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Psychometric assessment of the Hallucinogen Rating Scale☆

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Abstract

Reliability and convergent-discriminant validity of a Spanish version of the Hallucinogen Rating Scale (HRS) were assessed in two differentiated populations of hallucinogen users involving the retrospective assessment of drug effects. In Study 1 (immediate assessment), 75 European users of the South American hallucinogenic drink *ayahuasca* answered the HRS 4 h after drug intake in their habitual setting. In Study 2 (delayed assessment), 56 adult polydrug users answered the HRS and a short form of the Addiction Research Center Inventory (ARCI) recalling the effects they experienced when they last took a hallucinogen, in order to test the convergent-discriminant validity of HRS with the scales of the standard questionnaire used in most studies involving psychoactive drugs. The HRS scales showed increases after both the immediate and delayed retrospective assessment of drug effects. Reliability data indicated that four of the six scales show an acceptable level of internal consistency. Significant but limited correlations were found between the Perception and Somaesthesia scales and the ARCI LSD scale, pointing out the questionnaire's construct validity. Thus, the HRS was sensitive to hallucinogenic drug effects other than those elicited by intravenous *N*,*N*-dimethyltryptamine (DMT), for which it was originally designed, and showed reasonable reliability and convergent validity. Results suggest its usefulness in the evaluation of subjective effects elicited by psychoactive drugs with hallucinogenic properties, and constitute a preliminary approach to the effects of *ayahuasca* in European subjects.

Keywords: Hallucinogen Rating Scale (HRS); Immediate versus delayed retrospective assessment; Subjective effects; Reliability; Convergent analysis

1. Introduction

Experimental studies involving hallucinogenic drug administration to human subjects have awakened renewed interest since the research of Hermle et al. (1992) and Vollenweider et al. (1997a,b,c) with model psychoses in Europe and Strassman's studies involving the administration of *N*,*N*-dimethyltryptamine (DMT) to healthy volunteers in the US (Strassman et al., 1994, 1996; Strassman, 1996). Before the resumption of clinical studies, these intriguing drugs had received little attention in psychiatry and human experimental psychopharmacology in the last two decades, despite their popularity as recreational drugs. Hallucinogen consumption, especially of LSD, rather than decreasing, has remained stable or even increased throughout the years and has recently won new impetus in the form of synthetic amphetamine derivatives such as MDMA (Pope et al., 1990; Schuster et al., 1998). Additionally, in Europe, a new pattern of use is emerging involving the so-called 'natural drugs' or 'shamanic inebriants', such as *peyote* (a mescaline-containing cactus) or *ayahuasca* (a DMT containing-drink) rediscovered by religious cults or 'new age' groups. Regarding *ayahuasca*, several groups ingesting this South American hallucinogenic drink have settled in recent years in several European countries, particularly in Holland, Italy, Germany and Spain. This hallucinogenic beverage is obtained from infusing various plants native to the Amazon Basin, habitually *Banisteriopsis caapi* and

☆ The full text of Appendix A is available at the journal website at http://www.elsevier.com/locate/drugalcdep under 'Supplementary Materials'.

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Psychotria viridis (Rivier and Lindgren, 1972). The drink contains both the potent short-acting hallucinogen DMT, the same used parenterally in Strassman's study, and several alkaloids known generically as beta-carbolines, which render DMT orally active by preventing its peripheral metabolism due to their monoamine oxidase inhibiting properties (McKenna et al., 1984; Callaway et al., 1999). This preparation is becoming increasingly popular in the countries mentioned above probably because it is a 'plant' drug (i.e. not the product of chemical synthesis) and because both the tea and the several religious groups which consume it in a ritual setting enjoy legal protection in Brazil. All these aspects have made it possible for a growing number of people to come into contact with *ayahuasca* outside South America.

