# Hallucination-Like Experiences in the Nonclinical Population

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**Abstract:** Unusual subjective experiences are relatively common in the general population and have been associated with an increased level of vulnerability to psychosis. The current study aimed to a) determine the distribution of hallucination-like experiences (HLEs) in a community sample of young adults, b) investigate their dimensional subtypes, and c) test the association of HLEs with indicators of poor mental health. Four hundred thirty-seven participants (men, 41%) completed a battery of questionnaires including the 16-item Launay-Slade Hallucination Scale (LSHS), the 12-item General Health Questionnaire (GHQ-12) and the 21-item Peters et al. Delusions Inventory (PDI). The LSHS correlated significantly with GHQ-12 and PDI. Individuals with higher levels of psychological distress were found to report higher frequencies of the HLEs compared with those in the reference range. Exploratory factor analysis of LSHS produced a four-factor solution: a) "auditory and visual HLEs," b) "multisensory HLEs," c) "intrusive thoughts," and d) "vivid daydreams." The current results provide further support for the multidimensional nature of hallucination proneness in the general population and indicate that some HLEs (particularly those related to intrusiveness of thought) are associated with a lower level of perceived well-being.

**Key Words:** Launay-Slade Hallucination Scale, factor analysis, hallucinatory predisposition, psychosis, sex.

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There is an increasing consensus that the expressivity of symptoms of psychosis is distributed throughout the general population along a more or less homogeneous quantitative gradient (Aleman et al., 2001; Tien, 1991; van Os et al., 2009; Verdoux and van Os, 2002; Young et al., 1986) and that florid psychosis (*i.e.*, categorical diagnostic conditions described in the *DSM-IV* or ICD-10) constitutes the most extreme end of such a spectrum (Stip and Letourneau, 2009; van Os et al., 2009).

The development of psychometric measures that can capture the gradient of psychotic-like experiences (PLEs) is therefore important for psychosis risk screening and prognostic purposes. Indeed, the reporting of PLEs may also predict the future onset of mental disorders diagnosable as "psychosis" (*i.e.*, schizophrenia, manic-depression, or schizo-affective disorder; Chapman et al., 1994). For instance, Kwapil et al. (1997) reported that, at follow-up, those who scored high on a measure of delusional ideation were more likely to have experienced a mental health problem within the spectrum of nonaffective psychoses. Similarly, the reporting of hallucinatory experiences in childhood was found to be associated with a higher incidence of psychiatric problems in adolescence and early adulthood (Dhossche et al., 2002; Poulton et al., 2000). It is estimated that people experiencing PLEs with abnormally higher frequency and intensity have a 60-fold higher chance of developing psychosis (Hanssen et al., 2005).

A number of assessment instruments have been developed to investigate specific subcomponents of psychosis proneness in the attempt to characterize the quality and the predictive value that different PLEs have for psychosis. Studies conducted using the Peters et al. Delusions Inventory (PDI; Peters et al., 1999; Verdoux et al., 1999) have provided indicative prevalence figures and confirmed the multidimensional nature of delusional thinking in the general population (*e.g.*, Cella et al., 2011; Rocchi et al., 2008).

Similarly, studies conducted on hallucination-like experiences (HLEs) have suggested that high scores on instruments assessing hallucination proneness may predict future onset of mental illness (Johns, 2005; Lincoln, 2007; Wigman et al., 2011). However, the multidimensional nature of HLEs is still largely understudied. As a matter of fact, there is an underrepresentation of HLEs in many tools developed to investigate PLEs (*e.g.*, the Community Assessment of Psychic Experiences; Konings et al., 2006).

Several studies showed that aberrant perceptual experiences are commonly reported in the general population, mostly from individuals without psychiatric problems (*e.g.*, Aleman et al., 1999; Barrett and Etheridge, 1992; Beavan et al., 2011; Johns et al., 2002; Larøi et al., 2004; Posey and Losch, 1983; Tien, 1991). Prevalence rates, however, showed a considerable variability across studies and samples, principally as a reflection of different definitions and methods to assess hallucinatory experiences (Johns, 2005). More compelling evidence on the distribution and correlates of hallucinatory experiences in the general population may arrive from the use of common standardized assessment tools. Indeed, there is increasing awareness that investigating specific experiences might be more productive than concentrating on broadly heterogeneous constructs such as "psychosis" or "schizophrenia" (Beavan et al., 2011).

