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Computerized binary scale of auditory speech hallucinations (cbSASH)

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Abstract

Background: Evidence indicates that the neuropathology of auditory verbal hallucinations (AVH) varies according to their phenomenological characteristics. Therefore, AVH should be subgrouped accordingly in hallucinations research. As evaluation of these characteristics depends entirely on the patient report, obtaining measurement of the reliability of these reports is crucial.
Method: A computerized binary scale of auditory speech hallucinations (cbSASH) was developed to evaluate the phenomenology of AVH. It includes two subscales (inconsistency and malingering) to assess the reliability of the patient report. The cbSASH was administered along with MMPI-2, a general psychopathology scale, which includes similar validity subscales. Thirty-four psychotic patients with history of AVH were enrolled in this study.
Results: The scores on the inconsistency and malingering subscales of the cbSASH were correlated with the scores on the corresponding validity subscales in the MMPI-2. The combination of the malingering and inconsistency subscales provided robust measures of the reliability and ability of the patients' descriptions of their hallucinations.
Conclusion: The cbSASH provides a reliable and comprehensive evaluation of the phenomenology of AVH. Consequently, it is possible to subgroup patients according to the characteristics of their hallucinations. This refinement of AVH phenotypes could reduce the noise and inconsistency noted in AVH and psychosis research.

Keywords: AVH; Schizophrenia; Phenotype; Endophenotype; Validity measures

1. Introduction

Auditory speech hallucinations, commonly referred to as auditory verbal hallucinations (AVH), are one of the principal symptoms of psychosis. AVH have been the subject of important research efforts that used a wide

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range of methodology including phenomenological, neuropsychological, structural and functional brain imaging, and treatment intervention. This research generated important insights into the mechanisms of AVH, however, a significant degree of inconsistent findings across studies remains (Stephane et al., 2001a). Furthermore, the neural correlates of the hallucinatory experience are often found to be different across patients within a given study (Van de Ven et al., 2005; Silbersweig et al., 1995). This state of affairs could be partially related to the phenomenological heterogeneity of AVH.

Verbal hallucinations differ along multiple phenomenological variables (Table 1) such as presence or absence of insight into the abnormal nature of AVH, systematized or repetitive content, and the acoustic quality of the "voices". The phenomenological diversity of AVH has been observed since early last century and many attempts have been made to classify AVH in subgroups according to their phenomenological characteristics (Jaspers, 1959; Claude and Ey, 1932; Nayani and David, 1996). Furthermore, it has been suggested that the neuropathology of AVH varies according to the phenomenological characteristics of hallucinations (Stephane et al., 2003; Van de Ven et al., 2005).

In support of the latter hypothesis, a wide range of evidence could be found in the literature. For example, studies report that the neural correlates of perceiving verbal sounds differ according to the location of perception (i.e., inside or outside the head; Hunter et al., 2003) and according to the gender of the perceived sound (Sokhi et al., 2005). As AVH consist of male, female, or gender ambiguous "voices" experienced inside or outside the head, these subtypes of hallucinations could correspond to different neural correlates. Another example is that of anosognosia (i.e., the unawareness of the abnormal nature of AVH). Anosognosia of neurological symptoms is related to neural