The maintained prevalence of use of the classical hallucinogens, and the emergence of new patterns of use, including plant drugs and the widespread consumption of the so-called 'entactogenic' amphetamine derivatives, with mixed psychostimulant and hallucinogenic properties, have prompted new research efforts directed to clarify the complex psychological effects elicited by these agents. In this context, new psychometric research tools have been designed to quantify their effects on the central nervous system. By measuring the mood-, perception- and cognition-altering effects that are characteristic of a given drug, these instruments can help characterize their activity profiles over time and establish dose-response data. Although neuroendocrine and neurophysiological measures have also been tested for this purpose, the psychometric approach is still widely accepted, as such biological variables are usually less sensitive and specific. To date, no reliable unique biological measures are available to study dose-response relationships after the administration of hallucinogens to human subjects.

In the present study one intended both to approach the new phenomenon of *ayahuasca* use in Spain and further explore the sensitivity and psychometric properties of a recently developed instrument used to evaluate the perceptual, somatic and psychological effects of hallucinogenic drugs: the Hallucinogen Rating Scale (HRS). This self-report questionnaire was first designed to quantify the subjective effects experienced after the administration of DMT, and thus facilitate neuropharmacological research with these drugs in human subjects (Strassman, 1994, 1995). The items included in the questionnaire were originally generated by analyzing the verbal reports obtained after interviewing a number of experienced American DMT users. The resulting instrument was subsequently modified during the course of a controlled dose-response study conducted with DMT in 12 volunteers (Strassman et al., 1994). Its utility in human ketamine research (Bowdle et al., 1998) has also been demonstrated, and a recent study incorporated the HRS in the evaluation of the subjective effects elicited by psilocybin, MDE and methamphetamine in a group of healthy volunteers (Gouzoulis-Mayfrank et al., 1999). The items are grouped in six empirically-derived scales which, in the original dose-response study conducted by Strassman et al., and in subsequent DMT (Strassman, 1996; Strassman et al., 1996) and ketamine (Bowdle et al., 1998) studies, provided a better resolution of effects among doses than other biological variables used. The aim of the present study was thus to test whether the HRS was sensitive to the immediate and delayed assessment of hallucinogenic drug effects, and to explore its reliability and convergent validity, in order to establish its suitability for human psychopharmacological research with hallucinogens other than intravenous DMT.

2. Methods

A Spanish version of the questionnaire (Appendix A) was evaluated by means of two independent studies involving different approaches. Both study protocols had been previously reviewed by the Research Institute's review board. Approval by the hospital's Ethics Committee was deemed unnecessary, since both studies were non-experimental designs, that is the independent variable (drug ingestion) was not manipulated by the researchers. These non-experimental designs are more specifically known as ex post facto designs (DePoy and Gitlin, 1993).

In Study 1 the questionnaire was administered to a group of local users (Barcelona area, Spain) of *ayahuasca* immediately after one of their drug sessions (immediate retrospective assessment). In Study 2, one wished to compare the HRS results with those from the Addiction Research Center Inventory (ARCI), by means of a delayed retrospective assessment. The ARCI is the standard questionnaire used in studies involving drugs of abuse and includes a scale theoretically sensitive to the effects of hallucinogens (Haertzen et al., 1963; Haertzen, 1966, 1974). The HRS and a short version of the ARCI already validated into Spanish were administered to a group of polydrug users with experience in the consumption of hallucinogens. This time, volunteers were requested to answer both questionnaires recalling the effects they had experienced the last time they were under the influence of a hallucinogen. In both studies, reliability was assessed for each scale using Cronbach's alpha coefficient, and in the second study a convergent/discriminant analysis between the HRS and the ARCI scales was performed. This methodology would allow one first to cross-evaluate the HRS in two different samples and determine whether or not the instrument was sensitive to hallucinogenic drug effects in two different conditions (im-

mediate vs. delayed retrospective assessment of drug effects) and secondly, establish the HRS' convergent/discriminant validity with the most frequently used instrument in studies involving psychoactive drugs. The delayed retrospective assessment approach had already been used by Lamas et al. (1994) in their validation procedure of the Spanish version of the ARCI used in the present study.