To date, the Launay-Slade Hallucinations Scale (LSHS) is one of the measures that has received more attention from researchers (Bentall and Slade, 1985; Launay and Slade, 1981). Over time, the LSHS has undergone various rearrangements. The original version of the scale with dichotomous items (*i.e.*, "true/false"; Launay and Slade, 1981) was modified to account for different intensities replacing the binary choice with a 5-point Likert scale (Bentall and Slade, 1985). More recently, Larøi et al. (2004) refined the item selection to include items exploring hallucinations experienced in different sensory modalities. Factor analysis conducted on various versions of the scale showed that the hallucinatory construct measured using the LSHS is multifactorial (Aleman et al., 1999; 2001; Larøi et al., 2004; Serper et al., 2005). However, depending on the response format used and the number of items included in the scale, different factorial structures were found. Two-factor (Fonseca-Pedrero et al., 2010; Morrison et al., 2000; Serper et al., 2005), three-factor (Aleman et al., 2001; Paulik et al., 2006; Waters et al., 2003), and four-factor (Cangas et al., 2011, Larøi et al., 2004; Levitan et al., 1996) models have been described. The heterogeneity of the factor solutions so far advanced is not yet conducive to confirmatory factorial analysis (Fonseca-Pedrero

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et al., 2010; Paulik et al., 2006). However, in support of the reliability of the LSHS, previous research has shown that item endorsement patterns are stable across time (Aleman et al., 1999), and that the factorial structure observed in nonclinical samples is comparable with the one obtained in clinical samples (Levitan et al., 1996; Serper et al., 2005).

Because hallucinatory experiences are distributed across different sensory modalities, the use of the most extended versions of the LSHS is preferable in testing the multidimensionality of HLEs by factor analysis. Larøi et al. (2004) developed a modified, enriched version of the LSHS, which incorporates items tapping into all major perceptive domains. This modified version can offer a novel understanding of how different perceptual modalities may differently contribute to hallucinations in the general population.

This study aimed to investigate the prevalence and psychopathological correlates of HLEs as measured using the modified version of the LSHS, establish its factor structure in a nonclinical sample, and assess the relation that multidimensional features of HLEs may have with delusional thinking, as assessed using the PDI.

## METHODS

### Participants

A total of 500 young adults from Cagliari University were selected to take part in this study. Of those invited, 38 declined, and 25 did not return or complete the assessment. Inclusion criteria were being 18 years or older and having a good understanding of written Italian. The study conforms to the provisions of the Declaration of Helsinki in 1995 (as revised in Tokyo 2004). Each participant provided written informed consent.

### Measures

#### Launay-Slade Hallucination Scale

The 16-item modified version of the LSHS was used; this is a self-report scale investigating the multidimensionality of hallucinatory experiences in the general population. In this version, the items tap into sensory modalities other than auditory, such as the visual, olfactory, or tactile modalities. The scale also includes items on hypnagogic and hypnopompic hallucinations and on the sensed presence (*i.e.*, the experience of feeling the presence of someone close who has died) (Larøi and Van der Linden, 2005; Larøi et al., 2004). Respondents have to rate each item on a five-point scale: (0) "certainly does not apply to me," (1) "possibly does not apply to me," (2) "unsure," (3) "possibly applies to me," and (4) "certainly applies to me." The original English version of the LSHS, as in Larøi et al. (2004), was translated in Italian by A. P., then back-translated to English. Translation accuracy was then confirmed by an English-speaking translator and optimized with the help of FL. This version of the LSHS was found to have high reliability coefficients (Cronbach $\alpha = 0.87$).