Table 1
The phenomenological variables of AVH

(1) Acoustic qualities
  (a) Clarity
    (i) Clear (like external speech)
    (ii) Deep (like internal speech or thinking in words)
  (b) Personification
    (i) Man's voice
    (ii) Women's voice
    (iii) Robot voices
  (c) Loudness (does AVH have loudness)
    (i) No
    (ii) Yes
      (1) Level
        (a) Like normal conversation
        (b) Louder
        (c) Softer
      (2) Does loudness vary with time?
(2) Location
  (a) Inner space
    (i) Head
    (ii) Other parts of the body
  (b) Outer space (if yes)
    (i) Distance
      (1) Within hearing
      (2) Outside of hearing range
    (ii) Relation to the sensation field (through ears)
      (1) Yes
      (2) No
  (3) Number
    (a) One
    (b) More than one (if more than one)
  (4) Direction
    (a) Voices talk among themselves
    (b) Voices talk to the patient
(5) Linguistics
  (a) Syntax
    (i) First person
    (ii) Second person (You, name)
    (iii) Third person (he/she, name)
  (b) Complexity
    (i) Hearing words
    (ii) Hearing sentences
    (iii) Hearing conversations
(6) Relation to the moment (related to thoughts or action at the moment when heard)
  (a) Yes
  (b) No
(7) Content
  (a) Range
    (i) Repetitive
    (ii) Systematized
  (b) Focus
    (i) Self
    (ii) Non-self
(8) Order
  (a) First order (hear)
  (b) Second order (talk back to the voices)
  (c) Third order (converse with the voices)
(9) Replay
  (a) Experiential (previously heard)
  (b) Patient speech
  (c) Patient thoughts
(10) Source attribution
  (a) Self
  (b) Other (if yes)
    (i) Someone familiar
    (ii) God/spiritual being
    (iii) Deceased person
(11) Time course
  (a) Time dimension
    (i) Constant
    (ii) Episodic
  (b) Modulation
    (i) Worsening modulators
    (ii) Improvement modulators
(12) Mode of occurrence
  (a) Spontaneous
  (b) Triggered (if triggered)
    (i) Inducible by will
    (ii) Other triggers
(13) Concomitance (to)
  (a) Speaking
  (b) Listening to speech
  (c) Listening to non-speech sounds
  (d) Activities requiring attention
(14) Control strategies
  (a) Listening to speech
  (b) Speaking
  (c) Listening to non-speech sounds
  (d) Activities requiring attention
  (e) Other control strategies
(15) Safety
  (a) Affect safety
  (b) Does not affect safety
(16) Affective relatedness
  (a) Comforting
  (b) Bothersome
(17) Nosognosia
(18) Association with other abnormal perceptions
(19) Concomitance with other abnormal perceptions
(20) Stability of the characteristics overtime

specificity (Babinski, 1914). Therefore, AVH–a symptom of a diseased brain–should have neural correlates that differ according to the presence or absence of anosognosia.

Furthermore, some treatment studies bring additional support to the above theory of phenomenological neuropathological correlations of AVH. In one study (Miller, 1996), it was found that current pharmacological treatments affect phenomenological variables differentially. Variables such as frequency, intensity, and behaviors related to hallucinations are improved with treatment while variables such as duration and acoustic quality are not. In another paper (Stephane et al., 2001b), preliminary evidence shows that a subtype of hallucinations–those with repetitive content–responds to an unconventional treatment by the antiobsessional agent fluvoxamine. These findings indicate that it is necessary to monitor how AVH are altered with treatment rather than just monitor their presence or absence, but also that differential neurobiologies underlie the phenomenological variables of AVH.

Given the above considerations, it is necessary to subgroup patients according to the phenomenological variables of their AVH in hallucinations and psychosis research. With this approach, the heterogeneity confound could become a methodological advantage. AVH heterogeneity may provide a clinical window onto the diversity of underlying pathological processes.

Currently, the assessment instruments of general psychopathology such as the structured clinical interview for DSM IV (SCID), brief Psychiatric Rating Scale (BPRS) (Overall and Gorham, 1962), and the Positive and Negative Symptoms Scale (PANSS) (Kay et al., 1998) rate only a few variables (e.g., whether the voices are commenting, or whether they are associated with other modalities of hallucinations). Other instruments for specific assessment of AVH (Miller, 1996; Haddock et al., 1999; Chadwick et al., 2000) provide only partial phenomenological evaluation. These instruments assess the severity of hallucinations on a continuous scale, have good inter-rater reliability, and, generally, were validated against another scale. The inter-rater reliability addresses the imprecision of the assessment of severity on a continuous scale; however, the process of validation against another scale is based on a potentially flawed methodology. A given rater scores an item on the scale under study and the same (or similar) item on a previously published scale, and then correlations between the two scores are examined.

Furthermore, the assessment of AVH, like other psychiatric symptoms, depends entirely on the patients' reports. While most subjects would describe their experiences in an honest manner some may exaggerate or minimize their experiences for a wide range of benefits (Resnick, 1997). Others may be unable to describe their experiences or their experiences cannot be adequately described in terms of the question asked. Therefore, it is important to evaluate the reliability of the patient reports for adequate characterization of AVH.