2.1. Questionnaires

The HRS (version 3.06) was adapted into Spanish using the back-translation method, a judgmental method for investigating the conceptual equivalence (i.e. meaning symmetry) of the original and translated versions of a scale, necessary for valid cross-cultural comparisons (Berry, 1980). The HRS was translated independently by two Spanish researchers working in the field of psychopharmacology and with a good knowledge of the English language. These two Spanish versions were then contrasted and a final Spanish version was adopted. This was translated back into English by two independently working translators. The differences between retranslations were discussed and a final retranslated version was agreed upon. Finally, the original source and the back-translated items were compared for non-equivalence of meaning, and any discrepancies were noted. The translation-retranslation process was repeated several times until no semantic differences were noticed between the two questionnaire forms (Brislin, 1980).

The version of the American scale used in the present translation and evaluation is shorter than that used originally by Strassman et al. in their initial DMT dose-response study. The questionnaire has undergone several modifications and it now includes 71 items distributed in six scales: *Somaesthesia*, reflecting somatic effects including interoceptive, visceral and tactile effects; *Affect*, sensitive to emotional and affective responses; *Volition*, indicating the subject's capacity to willfully interact with his/her 'self' and/or the environment; *Cognition*, describing alterations in thought processes or content; *Perception*, measuring visual, auditory, gustatory and olfactory experiences; and finally *Intensity*, which reflects the strength of the overall experience (Strassman et al., 1994). The 71 items, their Spanish translation and their scale location are shown in Appendix A. All items are scored 0–4 (0 = not at all, 1 = slightly, 2 = moderately, 3 = quite a bit, 4 = extremely). Scorings on items 19, 62, 63, 64, 65, 66, 67 and 68 are inverted, since lower values are expected with increasing doses. The scores for the different scales are obtained by summing the scores obtained for the scale's individual items, divided by the number of items included in a given scale. A detailed account of item selection and scale development can be found in Strassman et al. (1994).

The short version of the ARCI used in the present study was an already existing Spanish version of Martin et al.'s widely used 49-item short form (Martin et al., 1971). It was translated and evaluated by Lamas and colleagues and has shown adequate reliability and discriminant validity (Lamas et al., 1994). It contains five scales or groups: MBG, morphine–benzedrine group, measuring euphoria; PCAG, pentobarbital–chlorpromazine-alcohol group, measuring sedation; LSD, lysergic acid diethylamide scale, which measures dysphoria and psychotomimetic effects; BG, benzedrine group, a stimulant-sensitive scale; and the A scale, amphetamine, sensitive to the effects of *d*-amphetamine. Alpha coefficients for these scales range from 0.49 to 0.87.

2.2. Study 1

2.2.1. Subjects

Prior to the study, several groups taking *ayahuasca* for recreational purposes in the Barcelona area (Spain) were contacted. In this preliminary evaluation of the HRS' sensitivity to the subjective effects elicited by a hallucinogen other than intravenous DMT, emphasis was placed on obtaining as large a sample of users as possible, which inevitably militated against its homogeneity. It was also not feasible to obtain a psychological or psychiatric profile of the participants. Nevertheless, sex, age and number of previous ingestions were recorded. The nature and goals of the present study were explained to them, and a total of 75 adult *ayahuasca* users gave their written informed consent to participate. After pooling the questionnaires, four subjects were excluded because of unanswered items. The final study sample consisted of 71 subjects (38 men and 33 women) with a mean $\pm$ S.D. age of 36.59 ± 7.89 years (range: 18–50). Thirty-three subjects had ingested *ayahuasca* tea between 1 and 5 times (46.5%); 11 had between 6 and 10 times (15.5%) and 27 had taken it more than 10 times (38%).