#### General Health Questionnaire

The 12-item General Health Questionnaire (GHQ-12) is a self-report questionnaire assessing psychological distress in relation to major mental health symptoms. Respondents have to rate the presence and frequency of each symptom on a 4-point scale (*i.e.*, "not at all," "less than usual," "more than usual," "rather more than usual") within the past 4 weeks (Goldberg, 1972; Politi et al., 1994). For the purpose of this study, a dichotomous scoring system was used, attributing a point to each item with a "more than usual" or "rather more than usual" response. Previous research using this scoring method showed that a score of 4 or more is likely to be associated with a common mental disorder (Politi et al., 1994).

#### Peters et al. Delusions Inventory

This is a 21-item questionnaire designed to measure delusional proneness in the general population (Peters et al., 2004). For each positively endorsed item, the participant is required to rate the degree of distress, preoccupation, and conviction separately on 5-point Likert scales (1 to 5). Because the absolute prevalence of answers on the PDI items influences scores on the three subscales, a "weighted" score for these dimensional subscales was calculated by dividing the total values by the number of endorsed items on the PDI main queries, as in Cella et al. (2011). The PDI was found effective in discriminating patients with a diagnosis of psychosis from controls devoid of mental disorders (Peters et al., 2004; Preti et al., 2007).

### Data Analysis

Data were analyzed using nonparametric statistics because of violation of normality assumptions (Kolmogorov-Smirnov, with Lilliefors significance correction, $p < 0.01$ or lower in all explorations). All tests were two-tailed, with threshold set at $p < 0.05$. A Mann-Whitney *U*-test for nonnormal distributions was used to compare the ordinal variables. Categorical data were analyzed using the chi-squared test. Scale reliability was measured using Guttman's lambda 2 (Guttman, 1945; Sijtsma, 2009). Reliability values higher than 0.70 are considered acceptable for single questionnaires (Nunnally, 1978).

Factor analysis was carried out using FACTOR (Lorenzo-Seva and Ferrando, 2006). Exploratory maximum likelihood with Promax rotation was used to generate the model. The best solution was conditional on the result of parallel analysis, using marginally bootstrapped samples ($n = 500$) to extract factors with eigenvalues higher than 1 and retaining only those that were statistically higher than the mean of random eigenvalues generated by bootstrapping. However, to decide on the best solution, additional elements were also taken into consideration. The ratio of root mean square of residuals (RMSR) to the expected mean value of RMSR (emRMSR) was used to assess fitness of the model: for a good fit, the value of RMSR should be lower than that of the emRMSR. Bentler's Simplicity Index (Bentler, 1977) and the reliability estimate of the extracted components (Mislevy and Bock, 1990) were also used to assess adequacy of the model. Because exploratory maximum likelihood generates a profile of fit of the extracted solution, additional information on the best solution was derived from the root mean square error of approximation (RMSEA) and the related test of close fit for RMSEA, which is testing the null hypothesis that the population RMSEA is not greater than 0.05. The comparative fit index (CFI) was also used. RMSEA of 0.06 or lower and CFI of 0.95 or higher are considered acceptable (Schermelleh-Engel et al., 2003). Any 1-point increase in CFI over the preceding solution is considered evidence of a better fit (Cheung and Rensvold, 2002).

The regression method was used to calculate standardized factor scores (expressed as *Z*-scores, *i.e.*, mean, 0; SD, 1). Standardized factor scores are conceived as an estimate of the score each subject would have obtained on each factor, if measured directly.

## RESULTS

Of the participants, 41% were men. Age and parental education did not differ between the sexes (Table 1). Guttman's lambda squared for the LSHS was 0.89; this was 0.87 for the GHQ-12 and 0.77 for the PDI.

The distribution of scores on the GHQ-12, PDI, and LSHS are summarized in Table 1.

Age negatively correlated with LSHS scores (Spearman $\rho = -0.18$, $p < 0.0001$) but not with GHQ-12 or PDI scores (in both comparisons, Spearman $p > 0.10$).