To address these shortcomings, we developed a computerized binary Scale of Auditory Speech Hallucinations (cbSASH). It provides a comprehensive assessment of the phenomenology of AVH along with measures of the reliability of the patient report. The latter consists of two subscales for inconsistency of the patient report and malingering. In this study, we examine the psychometric properties of these subscales against the psychometric properties of similar established validity subscales in the MMPI-2 (Butcher et al., 1989). The validity subscales of the MMPI have been proven stable measurements of test taking attitude over a span of 40 years of a person's life (Greene, 1990; Pancoast and Archer, 1989). Unlike the validation method of above-mentioned scales, the individual items in the cbSASH and MMPI-2 subscales are different but with presumed similar psychometric properties.

The cbSASH characterization of AVH depends on the phenomenological variables identified in a previous paper (Table 1; Stephane et al., 2003). All variables have binary values. Some variables lend themselves readily to binary coding (e.g., "content range": the voices have either repetitive or systematized content), whereas other variables do not. For the latter variables, where there are no empirical data or reasonably safe a priori assumptions to suggest mutually exclusive values, each variable was further subdivided into two variables, and the division was repeated until mutually exclusive values were achieved (e.g., there is no empirical data to suggest that AVH should occur exclusively either in inner or outer space). Therefore, the variable "space location" was broken down in two variables with mutually exclusive values: inner space location and outer space location.

The binary encoding, as argued above, is motivated by evidence driven theoretical considerations about the possible pathophysiology of AVH subtypes (Stephane et al., 2003). Another advantage of binary coding is that it could minimize the subjective error of assessment along a continuous scale. Furthermore, it is possible that a computerized assessment of the characteristics of AVH is more accurate than ratings by a life professional. The patient may try to meet what he perceives as the

expectation of the test administrator, or take an adversary attitude against him or her.

2. Method

2.1. Subjects and procedures

34 patients (31 males, 3 females) meeting the DSM-IV criteria for schizophrenia or schizoaffective disorder with a history of AVH participated in this study. They were recruited from the outpatient clinic at the Minneapolis VA Medical Center (VAMC). All subjects gave written informed consent approved by the VAMC and the University of Minnesota Institutional Review Boards. Diagnostic evaluation was carried out by a master level research assistant who was trained to use the structured clinical interview for DSM-IV (SCID). Consensus diagnosis was established with the treating psychiatrist or by three other psychiatrists when the treating psychiatrist was not available.

The severity of psychopathology was assessed with the Brief Psychiatric Rating Scale (BPRS) (Overall and Gorham, 1962), and the Positive and Negative Symptoms Scale (PANSS) (Kay et al., 1998). The duration of illness was derived from reviews of patient records. All patients but one were medicated with atypical antipsychotic medications. The chlorpromazine equivalent doses of medications were estimated according to the methods of Woods (2003), and Van Kammen and Marder (1995). Measures of premorbid intellectual functioning were obtained by the National Adult Reading Test (NART) (Blair and Spreen, 1989). Table 2 summarizes the clinical and background data of our sample.

The subjects underwent testing by the MMPI-2 and the cbSASH described below either on the same day or no longer than 2 weeks apart. These procedures were administered in random order.

Table 2

	Minimum	Maximum	Mean	Standard deviation
(a) Demographics of the patients				
Age	35	64	51.97	6.398
Education level (EL)	10	21	13.35	2.186
Parents EL	5	16	10.97	2.636
NART_Verbal	84.2	116.2	99.573	9.5809
NART_Performance	98.4	113.5	105.693	4.5178
NART_Full score	88.8	116.9	102.257	8.3881
(b) Clinical characteristics of the patients				
BPRS	31	67	46.32	11.405
SANS-total	0	19	7.93	4.835
SAPS-total	0	16	8.27	4.653
Duration of illness	3	38	22.38	9.994
Chlorpromazine equivalent dose	100	1250	378.06	220.45

2.2. cbSASH

The cbSASH includes three subscales: phenomenological, inconsistency and malingering subscales. All items are yes or no questions. The phenomenology subscale consists of 127 questions based on the phenomenological variables in Table 1. The latter two subscales explore the test taking attitude of the subject.