2.2.2. Study procedure

The subjects were requested to complete the questionnaire on a single occasion 4 h after *ayahuasca* ingestion, once the psychoactive effects had resolved. Instructions were given by one of the researchers or by a trained collaborator in the habitual setting where the subjects ingested the tea. They were asked to answer according to the effects experienced on that particular occasion and to answer each item according to the maximum intensity with which each effect was felt, thus avoiding the possibility of doubt in case the same effect had been felt with different intensities on different occasions.

2.3. Study 2

2.3.1. Subjects

Fifty-six polydrug users (48 men and eight women), with a mean ($\pm$ S.D.) age of 26 ± 6.72 years and previous experience with hallucinogens, were recruited by word of mouth, in collaboration with the methadone maintenance program of the Hospital de Sant Pau, Barcelona. Eligibility criterion was hallucinogen use during the last 5 years. Of the 56 subjects included, four had used a hallucinogen the preceding week (7.1%); 16 during the preceding month (28.6%); another 16 during the preceding year (28.6%) and 20 during the last 5 years (35.7%). Regarding present use of other illicit drugs, 50 of the 56 subjects admitted they were presently taking the following: cannabis ($n = 47$), cocaine ($n = 27$), amphetamine ($n = 21$), MDMA ($n = 15$), opiates ($n = 10$) or others ($n = 10$). Prior to participation, the subjects signed a written informed consent.

2.3.2. Study procedure

In this second study, a delayed retrospective assessment (also termed 'simulation' by some authors, see Lamas et al., 1994) approach was used. That is, subjects were requested to complete the HRS and the ARCI according to their recollection of the effects they had experienced when they last took a hallucinogen. Again, they were instructed to indicate the maximum intensity with which a particular effect had been felt (HRS) and to answer 'true' or 'false' (ARCI) depending on whether a particular statement applied to their last experience with a hallucinogen. The order of administration of the two questionnaires was balanced to avoid an effect of order in the responses.

2.4. Data analysis

Two criteria were considered in the analysis of the Spanish version of the HRS scales: (1) reliability, measured using Cronbach's alpha coefficient (studies 1 and 2); and (2) convergence-discriminance between the HRS and the ARCI scales (study 2). This validity criterion was assessed by studying correlations between the HRS and ARCI scales. The occurrence of a significant correlation was hypothesized between at least the Somaesthesia scale included in the HRS and the ARCI LSD scale, together with an absence of significant correlations between the six HRS scales and the other four ARCI scales, as the ARCI LSD scale is known to reflect basically the somatic-dysphoric effects elicited by hallucinogens. Reliability and intercorrelations of the ARCI scales are also presented in Section 3.

Additionally, in order to cross-evaluate the pattern of responses in both samples, where different methodological approaches had been used, the following analysis was performed: First, Pearson's product-moment correlations among the six HRS scales were computed in both samples. Subsequently, a Principal Component Analysis was performed on the correlation matrix thus obtained.

The purpose of this analysis was merely to compare results obtained in the two different samples. Scale development has been reported previously (Strassman et al., 1994) and one desired to maintain the questionnaire's original structure, so no first order Principal Component Analysis was performed on the individual items. Moreover, the small sample size precluded such an approach.

Once the product-moment correlations were obtained, the decision about the appropriate number of factors was made considering those factors with an eigenvalue greater than 1. Oblique rotation of the principal components extracted was preferred to orthogonal rotation because of the intensity of the correlations obtained between some scales. In order to test the null hypothesis stating that the factor structure was similar in the two samples studied, both factor solutions were compared. The similarity of both oblique factorial solutions obtained in the two samples was evaluated using the following indices: (a) the factorial congruency index (Harman, 1976); (b) the discrepancy or distance index, which is the square root of the average squared difference between the corresponding elements of the respective columns of factor loadings (Mulaik, 1972); (c) the non-parametric salience index, s (Cattell and Baggaley 1960); and (d) Pearson's r between Fisher's Z-transformed factor loadings. Different indices were used because of controversy among authors over the most appropriate index to be employed. However, Cattell (1978) indicated that these four indices tend to yield similar results. Good agreement between factors in the different samples would yield a congruency index near 1 (acceptable values are those above 0.90), a discrepancy index near zero, and salience and Fisher's Z-transformed index values near 1.