Scores on the GHQ-12 positively correlated with PDI scores (Spearman $\rho = 0.41$, $p < 0.0001$) and LSHS scores (Spearman

**TABLE 1.** Sociodemographic Characteristics of the Samples and Distribution of Scores on the GHQ-12, PDI, and LSHS

| | Men ($n$ = 178) | Women ($n$ = 259) | Statistics |
|---|---|---|---|
| Age, mean (SD); range | 24.7 (3.4); 18–34 | 24.7 (3.5); 18–45 | Mann-Whitney $U$-test, $z = -0.15$, $p = 0.88$ |
| Highest level of parental education, $n$ (%) | | | $\chi^2_{(2)} = 1.66$, $p = 0.43$ |
| Compulsory school | 38 (21.3%) | 65 (24.8%) | |
| High school diploma | 99 (55.6%) | 128 (49.4%) | |
| College graduate or higher | 41 (23.0%) | 66 (25.5%) | |

| | Men ($n$ = 178) | | | | | Women ($n$ = 259) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Range | Skewness | Kurtosis | Mean | SD | Range | Skewness | Kurtosis | |
| GHQ-12 | 2.2 | 2.9 | 0–11 | 1.43 | 1.15 | 2.8 | 3.1 | 0–12 | 1.05 | 0.15 | Mann-Whitney $U$-test, $z = -1.99$, $p = 0.04$ |
| PDI | 4.2 | 3.2 | 0–17 | 0.95 | 1.57 | 4.4 | 3.2 | 0–16 | 0.74 | 0.26 | Mann-Whitney $U$-test, $z = -0.45$, $p = 0.65$ |
| PDI distress | 0.9 | 1.4 | 0–5 | 1.05 | −0.41 | 0.6 | 1.3 | 0–5 | 1.80 | 1.67 | Mann-Whitney $U$-test, $z = -3.22$, $p = 0.001$ |
| PDI preoccupation | 0.8 | 1.3 | 0–5 | 1.04 | −0.39 | 0.5 | 1.1 | 0–5 | 1.88 | 2.15 | Mann-Whitney $U$-test, $z = -3.37$, $p = 0.001$ |
| PDI conviction | 1.1 | 1.6 | 0–5 | 0.94 | −0.69 | 0.6 | 1.3 | 0–5 | 1.71 | 1.25 | Mann-Whitney $U$-test, $z = -3.56$, $p = 0.0001$ |
| LSHS | 9.0 | 9.0 | 0–44 | 1.30 | 1.51 | 11.8 | 11.9 | 0–54 | 1.23 | 0.91 | Mann-Whitney $U$-test, $z = -1.98$, $p = 0.04$ |

GHQ-12 indicates 12-item General Health Questionnaire; PDI, Peters et al. Delusions Inventory; LSHS, Launay-Slade Hallucination Scale.

$\rho = 0.45$, $p < 0.0001$). LSHS and PDI scores were positively correlated (Spearman $\rho = 0.42$, $p < 0.0001$).

In our sample, 85 (32.8%) female and 43 (24.2%) male participants scored 4 or above on the GHQ-12 (*i.e.*, the threshold suggesting potential psychological distress needing clinical attention): $\chi^2 = 3.41$, $p > 0.05$. Those scoring in the GHQ-12 clinical range ($n$ = 128) had statistically higher scores on the PDI ($6.0 \pm 3.6$ *vs.* $3.6 \pm 2.7$; Mann-Whitney $U$-test, $z = -6.55$, $p < 0.0001$) and on the LSHS

**TABLE 2.** Mean Scores, Standard Deviations, and Percentages of Subjects Endorsing the Positive Response for the Revised Launay-Slade Hallucination Scale Items ($n$ = 437)