The inconsistency subscale contains 11 pairs of questions. Each item of the pair consists of the same question worded differently (e.g., "I hear conversations"; "The voices have conversations"). Inconsistent responses are yes–no or no–yes (5 pairs), yes–yes or no–no (6 pairs).

The malingering subscale includes 30 questions of a priori rarely endorsed questions as per the clinical experience of the authors and the literature (e.g., "The wind seems to blow the voices in my head").

The order of the presentation of the questions was fixed. The items of the inconsistency pairs were separated by 50–100 questions. The questions from the malingering subscale were placed next to similar phenomenological questions (e.g., "I hear voices when I feel bloated" was placed next to "I hear voices when I feel depressed"; "The voices change sex in the middle of the sentence" was presented after "The voices sound like men talking"). The scale was programmed using Eprime (Psychology Software Tool, Pittsburgh, PA). Patients were instructed to take as much time as needed before responding and the questions remained on the screen until a response was made. There was 1 s blank screen before the subsequent question appeared. The administration time was between 30 and 45 min.

3. Analyses

All analyses were performed using the statistical package SPSS 13.0 (Chicago, IL). The frequency of endorsement of all items in the cbSASH was obtained in order to verify the validity of the a priori assignment of some items to the malingering subscale.

To evaluate the psychometric properties of the malingering and inconsistency subscales of the cbSASH, correlation analyses were carried out between those subscales and the corresponding subscales in the MMPI-2: the infrequency scales (F, Fb, and Fp; hereafter collectively referred to as Fs), and the variable response

inconsistency (VRIN), respectively. The fraction of endorsed or inconsistent items was used in these analyses.

Discriminant analyses were performed to evaluate the discriminatory properties of the malingering and inconsistency subscales in the cbSASH between the malingering/non-malingering, inconsistent/consistent, and malingering and inconsistent/non-malingering and consistent subgroups as defined based on the MMPI-2 subscales. We used the Fp subscale to define the first two groups as the normative population for this scale was based on patient populations. Therefore, it is appropriate for the definition of malingering and non-malingering hallucinating patients. The inconsistency subgroups were defined based on the VRIN subscale as it has the same design as the inconsistency subscales in the cbSASH.

4. Results

4.1. The a priori malingering subscale item assignment

The items from the malingering subscale were endorsed less frequently (21.1%) than the items in the phenomenology subscale (58.8%), Fig. 1A. The distribution of the percentage of endoresement of each question is presented as a cumulative distribution function for the malingering and phenomenology subscales in Fig. 1B. It can be noted that the rate of endorsement of all items in the malingering subscale is below 40%. Some of the items of the phenomenology subscale have a similarly low frequency as items in the malingering subscale. Upon examination of such items (e.g., "I hear voices more when I stop drinking alcohol"), it was reasonable to assume that these items have a true low frequency in our sample. Therefore, our a priori assignment of the items into malingering and phenomenology subscales was retained.

4.2. Correlation analyses

The correlation between the scores on the malingering and inconsistency subscales and corresponding subscales in the MMPI-2 (i.e., Fs and VRIN) is indicated in Table 3. The scores on the inconsistency subscale were significantly correlated with the VRIN scores. Similarly, the scores on the malingering subscale were significantly correlated with the scores on the Fs subscales. As anticipated, the highest correlations of the malingering score were found with the Fp subscale. This is likely related to the similarity of design as both subscales are based on normative patients' population.

4.3. Malingering and inconsistency scores across groups of patients

According to the *T*-scores on the VRIN and Fp subscales, the patients were divided into subgroups: inconsistent (IC) (VRIN>65) vs. consistent (C) (VRIN<65), and malingering (M) (Fp>65) vs. non-malingering (NM) (Fp<65). The scores on the malingering and inconsistency subscales of the cbSASH were compared between these subgroups. The average scores per group are plotted in Fig. 2.