3. Results

3.1. Mean scores and reliability of the HRS scales

Both the subjective effects elicited by *ayahuasca* (immediate assessment, Study 1) and the recollection of previous hallucinogen-induced subjective effects (delayed assessment, Study 2) produced increases in the six HRS scales. Mean scores, standard deviations and reliability estimates (Cronbach's alpha) obtained for the six HRS scales in studies 1 and 2 are shown in Table 1. In Study 1, alpha coefficients for Perception, Cognition, Somaesthesia and Affect were adequate and acceptable (range between 0.81 and 0.88), reflecting a good degree of internal consistency. However, alpha coefficients for

the Intensity and Volition scales failed to reach a reasonable value. The Intensity scale showed the lowest internal consistency of the six scales. In Study 2, alpha coefficient values for the HRS scales replicated those found in Study 1, showing similar figures, especially for Perception and Cognition and to a lower extent for Somaesthesia and Affect. Although the Intensity scale reached a higher alpha value in this sample than in the previous sample, it was still low for an acceptable internal consistency.

3.2. Intercorrelations and principal component analysis: cross-evaluation of the two samples

Pearson's product-moment correlations between HRS scales are also shown in Table 1.

The highest correlations were found between Perception and Somaesthesia (Study 1) and between Affect and Cognition (Studies 1 and 2). Volition was the only scale inversely related to the rest, showing the lowest correlations in the matrix. This pattern of correlations between Volition and the other scales suggested that Volition was measuring a different construct or mapping a different content compared to the other HRS scales, which were all positively related in the correlation matrix.

The pattern of correlations obtained in the two samples showed a high degree of similarity. To further test this behavior a principal component analysis of intercorrelations between the HRS scales was performed. This analysis rendered in Study 1 two factors explaining approximately 75% of the variance in the correlation matrix (first factor: 57.5%; second factor, 16.8%). After an oblique rotation of both factors, a clear pattern appeared, showing a negative association between the two components (see Table 2), the correlation between both being $r = -0.19$. The first component included Somaesthesia, Perception, Cognition, Affect and Intensity; and the second component included only the Volition scale. The same analysis was performed with the factor matrix obtained in Study 2. As shown in Table 2, the factorial matrix was practically equal in both samples. Taken together, the two factors that emerged explained approximately 68% of the variance in the

Table 1
Intercorrelations (Pearson's r) among Hallucinogen Rating Scale (HRS) scales in the two samples studied, plus means ± S.D. and reliability coefficients associated with each HRS scale in the two samples[a]

	Aff.	Cog.	Int.	Per.	Som.	Mean ± S.D.	Alpha
Aff.	1					1.82 ± 0.58	0.81
Cog.	0.69**	1				1.92 ± 0.77	0.87
Int.	0.39**	0.55**	1			2.56 ± 0.58	0.33
Per.	0.53**	0.65**	0.48**	1		1.87 ± 0.70	0.88
Som.	0.63**	0.66**	0.52**	0.74**	1	1.45 ± 0.64	0.82
Vol.	−0.30*	−0.23*	−0.24*	−0.06	−0.13	1.42 ± 0.44	0.51
Aff.	1					1.75 ± 0.47	0.72
Cog.	0.70**	1				1.85 ± 0.72	0.86
Int.	0.34**	0.45**	1			2.49 ± 0.62	0.50
Per.	0.62**	0.66*	0.49**	1		1.72 ± 0.73	0.91
Som.	0.49**	0.40**	0.27**	0.47**	1	1.76 ± 0.63	0.71
Vol.	0.12	−0.09	−0.09	0.05	0.02	1.58 ± 0.48	0.54

[a] Upper and lower panels show data for study 1 ($N = 71$) and study 2 ($N = 56$), respectively. Aff. = affect, Cog. = cognition, Int. = intensity, Per. = perception, Som. = somaesthesia.

