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Psychology of Anomalous Experiences: psychometric properties of the Multivariable Multiaxial Suggestibility Inventory-2 Reduced (MMSI-2-R)

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Abstract

Anomalous experiences are perceptual alterations, which can be explained as possible hallucinatory symptoms (clinical model) or as a way of representing reality according to the beliefs of each individual (cognitive or phenomenological model). The aim of this study was to explore how these experiences are developed in the general population integrating both models. The statistical justification of the Multivariable Multiaxial Suggestibility Inventory-2 Reduced (MMSI-2-R) was completed in a non-probabilistic convenience sample of 1,773 participants. In the same way, subjects came from three different Spanish communities: Madrid, Albacete, and Barcelona. Factor analysis resulted in six factors, which offered high reliable indices. In order to integrate the cognitive model as a possible interpretative criterion, scores were scaled conforming different attitudes to anomalous experiences: believers in the paranormal (magical beliefs), agnostic attitudes, and non-believers. It was concluded that believers tend to develop these alterations in a more frequent way than non-believers.

Keywords

Anomalous experiences, hallucinations, psychotic-like experiences, magical beliefs, paranormal beliefs.

Psicología de las experiencias anómalas: propiedades psicométricas del Inventario Multiaxial de Sugestibilidad Multivariable -2 Reducido (MMSI-2-R)

Resumen

Las experiencias anómalas representan alteraciones perceptivas que pueden ser explicadas como posibles síntomas alucinatorios (modelo clínico) o como una manera de representar la realidad acorde con las creencias de cada individuo (modelo fenomenológico). El objetivo de este estudio fue explorar cómo estas experiencias se desarrollan en la población general integrando ambos modelos. La justificación estadística del Inventario

Multiaxial de Sugestibilidad Multivariable -2 Reducido (MMSI-2-R) fue completada con una muestra de conveniencia no-probabilística formada por 1773 participantes. Del mismo modo, los sujetos seleccionados procedían de tres comunidades españolas distintas: Madrid, Albacete y Barcelona. El análisis factorial presentó seis factores principales, los cuales arrojaron índices elevados de fiabilidad. Con el objetivo de integrar el modelo cognitivo como un posible criterio interpretativo, las puntuaciones fueron baremadas en base a diferentes actitudes frente a las experiencias anómalas: creyentes en lo paranormal (creencias mágicas), actitud agnóstica y no creyentes. Se concluye que los creyentes tienden a desarrollar estas alteraciones de manera más frecuente que los no creyentes.

Palabras clave

Experiencias anómalas, alucinaciones, Psychotic-Like Experiences, creencias mágicas, creencias paranormales.

The term *anomalous experience* is used to describe a group of unusual phenomena that are in the boundaries of consciousness (e.g., Gallagher, Kumar, & Pekala, 1994; McClenon, 1994; Nadon & Kihlstrom, 1987; Palmer, 1979). These phenomena, although present in the general population, are hard to explain due to their complexity and are often classified as parapsychological, religious, or ufological experiences, among other denominations, depending on the phenomenological nature of the experience. Jaén-Moreno, Moreno-Díaz, Luque-Luque and Bell (2014) also used it to define a set of symptoms (hallucinatory and delirious) present in the subclinical psychotic states (see also Brenner et al., 2007). The concept of subclinical psychosis is a term which was listed by Capra, Kavanagh, Hides and Scott (2013) to explain experiences close to psychosis, also known as, psychotic-like experiences (PLEs). They are present in a phenotypic continuum, a period in which the degradation of a psychotic symptomatology can be identified.

Recent epidemiological studies show that anomalous experiences are indeed present in the general non-clinical population. On the one side, according to Peters, Joseph, Day and Garety (2004), the prevalence index is of 29.8% in the general adult population. On the other side, Horwood et al. (2008) defended that the prevalence index reaches up to 38.9% in the general adolescent population. Regardless, a more in-depth meta-analysis by van Os, Linscott, Myin-Germeys, Delespaul, and Krabbendam (2009) found a prevalence rate of 5% among the general adult population. Simultaneously, Fonseca-Pedrero et al. (2011a) conducted a study with the adolescent Spanish population which found a prevalence rate of 43% for experiences associated with magical thoughts and 8.9% for psychotic-like experiences. Therefore, there is a qualitative difference and a quantitative variation in the existence of anomalous experiences, including the meaning of the term anomalous experience, ranging from PLEs to more severe psychotic symptoms. Subsequently, anomalous experiences would be placed below the clinical threshold, despite not constituting any psychopathological symptoms by themselves (Johns & van Os, 2001; Verdoux & van Os, 2002). This conception belongs to the model of the psychotic continuum described by Stefanis et al. (2002) alongside other authors (e.g., Vollema, Sitskoorm, Appels, & Kahn, 2002; Yung et al., 2003).