The IC subgroup had significantly different scores from the C subgroup on the inconsistency ($t(32)=2.888$,

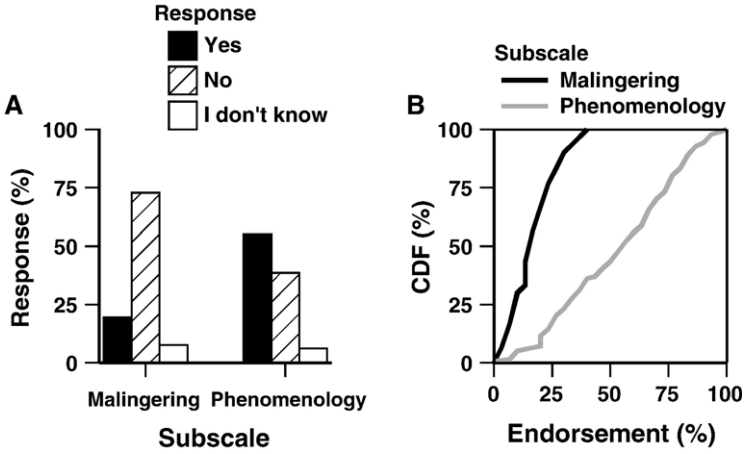

Fig. 1. (A) Counts of yes, no, and unsure responses for the combined items of the malingering and phenomenology subscales, (B) Cumulative distribution function (CDF) of endorsement of the questions from the Malingering subscale (Black line) and from the Phenomenology subscale (Gray line). The figure shows that the Phenomenology questions were endorsed more frequently than the Malingering questions.

Table 3
Correlations (Spearman ρ, $N=34$) between cbSASH malingering and inconsistency subscales and MMPI F, Fb, Fp and VRIN subscales

cbSASH		MMPI			
		F	Fb	Fp	VRIN
Malingering	ρ	0.363	0.51	0.592	0.53
	p	0.035	0.002	0.0002	0.001
Inconsistency	ρ	−0.057	−0.055	0.224	0.421
	p	0.75	0.757	0.203	0.013

$p=0.007$) and malingering subscales of the cbSASH ($t(32)=3.754$, $p=0.006$). On the other hand, the M subgroup differed significantly from the NM subgroup on the malingering subscale of the cbSASH ($t(32)=-2.900$, $p=0.007$), but not on the inconsistency subscale ($t(32)=0.730$, $p=0.471$).

In addition, the patients were divided between those giving reliable responses (i.e., with low Fp and VRIN scores) (NM-C) and those with less reliable responses (i.e., with a high score in one or both of the Fp and VRIN subscales) (M-IC). We found that the reliable group had significantly different malingering scores than the less reliable group ($t(32)=-4.135$, $p=0.0002$), but no significant difference in the inconsistency scores ($t(32)=-1.402$, $p=0.171$).

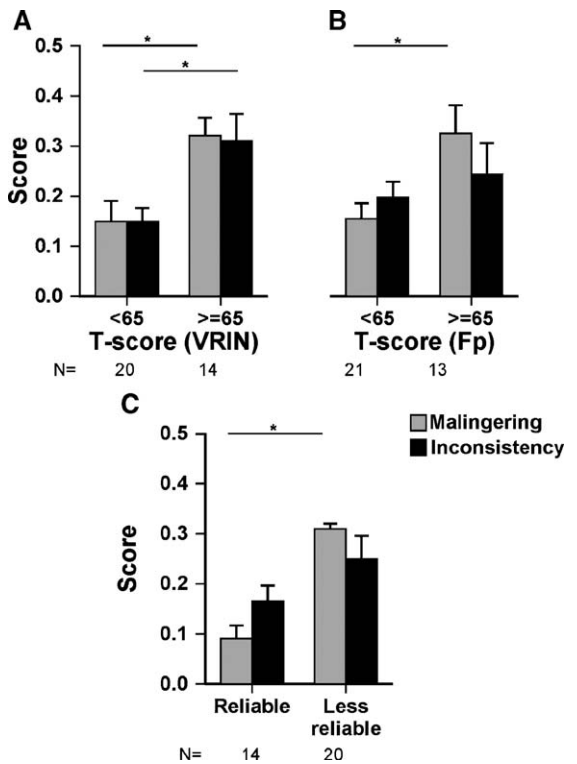

Fig. 2. Mean scores on the malingering and inconsistency subscales of the cbSASH in subgroups defined by the scores on the VRIN (A), Fp (B), and VRIN and Fp combined (C). *Denotes significance.