* $P < 0.05$;

** $P < 0.01$ (two tailed).

Table 2
Oblique rotated factor pattern matrix for the Hallucinogen Rating Scale (HRS) scales in the two samples studied

	Study 1 ($N = 71$)			Study 2 ($N = 56$)	
	1st Factor	2nd Factor		1st Factor	2nd Factor
Somaesthesia	0.9074	0.1236	Somaesthesia	0.6690	0.1160
Perception	0.8949	0.2351	Perception	0.8589	0.0411
Cognition	0.8563	−0.0836	Cognition	0.8484	−0.1251
Affect	0.7458	−0.2183	Affect	0.8444	0.1985
Intensity	0.6684	−0.1536	Intensity	0.6277	−0.3084
Volition	−0.0344	0.9639	Volition	0.0480	0.9543

Table 3
Means, S.D., reliability coefficients and intercorrelations (Pearson's r) among Addiction Research Center Inventory (ARCI) scales[a]

	A	BG	LSD	MBG	PCAG
BG	0.66**				
LSD	0.05	−0.14			
MBG	0.62**	0.38**	−0.11		
PCAG	−0.19	−0.35**	0.29*	−0.14	
Mean	6.39	3.75	3.02	9.84	−0.80
S.D.	1.87	2.12	2.42	3.54	1.81
No. items	11	13	14	16	15
Alpha	0.42	0.48	0.57	0.70	0.30

[a] $N = 56$; PCAG, pentobarbital–chlorpromazine–alcohol group; LSD, lysergic acid diethylamide scale; BG, benzedrine group; A, amphetamine; MBG, morphine-benzedrine group.
* $P < 0.05$;
** $P < 0.01$ (two tailed).

second study (first factor: 50.2%; second factor: 17.9%), and, again, they showed a slight negative association ($r = -0.3$).

The similarity evaluation of the two oblique factorial solutions yielded the following indices for the first and second component, respectively: congruency index = 0.99 and 0.99; discrepancy index = 0.08 and 0.08; salience index = 1 and 1; and Fisher's Z-transform index = 0.97 and 0.99.

3.3. Convergent and discriminant validity of the HRS scales

The ARCI scales were used to assess convergent and discriminant validity of the HRS in Study 2. Mean scores, standard deviations, alpha coefficients and intercorrelations between the ARCI scales are shown in Table 3. As can be seen, the delayed assessment of hallucinogen effects produced increases in the MBG and A scales, and to a lower extent in the BG and LSD scales, in relation to the number of items. Scale A strongly correlated with both the BG and MBG scales. This correlation between the A and BG scales replicates that ($r = 0.70$) reported by Lamas et al. (1994) in their validation study. In addition, the BG scale was positively related to the MBG scale although with less intensity. As a group, these three scales could be considered to reflect stimulating effects. All three correlated negatively with the PCAG scale. In addition, the LSD scale was positively correlated with PCAG and tended to be inversely related with the three stimulant-sensitive scales, although in no case did correlations reach a significant value.

Correlations between the HRS (including a global score for the HRS obtained by summing the individual scores in the six scales), and ARCI scales are shown in Table 4. As hypothesized, a convergent correlation was obtained between the LSD scale and the HRS scales. The highest significant correlations were found with the Somaesthesia and Perception scales. The global HRS score was also significantly correlated with the LSD scale ($r = 0.32$, $P < 0.05$). In contrast, the stimulant-sensitive scales, A and BG did not correlate significantly with the different HRS or the global score, whereas MBG showed a significant correlation with the Intensity scale ($r = 0.32$, $P < 0.05$), but correlated negatively with the global HRS score. An exception to this behavior was the two significant negative correlations found between Volition and the A and BG scales. These correlations were consistent with the results mentioned above, and further support the hypothesis that the Volition scale was measuring an independent dimension not reflected by the other five scales.