The model of psychotic continuum comes from the hypothetical assumption that the symptoms observed in psychotic patients can also be found in the non-clinical population at different levels of intensity. The scientific validity of the model was analyzed by van Os et al. (2009), who arrived at the conclusion that the psychopathological, demographic, and epidemiological characteristics observed in schizophrenic patients are like those of subclinical psychosis. Similarly, Cantor-Grae and Selten (2005) discuss that certain risk factors, such as childhood trauma, belonging to marginalized ethnic groups, or having precarious education levels, present in schizophrenia are also found in PLEs (see also Krabbendam & van Os, 2005). However, some investigations question whether anomalous experiences make up experiences related to psychotic disorders (Escolà-Gascón, 2016; Font, 2016; Irwin, Dagnall, & Drinkwater, 2013; Parker, 2006). These studies proposed that anomalous experiences could exist in dimensions which are of a non-pathological type, such as magical ideation, causal illusions, and paranormal beliefs, that promote their development (see Yarritu, Matute, & Vadillo, 2013). In fact, Irwin (2009) suggests the presence of a loop between paranormal beliefs and anomalous experiences. This hypothetical model would describe anomalous experiences as a subjective validation of the subject's paranormal beliefs, where the believer intends to continue believing in the paranormal. Following this idea, the individual can expose him/herself to find new experiences which act as a guarantor for their belief

system (Gallagher et al., 1994; Iborra, 2016). In their clinical study, Capra et al. (2013) indirectly supported this proposal by excluding magical thoughts and beliefs from psychopathologically significant behaviors in the psychotic continuum.

Therefore, there are two models that can be identified within this conception. First, Model 1 contemplates that PLEs are not strictly associated with the presence of a disorder, but rather those experiences change in accordance with other variables, such as intrusiveness, belief systems, and other cultural factors (Johns & van Os, 2001; Lawrie, Hall, McIntosh, Owens, & Johnstone, 2010). Second, Model 2 postulates that PLEs represent a psychotic vulnerability factor for the development of future disorders, depending on three parameters: (1) tendency, (2) persistence, and (3) deterioration (David, 2010; Rus-Calafell & Lemos-Giráldez, 2014; van Os et al., 2009).

El-Mallakh and Walker (2010) argued that anomalous experiences can also be described as perceptive deformations or deceptions, including the concept of pseudohallucinations or pseudoperceptions. On the one hand, according to Belloch, Baños, and Perpiñá (1995) perceptive deformations appear when a stimulus present in the objective exterior space, also accessible to the sensory organs, is perceived in a different manner compared to its formal characteristics (see also Jaspers, 1993). Nevertheless, the distortion does not usually appear in the sensory organs themselves; instead, it lies in the interpretation that the subject elaborates from the perceived stimulus (Hamilton, 1985; Neisser, 1981). On the other hand, Ey, Bernard, and Brisset (1980) suggested that perceptive deceptions can be labeled as psychic hallucinations which provoke vivid hallucinatory activity within the imagination and thoughts of the individual. In agreement with this idea, Villagrán and Luque (1994) preferred to use the term pseudohallucination in order to differentiate this phenomenon from classical psycho-sensory hallucinations, since those lacked corporeality and objectivity in the exterior space.

Considering the examples presented, numerous investigations advise that hallucinations and pseudohallucinations can manifest themselves according to their sensory modalities (Asaad & Shapiro, 1986; Posey & Losch, 1983). On the one side, the most frequent anomalous experiences among the general population are constituted by those who are sensitive to the senses of taste, smell, and touch. On the other side, when anomalous experiences are conceived and evaluated as subclinical phenomena (continuum model), the alterations that predominate are of an olfactory, taste, cenesthetic, and auditory type. These conclusions contemplate whether pseudohallucinations and subclinical hallucinations share the same etiological base (Barrett, 1993; Barrett & Etheridge, 1994). According to Luque and Villagrán (2000), pseudohallucinations represent a non-pathological expression of the hallucinatory phenomenon, which only constitute the imaginary phenomena present in normal perceptions which initially seemed hallucinatory. Praveen, Walker, and El-Mallakh (2010) also supported this notion, with the addition that perceptive deceptions were frequent in the remission phases of psychosis. This suggestion was recently complemented by Telles-Correia, Lúcia, and Gonçalves (2015), who noted that pseudohallucinations could also develop regardless of hallucinatory psychotic symptoms. In fact, these discussions have not finished as yet. Some investigations still question the limits between hallucinations and pseudohallucinations (El-Mallakh & Walker, 2010).

Anomalous experiences can be measured and evaluated among the general population using multiple instruments (Irwin, 2009). On the one side, in congruence with the theoretical fundaments mentioned earlier, some have been elaborated with the intention of providing a representative and objective measure of the propensity to psychosis (e.g., Bentall & Slade, 1985; Mason & Claridge, 2006; Núñez, Arias, Vogel, & Gómez, 2015; Ros-Morente, Vilagrá-Ruiz, Rodríguez-Hassen, Wigman, & Barrantes-Vidal, 2011; Fonseca-Pedrero et al., 2011b). On the other side, several tests focus their attention on the evaluation of anomalous experiences as perceptive deformations or aberrant perceptions. Two examples to illustrate this could be the questionnaire of Chapman, Chapman, and Rawlin (1978), referred to as PAS (Perceptual Aberration Scale), and the CAPS scale (Cardiff Anomalous Perceptions Scale) designed by Bell, Halligan, and Ellis (2006). The main objective of the CAPS scale was to find out if there was a positive correlation between perceptive deformations and certain psychotic-type symptoms (Bell et al., 2006). Unlike other tests, the CAPS scale conceptualizes anomalous experiences as perceptions which are unilaterally independent of the clinical-psychiatry context (Jaén-Moreno et al., 2014).