4.4. Discrimination and classification

Discriminant analyses were performed to determine how well the malingering and inconsistency subscales of the cbSASH discriminate the above-mentioned MMPI-2 defined subgroups of patients. For this purpose we implemented a stepwise discriminant analysis with the malingering and inconsistency subscales as potential discriminant variables.

THE C vs. IC patients were significantly discriminated by the Inconsistency scores on the cbSASH (Wilks' $\lambda=0.793$, $p=0.007$), with 73.5% of cross-validated correctly classified cases (Table 4). Fisher's linear discriminant function was:

$$Z = 1.798 - 6.282 \text{ Inconsistency score.}$$

In addition, the M vs. NM patients were significantly discriminated by the malingering scores (Wilks' $\lambda=0.792$, $p=0.007$), with 67.6% of cross-validated correctly classified cases (Table 5). Fisher's linear discriminant function was:

$$Z = 1.947 - 6.111 \text{ Malingering score.}$$

Furthermore, M-IC patients were significantly discriminated from the NM-C patients by the malingering score (Wilks' $\lambda=0.652$, $p=0.0002$), with 79.4% of cross-validated correctly classified cases. Fisher's linear discriminant function was:

$$Z = 1.546 - 9.515 \text{ Malingering score.}$$

Table 4
Classification results (%) of discrimination analyses

		Predicted group	
		T-score (VRIN)<65	*T*-score (VRIN)≥65
Original group	*T*-score (VRIN)<65	85	15
	T-score (VRIN)≥65	42.9	57.1

Table 5
Classification results (%) of discrimination analyses

		Predicted group	
		T-score (Fp)<65	*T*-score (Fp)≥65
Original group	*T*-score (Fp)<65	85.7	14.3
	T-score (Fp)≥65	61.5	38.5

Including the inconsistency and malingering scores in this discrimination did not improve discrimination (Wilks' $\lambda=0.650$, $p=0.001$), with 79.4% of cross-validated correctly classified cases (Table 6). As can be seen from Fisher's linear discriminant function below (see also Fig. 2), the inconsistency scores contributed little to the discrimination.

$$Z = 1.665 - 9.259 \text{ Malingering score} - 0.790 \text{ Inconsistency score.}$$

5. Discussion

Illnesses such as schizophrenia and schizoaffective disorders are constructs based on clinical diagnostic criteria. Research on these illnesses often yields inconsistent findings across studies and, sometimes, different findings across schizophrenia subjects within one study (Bruder et al., 2004; Van de Ven et al., 2005). This inconsistency could be related to the heterogeneity of these illnesses which led to the development of alternative approaches such as the investigation of endophenotypes (i.e., subgroups of patients sharing a common biological, cognitive or neuropsychological marker; Gottesman and Gould, 2003), and intermediate phenotype (i.e., subgroups of patients sharing common genetic features; Goldberg et al., 2003).

Investigation of the mechanisms of AVH has been a subject of interest for many researchers for years. The AVH subgroup of schizophrenia patients could be considered a more homogenous phenotype than the schizophrenia category, as some schizophrenia patients do not suffer from hallucinations. In the past few years, this research yielded many insights about the mechanisms of AVH. However, it has not been much more successful than other areas of schizophrenia research. This limited success indicates that the category of AVH is not a refined enough phenotype.

As mentioned above, the pathophysiology of AVH could vary according to the phenomenological characteristics of hallucinations. Therefore, a refinement of the phenotype, by subgrouping patients according to the characteristics of AVH, could reduce the inconsistency of AVH research. It is noteworthy that a refined phenotype is a different approach to the investigation of psychosis from the endophenotype or intermediate phenotype methods. The latter categories could include non-patients that share a given marker while the former includes patients only. Therefore, a refined phenotype could provide complementary information that is not possible by the investigation of the endophenotype or intermediate phenotype. The cbSASH provides reliable comprehensive phenomenological characterization of the patient experience, therefore reliable refined phenotypes of AVH could be investigated.

