois demands for the 'real' (the 'perfect likeness' is 'Unrestrainedly abused').
5. For an account of motion toys see Barbara Maria Stafford and Frances Terpak, *Devices of Wonder. From the World in a Box to Images on a Screen*, Los Angeles: Getty Research Institute, 2001, pp. 354–9. Stafford and Terpak characterize these as 'avant garde toys' that magically 'sprang into action' (p. 356).
6. Roland Barthes, *Camera Lucida. Reflections on Photography* (1980) trans. Richard Howard, New York: Vintage, 2000, p. 4.
7. Martin Meisel, *Realisations*, Princeton: Princeton University Press, 1983, pp. 27, 61.
8. 'Look with one eye at the edge of the hand, so that the finger nearest the hand shall cover all the others. Then open the second eye; by it the other fingers will be seen foreshortened. *The images of the hand therefore within the two eyes are different.*' John Tyndall, *Notes on a Course of Nine lectures on Light*, 2nd edn., London: Longmans, Green & Co, 1870, p. 28.
9. Hermann von Helmholtz, *Treatise on Physiological Optics*, ed. James P. C. Southall, 3 vols., Wisconsin: Optical Society of America, 1924, vol. iii, p. 270.
10. F. Marion, *The Wonders of Optics*, trans. Charles W. Quin, New York: Scribner & Co, 1870, pp. 53–9, describes a number of optical motion toys and the perceptual experience on which they rely, preceded by the lighted stick experiment (p. 53).
11. Tyndall, *Notes on a Course of Nine Lectures*, p. 26.
12. Eadweard Muybridge perfected serial photographs with his famous *Horse in Motion* series in 1878. Etienne-Jules Marey influenced this work and was himself influenced by it, developing a camera that could take 30 photographs per second. He wrote *Descriptive Zoopraxography or the Secret of Animal Locomotion made Popular*, University of Pennsylvania, 1893.
13. William B. Carpenter, in Stephen Herbert, ed., *A History of Pre-Cinema*, 3 vols., London and New York: Routledge, 2000, vol. i, p. 318. From the last of three articles contributed to the *Student and Intellectual Observer*, 1868 ('On the Zoetrope and its Antecedents' (pp. 427–44), 'The Anorthoscope' (pp. 24–31), 'The Anorthoscope' cont., pp. 110–28).
14. Quoted in P. H. Emerson, *Naturalistic Photography*, London: Sampson Low & Co., 1889, p. 102.
15. Helmholtz, *Physiological Optics*, pp. 270–2.
16. A zoetrope in the Bill Douglas Centre, University of Exeter.
17. Barthes, *Camera Lucida*, p. 5.
18. Henry Fox Talbot, *The Pencil of Nature*, London: Longman, Brown, Green & Longmans, 1844 (no pagination): facsimile edn., Larry J. Schaaf, New York: Hans P. Kraus, 1989. Comment, plate 2.
19. The 'single shutter standing open' anticipates the punctum, Barthes's unplanned moment of intensity in the photograph, *Camera Lucida*, pp. 25–7.
20. *Journal of the Photographic Society*, 1 (1853), pp. 6–7; 26–7; 74–6. Robert Hunt, an active member of the Society, wrote in detail on photography in his 1851 Exhibition *Hand-Book to the Official Catalogues*, 2 vols., London: Spicer & Clowes, 1851, vol. i, pp. 397–413. Remarks on light, p. 404.
21. John Ruskin, *The Complete Works of John Ruskin*, ed. E. T. Cook, Alexander Wedderburn, 39 vols., London: George Allen, 1903–12, vol. vi, p. 68. This quotation prefaces Lindsay Smith's pioneering *Victorian Photography, Painting and Poetry: The Enigma of Visibility in Ruskin, Morris and the Pre-Raphaelites*, Cambridge: Cambridge University Press, 1995, a study from which I have learned greatly.
22. Sir William Newton, *Journal of the Photographic Society*, 1 (1853), p. 7.
23. Emerson, *Naturalistic Photography*, p. 107. Subsequent page references in text.
24. Emerson adapts Helmholtz in the service of a pre-Impressionist reading of photography. Often seen as