A non-predicted correlation was obtained between PCAG and the HRS scales, mainly Cognition and Somaesthesia, also observed with the global HRS score ($r = 0.39$, $P < 0.01$). It should be noted, however, that PCAG and LSD share a number of items, and as the ARCI correlations already showed these two scales are partially related. In order to remove the influence of the LSD scale on PCAG scores, the partial correlation between the global HRS score and PCAG was computed ($r = 0.29$, $P < 0.05$). Although this correlation was lower than the previous one, it was still significant and indicated a positive relation between PCAG and some HRS scales. This unexpected correlation should

Table 4
Correlations (Pearson's r) among Hallucinogen Rating Scale (HRS) and Addiction Research Center Inventory (ARCI) scales in Study 2[a]

	Affect	Cognition	Intensity	Perception	Somaesth.	Volition	Global
A	−0.03	−0.02	−0.06	−0.05	0.13	−0.27*	−0.06
BG	−0.16	−0.06	−0.10	−0.09	−0.10	−0.27*	−0.18
LSD	0.14	0.23	0.23	0.28*	0.33*	0.03	0.32*
MBG	0.04	−0.01	0.32*	−0.01	0.10	−0.19	−0.07
PCAG	0.36	0.29*	0.21	0.19	0.38*	0.15	0.39**

[a] $N = 56$; Global, global HRS score; PCAG, pentobarbital–chlorpromazine–alcohol group; LSD, lysergic acid diethylamide scale; BG, benzedrine group; A, amphetamine; MBG, morphine–benzedrine group.
* $P < 0.05$;
** $P < 0.01$ (two tailed).

be interpreted cautiously, given the low alpha value obtained for PCAG in the present study, and considering the fact that Haertzen (1974) had already described a high correlation between the PCAG and LSD scales.

4. Discussion

The purpose of the present study was to test the sensitivity of the HRS to a hallucinogenic drug other than intravenous DMT and to evaluate the reliability and validity of the questionnaire in two different populations of hallucinogen users, implying the immediate and delayed retrospective assessment of hallucinogenic drug effects. Results showed increases in the six scales in both samples and acceptable reliability values in four of the six HRS scales. Significant correlations were also found between the Perception and Somaesthesia scales with the ARCI LSD scale.

One of the most interesting aspects of the data presented above is the notable similarity of the psychometric indices obtained in the two studies undertaken in the evaluation process.

Despite the limitations associated with the heterogeneous nature of the studied samples, similar alpha values were obtained in five of the six HRS scales using quite different approaches, one involving the immediately preceding consumption of a hallucinogen, and the other the recollection of drug effects more distant in time. Alpha values obtained for Perception, Cognition, Somaesthesia and Affect indicated a good internal consistency for these four scales in both studies. Only two scales, Volition and Intensity, yielded poorer levels, indicating a non-uniform covariation of items or, as was very likely the case for the Intensity scale, too low a number of items. The number of items included in this scale is indeed lower than in the other five (only four items), and as alpha values depend on the number of items (McDonald, 1998), this could explain the poor internal consistency found for this scale. To the authors' knowledge, no reliability analyses have been published regarding the original American questionnaire or any of the existing translations of the HRS. One is consequently unable to compare the alpha values with those from other studies, but they objectively reflect a good degree of internal consistency in at least four of the six scales.