| | Mean | SD | Possibly Applies | Certainly Applies | Item-Total Correlation | Alpha if Item Was Deleted |
|---|---|---|---|---|---|---|
| 1. Sometimes, a passing thought will seem so real that it frightens me | 1.17 | 1.30 | 14.0% | 6.4% | 0.46 | 0.897 |
| 2. Sometimes, my thoughts seem as real as actual events in my life | 1.18 | 1.25 | 14.6% | 4.6% | 0.48 | 0.896 |
| 3. No matter how hard I try to concentrate on my work, unrelated thoughts always creep into my mind | 1.81 | 1.40 | 25.4% | 13.0% | 0.45 | 0.899 |
| 4. In the past, I have had the experience of hearing a person's voice and then found that there was no one there | 0.44 | 0.92 | 4.8% | 1.8% | 0.59 | 0.892 |
| 5. The sounds I hear in my daydreams are generally clear and distinct | 0.62 | 1.09 | 6.2% | 3.7% | 0.64 | 0.890 |
| 6. The people in my daydreams seem so true to life that I sometimes think that they are | 0.46 | 0.97 | 6.2% | 1.6% | 0.62 | 0.891 |
| 7. In my daydreams, I can hear the sound of a tune almost as clearly as if I were actually listening to it | 0.51 | 0.99 | 5.3% | 2.3% | 0.66 | 0.890 |
| 8. I often hear a voice speaking my thoughts aloud | 0.40 | 0.91 | 4.1% | 2.1% | 0.61 | 0.892 |
| 9. I have been troubled by hearing voices in my head | 0.27 | 0.76 | 2.3% | 1.6% | 0.52 | 0.895 |
| 10. On occasions, I have seen a person's face in front of me when no one was in fact there | 0.29 | 0.83 | 3.7% | 1.8% | 0.54 | 0.894 |
| 11. Sometimes, immediately before falling asleep or upon awakening, I have had the experience of having seen, felt or heard something or someone that wasn't there, or I had the feeling of being touched even though no one was there | 0.72 | 1.23 | 9.4% | 5.0% | 0.68 | 0.888 |
| 12. Sometimes, immediately before falling asleep or upon awakening, I have felt that I was floating or falling, or that I was leaving my body temporarily | 0.85 | 1.35 | 11.0% | 7.3% | 0.61 | 0.891 |
| 13. On certain occasions, I have felt the presence of someone close who had died | 0.46 | 0.97 | 5.5% | 2.1% | 0.59 | 0.892 |
| 14. In the past, I have smelt a particular odor even though there was nothing there | 0.67 | 1.17 | 8.7% | 3.9% | 0.57 | 0.893 |
| 15. I have had the feeling of touching something or being touched and then found that nothing or no one was there | 0.51 | 1.03 | 6.2% | 2.7% | 0.66 | 0.889 |
| 16. Sometimes, I have seen objects or animals even though there was nothing there | 0.31 | 0.83 | 3.0% | 1.8% | 0.50 | 0.895 |

(16.4 ± 11.5 *vs.* 8.3 ± 9.7; Mann-Whitney *U*-test, z = –7.62, $p < 0.0001$) than did those in the reference range ($n = 309$).

## Item-Total Correlations and Frequency of HLEs

All LSHS items were found to have good discriminative proprieties with item-total correlations always higher than 0.45 (Table 2).

Overall, the incidence of hallucinatory experiences reported with certainty was in the range of 5% to 10%, depending on the experience. Sleep-related (*i.e.*, hypnopompic and hypnagogic) experiences were reported with higher frequency (5% to 10%) compared with auditory or visual hallucinatory experiences (less than 5%). Items with a more apparent pathological content (*e.g.*, item 4 on auditory hallucinations or item 8 on echoing of thoughts) were rarely endorsed with certainty (*i.e.*, 2% or less).

## Factor Structure

When forced, the unifactorial solution yielded a poor fit: RMSEA, 0.14; CFI, 0.74; RMSR, 0.099; emRMSR, 0.047 (ratio, 2.10).

The parallel analysis suggested a three-factor solution based on the mean of random eigenvalues generated through bootstrapping. However, fit indexes were still poor: RMSEA, 0.08 (test of RMSEA, <0.05: $p < 0.0001$, hypothesis to be rejected); CFI, 0.93. Only the RMSR was acceptable: RMSR, 0.039; emRMSR, 0.048 (ratio, 0.81).

The best compromise was a four-factor solution: RMSEA, 0.05 (test of RMSEA, <0.05: $p = 0.340$, hypothesis to be accepted); CFI, 0.98; RMSR, 0.024; emRMSR, 0.048 (ratio, 0.50). Bentler's simplicity index was 0.993, overlapping with the values of the three-factor solution (0.993).

Table 3 summarizes the results of the four-factor solution. The reliability estimates of the extracted components were good (all >0.70). Each factor explained at least 5% of the cumulative proportion of the variance.