- a member of the romantic 'soft focus' faction in Victorian photography, he admired Courbet and Millet as well as the Impressionists themselves (though he dramatically revoked his views later). See Gernsheim and Gernsheim, *The History of Photography*, pp. 456–60. His romanticism is inflected in a positivist way. Emerson's thinking on the differential intensity of light and shade, with a corresponding adaptation of focus (the camera imitating how the eye sees), appears to respond to Helmholtz's understanding of the differential function of the rods and cones. Rods, absent from the fovea centralis, were associated with the dark-adapted periphery of the eye, and took over from the light-adapted cones as receptors in conditions of progressively decreasing illumination, until in 'twilight vision' there is a 'scotoma' in the centre of the visual field. (Helmholtz, *Physiological Optics*, vol. ii, p. 346.)
25. Ludwig Wittgenstein, *Remarks on Colour*, ed. G. E. M. Anscombe, trans. Linda L. McAlister and Margarete Schattle, Berkeley and Los Angeles: University of California Press, pp. 38e, 36e.
 26. Laszlo Moholy-Nagy, 'Unprecedented Photography', *Photography in the Modern Era. European Documents and Critical Writings, 1913–1940*, ed. Christopher Phillips, New York: Metropolitan Museum of Art, 1989, p. 85.
 27. W. E. Henley, 'Nocturn', 'Hospital Sketches', *Cornhill Magazine*, 1875; Matthew Arnold, 'Dover Beach' (1867), *The Poems of Matthew Arnold*, ed. Kenneth Allott, London: Longmans, Green, & Co., 1965; James Thomson, 'The City of Dreadful Night', *National Reformer*, 1874.
 28. Robert Browning, 'Mesmerism' (1855), *Robert Browning. The Poems*, 2 vols., ed John Pettigrew, Harmondsworth: Penguin Books, 1981; William Morris, 'Summer Dawn', *The Defence of Guenevere and other Poems*, 1858; Michael Field, 'Ebbtide at Sundown', in *Wild Honey from Various Thyme*, London: T. Fisher Unwin, 1908, Oscar Wilde, 'Impression Du Matin', *Poems*, Boston: Roberts Bros., 1881; Mary F. Robinson, 'Venetian Nocturne', *Collected Poems, Lyrical and Narrative*, London: T. Fisher Unwin, 1902; Graham R. Thomson, 'Nocturn' (2 poems with this title), 'Invocations', *The Poems of Rosamund Marriott Watson*, London and New York: John Lane, 1912; Mary Coleridge, 'Shadow' (1897), *Collected Poems of Mary Coleridge*, ed. Theresa Whistler, London: Rupert Hart Davis, 1954. Thanks to Ana ParejoVadillo for introducing me to the Nocturne genre. Susan Stewart, in her phenomenological study, *Poetry and the Fate of the Senses*, Chicago and London: University of Chicago Press, 2002, also posits a category of Nocturne poems. For her these pre-date photography and reach back beyond the eighteenth century, relating to a primal experience of darkness. One could say that photography reinflected this genre.
 29. Thomas Hardy, *The Complete Poems*, ed. James Gibson, Basingstoke: Palgrave, 2001. 'The Photograph' (1917) 'Neutral Tones' (1898); 'At Castle Boterel' (1914).
 30. Walter Benjamin, 'A Small History of Photography' (1931), *One-Way Street*, trans. Edmund Jephcott, Kingsley Shorter, NLB, London: 1979, pp. 240–57, 244, 245. On Benjamin and photography see Eduardo Cadava, *Words of Light. Theses on the Photography of History*, Princeton: Princeton University Press, 2004.
 31. Kierkegaard, *Repetition*, p. 176.
 32. Kierkegaard, *Fear and Trembling* (edition as for *Repetition*), p. 33.
 33. Nietzsche, *Thus Spoke Zarathustra*, p. 241.
 34. Gilles Deleuze, *Difference and Repetition* (1968), trans. Paul Patton, New York: Columbia University Press, 1994, p. 8.
 35. Freud, 'Remembering', p. 154.
 36. Thomas Hardy, 'The Fiddler of the Reels', *The Fiddler of the Reels and Other Stories 1888–1900*, London: Penguin Books, 2003, p. 191.

Conclusion: The End of Glass Culture—from Nineteenth-Century Modernity to Modernism

1. Natalia Ginzburg, Extract from the short story 'My Work', *Le Piccole Virtù*, Turin: Einaudi, 1998, trans. Ursula Armstrong.
2. Walter Pater, 'Diaphaneite' (1864), *Miscellaneous Studies. A Series of Essays*, London: Macmillan & Co., 1895, pp. 251–9.
3. Slavoj Žižek, *The Parallax View (Short Circuits)*, Cambridge, Mass.: MIT Press, 2006.
4. Immanuel Kant, *Critique of Judgement*, trans. James Creed Meredith, Oxford: Clarendon Press, 1952, p. 91.
5. Italo Calvino, *Invisible Cities*, trans. William Weaver, London: Vintage, 1974, p. 53.
6. I have been eclectic in my reading of mediation, drawing variously upon Hegel, Marx, Merleau-Ponty, Lefebvre. I am sympathetic to the openness of Bruno Latour approach. See 'How to be Iconophilic in Art, Science, and Religion', in Caroline A. Jones and Peter Galison, eds., New York and London: Routledge, 1998, pp. 418–40. He reads mediation in the familiar sense of the middle ground of mind and world (subject and object are therefore not separate). He argues that mediation is absent from the scene of action because it is not inscribed in it, but for that very reason accomplishes shifts of relationship that achieve a 'putting into presence' (p. 438) of experience. Mediation is a way of redirecting information (not transferring it), by transforming representation and re-embodiment. In much the same way glass redirects and embodies experience.

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