The equivalence of the two different assessment approaches used in the present study, that is immediate versus delayed, was further confirmed by the principal component analyses performed. Similarity indices showed a high degree of convergence between the two factorial solutions extracted. Consequently, it can be inferred that the same underlying factors accounted for the relationships among variables in both cases. Furthermore, mean values obtained for the HRS scales in studies 1 and 2 were similar and higher than those reported by Grob et al. (1996) in a study in which a moderate-low dose of *ayahuasca* was administered, and fall between the scores obtained with dosage levels of 0.2–0.4 mg/kg IV DMT, in the study of Strassman et al. (1994), reflecting a full hallucinogenic effect. These data would support the value of delayed retrospective assessment of drug effects as a questionnaire-validation procedure, as previously suggested by Haertzen (1974) and Lamas et al. (1994) regarding the ARCI.

Before performing the convergent-discriminant analysis between the HRS and the ARCI, the internal consistency of the ARCI scales was studied. For some of them, Cronbach's alpha values tended to be lower in the sample than those reported in the original adaptation of the instrument (Lamas et al., 1994). Alpha coefficients were similar for MBG, LSD and A scales, but PCAG obtained a considerably lower value in the sample than in the original study. The BG scale also yielded a lower value in the present analysis. Showing a pattern described in previous studies, A, MBG and BG correlated strongly with each other. In this study, they showed negative correlations with PCAG and LSD, and these two scales showed a significant positive correlation.

Consistent with the hypothesis, the highest correlations between questionnaires were found between several HRS scales and the LSD scale included in the ARCI. LSD correlated significantly with Perception, Somaesthesia and the global HRS score. This pattern of convergent correlations is also an index of the construct validity of these scales (Cronbach and Meehl, 1955). The results obtained indicate that the ARCI LSD and the HRS (in a global sense) are measuring the same construct, though probably covering different aspects, given the moderate values of the correlations obtained. Regarding the already-mentioned correlation between PCAG and several HRS scales, no explanation was found other than the variance shared between PCAG and LSD scale (8%). Haertzen (1974) reported a 0.44 correlation between the two scales. Although high scores were obtained for the stimulant-sensitive ARCI scales (MBG, A, BG), no correlations were found between these and the HRS scales except between MBG and Intensity, a correlation that was not present when the global HRS score was considered. This can be interpreted as an ability of the Intensity scale to capture the euphoria and the stimulating aspects of hallucinogen-induced phenomena. This ability is not observed when the global HRS score is considered, presumably indicating a greater sensitivity of the HRS to hallucinogenic than stimulant effects. Although the second highest, the correlation between the global HRS score and the LSD scale was modest, explaining only 10% of the variance. This suggests that the dysphoric somatic effects measured by the LSD scale (Haertzen, 1974) are

part of the effects elicited by hallucinogens only to some extent, but are by no means central to the experience, as has long been argued.

Finally, a brief comment on the specificity of the HRS must be made. In Study 2, data on non-hallucinogen effects were not collected, so conclusions on this aspect of the questionnaire can not be drawn. Future studies should address this issue by asking drug abusers to score the HRS for their recollection of a wider variety of drug experiences.

To summarize, the similar results obtained in the two different settings indicate that the HRS was effectively sensitive to hallucinogenic drug effects in the samples, other than intravenous DMT, and also demonstrate the value of delayed retrospective assessment of drug effects in validation procedures. Four out of six scales showed an acceptable degree of internal consistency and therefore reasonable reliability. The HRS Intensity scale showed a positive correlation with an ARCI stimulant-sensitive scale (MBG). This pattern was not seen for the other five scales, probably indicating the questionnaire's greater sensitivity to hallucinogenic than stimulant effects. Finally, the HRS showed a significant but limited correlation with the LSD scale of the ARCI, which met the authors' expectations. In view of the results obtained in the present study, one believes the HRS will prove a valuable instrument in the assessment of subjective effects in those research trials involving the administration of drugs with hallucinogen-like properties. Nevertheless, future dose-response studies using both the HRS and the ARCI will help clarify the ability of the first to reflect and measure additional aspects of hallucinogen-induced phenomena, other than the somatic-dysphoric symptoms measured by the ARCI.

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