The four factors can be labeled as: "auditory and visual HLEs" (factor 1), "multisensory HLEs," tapping the "sensed presence" of something/someone via a sensory modality other than auditory and

**TABLE 3.** Factor Analysis of LSHS and Factor Loading (Loading <0.30 was Not Reported)

| | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|---|---|---|---|---|
| 1. Sometimes, a passing thought will seem so real that it frightens me | | | 0.740 | |
| 2. Sometimes, my thoughts seem as real as actual events in my life | | | 0.885 | |
| 3. No matter how hard I try to concentrate on my work, unrelated thoughts always creep into my mind | | | 0.624 | |
| 4. In the past, I have had the experience of hearing a person's voice and then found that there was no-one there | | | | 0.308 |
| 5. The sounds I hear in my daydreams are generally clear and distinct | | | | 0.747 |
| 6. The people in my daydreams seem so true to life that I sometimes think that they are | | | | 0.833 |
| 7. In my daydreams, I can hear the sound of a tune almost as clearly as if I were actually listening to it | | | | 0.773 |
| 8. I often hear a voice speaking my thoughts aloud | 0.512 | | | |
| 9. I have been troubled by hearing voices in my head | 0.643 | | | |
| 10. On occasions, I have seen a person's face in front of me when no one was in fact there | 0.940 | | | |
| 11. Sometimes, immediately before falling asleep or upon awakening, I have had the experience of having seen, felt, or heard something or someone that wasn't there, or I had the feeling of being touched even though no one was there | | 0.751 | | |
| 12. Sometimes, immediately before falling asleep or upon awakening, I have felt that I was floating or falling, or that I was leaving my body temporarily | | 0.669 | | |
| 13. On certain occasions, I have felt the presence of someone close who had died | | 0.677 | | |
| 14. In the past, I have smelt a particular odor even though there was nothing there | | 0.592 | | |
| 15. I have had the feeling of touching something or being touched and then found that nothing or no one was there | | 0.762 | | |
| 16. Sometimes, I have seen objects or animals even though there was nothing there | 0.323[a] | 0.390 | | |
| Eigenvalues | 6.71 | 1.82 | 1.22 | 0.89 |
| Random eigenvalues | 1.34 | 1.26 | 1.21 | 1.16 |
| Cumulative proportion of variance | 41.9% | 53.4% | 61.0% | 66.6% |
| Reliability estimate | 0.855 | 0.855 | 0.833 | 0.858 |
| Correlations between factors and measures of psychopathology | | | | |
| Factor 2 | 0.57* | | | |
| Factor 3 | 0.17* | 0.70* | | |
| Factor 4 | 0.59* | 0.84* | 0.70* | |
| Age | −0.09* | −0.15 | −0.19 | −0.19 |
| GHQ-12 | 0.17* | 0.42* | 0.46* | 0.36* |
| PDI | 0.11* | 0.41* | 0.49* | 0.32* |
| PDI distress | 0.08 | 0.30* | 0.29* | 0.23* |
| PDI preoccupation | 0.09 | 0.30* | 0.29* | 0.24* |
| PDI conviction | 0.11* | 0.31* | 0.28* | 0.23* |

GHQ-12 indicates 12-item General Health Questionnaire; PDI, Peters et al. Delusions Inventory; LSHS, Launay-Slade Hallucination Scale.

[a]Items loading higher than 0.30 were reported. Items loading on more than one factor were assigned to the factor with the higher loading. However, for completeness, loading on the other factors was reported as well. This occurred for just one item (item 16).

*Spearman rho correlation coefficient with $P < 0.0001$.

including "sleep-related hallucinatory experiences" (factor 2), "intrusive thoughts" (factor 3), and "vivid daydreams" (factor 4).

Correlations with measures of psychological distress (GHQ-12) and delusional proneness (PDI) were high for factors 3 and 2, mild for factor 4, and small for factor 1 (see bottom of Table 3).