The inconsistency and malingering subscales of the cbSASH have similar psychometric properties to the corresponding Fs and VRIN subscales in the MMPI-2 with respect to test taking attitude. This similarity is reflected in the significant correlation between cbSASH and MMPI-2 validity subscales, as well as the significant discrimination between MMPI-2 defined subgroups using the cbSASH subscales. However, the cbSASH and MMPI-2 subscales also have differences in their psychometric properties. It can be noted that the malingering subscale in the cbSASH is highly correlated not only with the Fs subscales but also with the VRIN subscale, while the inconsistency subscale of the cbSASH is correlated only with the VRIN. Therefore, the malingering subscale of the cbSASH captures the psychometric properties of the Fs and VRIN subscales of MMPI-2, while the inconsistency subscale of the cbSASH is sensitive only to the psychometric properties of the VRIN.

These differences are further reflected in the *t*-tests and discriminant analyses. The latter showed that the malingering subscale alone is sufficient to discriminate between NM-C (reliable), and M-IC (not reliable) patients. Fig. 2 shows that there are significant differences between the above subgroups of patients only with the malingering scores but not with the inconsistency scores. It also shows that the malingering

Table 6
Classification results (%) of discrimination analyses

		Predicted group	
		T-score (Fp)<65 and *T*-score (VRIN)<65	*T*-score (Fp)≥65 or *T*-score (VRIN)≥65
Original group	*T*-score (Fp)<65 and *T*-score (VRIN)<65	78.6	21.4
	T-score (Fp)≥65 or *T*-score (VRIN)≥65	20	80

scores significantly differed between M and NM subgroups, but also between C and IC subgroups, whereas differences of the inconsistency scores were found between C and IC subgroups only.

These differences between the validity scales of the cbSASH and MMPI-2 could be related to differences of mental phenomena evaluated by these instruments. The former compared to the latter requires a rather elaborate account of mental experiences. Therefore, inconsistent scores on the cbSASH could be related either to malingering, or inability to describe the experience of AVH in such a detailed fashion. On the other hand, a high score on the VRIN is mostly related to malingering or similar test taking attitude. Therefore, it is not surprising that the malingering subscale of the cbSASH has significant correlation with the VRIN scale also.

Nonetheless, these additional properties of the cbSASH subscales could be useful in AVH research. On one hand, the malingering subscale alone is sufficient for the discrimination between the NM-C and M-IC subgroups of patients. On the other hand, the malingering and inconsistency subscales combined could identify a third subgroup of patients; that of non-malingering but inconsistent (NM-IC) patients. Given the above considerations, the NM-IC subgroup likely consists of patients who lack the ability to describe their hallucinations. Consequently, this subgroup could be different in terms of the underlying psychopathology from the NM-C subgroup. Multivariate analyses such as clustering and multidimensional methods could be used to explore the interrelationship between the individual variables in the NM-C and NM-IC subgroups, and could provide clues about the underlying mechanisms (in progress in our lab). As the former subgroup includes subjects who are either lying about experiencing AVH or have a limited capacity to describe their experiences, a larger number of patients would be needed for a signal to emerge.

The most important contribution of the cbSASH is that it provides the means to assign patients to a specific phenotype of AVH with respect to the phenomenological variable under study. Including only reliable patients could reduce the noise, improve the signal, and possibly yield findings that would be missed otherwise. For example, some studies find evidence that AVH result from the attribution of one's own inner speech to "other" (Frith and Done, 1989; Ford et al., 2001). Subgrouping patients into two phenotypes (i.e., those who attribute AVH to someone else vs. those who attribute AVH to themselves) could be insightful. Also, studies investigating language processing disturbances associated with AVH (in progress in our lab) could fair better by subgrouping patients according to the linguistic complexity of their hallucinations. Furthermore, as previously suggested (Miller, 1996), monitoring how the characteristics of AVH have changed in response to a treatment could provide important information.

Finally, while the cbSASH provides a reliable means to investigate the phenomenological variables described in the literature, it does not confirm their meaningfulness in terms of corresponding to a neural specificity. Future research should discriminate between variables that are/are not relevant in terms of corresponding to a possible specific brain dysfunction.

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