## DISCUSSION

In this study, we investigated the factorial structure of HLEs and their relationship with delusional proneness and perceived well-being in young adults, using a modified version of the LSHS. This study also validates the Italian version of this scale. As in previous studies (Cella et al., 2008; Larøi and Van der Linden, 2005; Larøi et al., 2004), an appreciable proportion of our participants reported hallucinatory experiences with no substantial differences between different sensory modalities (*i.e.*, auditory HLEs were not more frequent compared with olfactory, tactile, or visual HLEs). However, sleep-related (*i.e.*, hypnopompic and hypnagogic) HLEs were reported with higher frequency (*i.e.*, 5% to 10%) compared with auditory or visual hallucinatory experiences (2% to 5%), and this is in line with previous studies (*e.g.*, Ohayon, 2000). Overall, the incidence of hallucinatory experiences endorsed with certainty was in the range of 5% to 10%, which is in line with the prevalence of schizotypal traits in the general population (Meehl, 1990; Meyer and Keller, 2001).

The study confirmed the multidimensionality of the LSHS; factor analysis yielded a four-factor solution. However, this solution does not clearly overlap with the factor structures reported in previous studies (*e.g.*, Aleman et al., 2001; Cangas et al., 2011; Fonseca-Pedrero et al., 2010; Goodarzi, 2009; Larøi et al., 2004; Launay and Slade, 1981; Levitan et al., 1996; Singh et al., 2003; Serper et al., 2005). Indeed, the inclusion of a more comprehensive list of items, exploring a wider extent of perceptive experiences compared with the previous versions of the scale modified the discernible factorial components, thereby contributing to the limited comparability with previous studies (Larøi and Van der Linden, 2005; Larøi et al., 2004; Paulik et al., 2006).

In this study, we replicated the association of tactile HLEs with hypnopompic and hypnagogic experiences reported in similar studies (Cheyne, 2001; Larøi and Van der Linden, 2005; Ohayon, 2000). In the current study, these items were grouped in a single factor together with items tapping in sensory modalities other than the auditory, a finding already observed with this version of the LSHS by Larøi and Van der Linden (2005) and Larøi et al. (2004). Larøi and Van der Linden (2005) and Larøi et al. (2004) interpreted this factor as describing sleep-related hallucinations. Other studies noted a relationship between hypnopompic and hypnagogic experiences and the "sensed presence" ("the feeling of raw otherness present-at-hand": Cheyne, 2001; Cheyne et al., 1999), which may explain the grouping of tactile and olfactory HLEs with items related to hypnopompic and hypnagogic experiences.

As in past studies (*e.g.*, Larøi et al., 2004; Levitan et al., 1996), daydreams and auditory hallucinations were accounted by different factors. The correlations of LSHS factors scores with PDI (a measure of delusional thinking) and GHQ-12 (a measure of distress) decreased from factor 3 (related to thought intrusiveness and vividness) to the other factors. This is in line with current clinically oriented research on the relevance of certain subtypes of anomalous subjective experiences, particularly disorders of stream of consciousness, as vulnerability factors for psychosis (Klosterkötter et al., 2001; Schultze-Lutter, 2009). In a nonclinical population, nondistressing hallucinations are much more frequent than HLEs related to distress or interference with functioning (Beavan et al., 2011; Tien, 1991).

LSHS items tapping into vividness, felt-realness, and thought intrusion have been hypothesized to have a stronger association with thought interference and thought pressure, which may anticipate the emergence of Schneiderian symptoms (see Klosterkötter, 1992; Raballo and Larøi, 2011). Notably, further converging evidence indicates that higher scores on the LSHS are associated with higher degrees of misattribution of internal events to an external source, which is a feature commonly observed in hallucinating patients with schizophrenia (Bentall and Slade, 1985; Jakes and Hemsley, 1986; Rankin and O'Carroll, 1995; Waters et al., 2010).

This study's results supported the multidimensionality of HLEs in a nonclinical sample. High propensity for hallucination proneness was associated with poor self-rated mental health and high psychosis proneness scores. Some HLEs (in particular those related to intrusiveness of thought) might be specifically associated with lower perceived levels of well-being and help to identify individuals at increased risk of psychosis (Yung and McGorry, 1996). Tools such as the LSHS can serve as valuable assessment instruments for population-based studies, large-scale screening, and risk of psychosis assessment.

## DISCLOSURE

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*The authors declare no conflict of interest.*

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