While on the lookout for new questionnaires to evaluate anomalous experiences in the general adult population, it can be concluded that the majority of existing questionnaires focus on (i) the evaluation of psychotic phenotypes, and (ii) the distinction between pathological and non-pathological anomalous experiences (Peters, Joseph, & Garety, 1999). The main disadvantages are that many of them were theoretically elaborated and validated in other cultural and social contexts, consequently generating methodological difficulties during the adaptation process. Despite all of them presenting a rigorous statistical justification, many were adapted with non-representative samples of the general Spanish population. All the same, another drawback was that most instruments did not allow for discrimination between sensory characteristics and anomalous experiences – an important aspect to be taken into account during the psychological evaluation process (Barrett, 1993; Barrett & Etheridge, 1994). Finally, another difficulty was that the majority of instruments had not taken into consideration the problems contem-

plated by some authors, such as Gallagher et al. (1994) and Irwin (2009), regarding whether or not paranormal beliefs changed in the presence of anomalous experiences.

Therefore, the objective of the current study was, firstly, to develop an instrument that enabled the evaluation of anomalous experiences among the general Spanish population, while trying to integrate both theoretical models (the continuum model and the perceptive deformations/deceptions model), and secondly, to elaborate a test with the capacity to discriminate between the sensory characteristics and anomalous experiences among three groups of subjects, classified according to their predisposition to the paranormal (non-believers, agnostics, and believers), allowing for the further comprehension of this phenomenon.

MATERIAL AND METHODS

Participants

The final sample for the investigation was obtained from October 2013 until March 2016. It comprised 806 men and 967 women (N=1,773); from the three Spanish provinces of Barcelona (67.5%), Madrid (17%), and Albacete (15.6%). The ages of the participants ranged from 18 to 78 years (Mean=34.24; Standard Deviation=13.363). Regarding their level of education, 67.8% of participants had completed professional training cycles; 24% had attended college; 5.7% had finished secondary school (ESO); and 2% had only attended elementary school. As far as their belief systems were concerned, the majority (48.6%) declared themselves to be believers in the paranormal; 34.6% confirmed their agnostic attitude; while 16.8% declared being non-believers. From the same sample, 39.7% of subjects thought they had had a paranormal experience during their lifetime; 35% reported not knowing; while 23.7% declared they had not had any kind of anomalous experience. Finally, it must be noted that most of the participants did not present any psychiatric history, even though 8.2% chose not to speak on the topic. The subjects who did confirm having a clinical-psychiatric history were dismissed from the sample.

Instruments

The Multivariable Multiaxial Suggestibility Inventory-2-Reduced (MMSI-2-R), which is used throughout this investigation, comprises 49 items. These items measure and explore not only hallucinatory-type experiences, but also perceptive deformations attenuated in the general adult Spanish population. The items were developed in the form of phrases or affirmations, the answers to which were encoded using the Likert five-point scale: 1 meaning *strongly disagree*, 2 *disagree*, 3 *neither agree nor disagree*, 4 *agree,* and 5 *strongly agree*. The MMSI-2-R has six factors or scales: *Visual and Auditory Perception* (Pva); *Cenesthetic Perception* (Pc); *Olfactory Perception* (Po); *Touch Perception* (Pt); *Taste Perception* (Pg); and *Paranoid Experience* (Et).

Procedure

The design of this study was classified as a multivariant model, which corresponded to an Exploratory Factorial Analysis, with the purpose of examining the validity of the MMSI-2-R construct.

The elaboration of the questionnaire was carried out in five different phases. The first was developed over the span of four months, from September 2011 until January 2012. During this phase, the constructs to be evaluated were defined, following the views of Gallagher et al. (1994) and Jaspers (1980) for anomalous experiences. The classical suggestibility model was also referred to for the exploration of psychological mechanisms which stemmed from these experiences (see also Hefferline, Bruno, & Camp, 1972). In addition, a first draft of items composed by 159 sentences was written up. Afterwards, it was analyzed by a group of experts who only rejected six items. The questionnaire was then ready for experimental application.

The second stage was carried out between February 2012 and December 2012. During this period, the questionnaire was conducted on a preliminary sample of 254 students from Barcelona, whose ages ranged from 18 to 39 years. This first analysis (Exploratory Factorial Analysis) determined that the experimental MMSI presented ambiguous and inconclusive results. For this reason, the theoretical basis of the test was reformulated and its elements rewritten. Once we reached this point in the investigation, the third development stage of the MMSI-2-R was initiated between June and September 2013.

The questionnaire was improved because of the previous experience with the first version. Its theoretical framework was redefined. (1) Items did not contain ambiguous expressions such as “normally” or “frequently”. (2) Some polarized adverbs like “never” and “always”, which generated confusion among the participants, were eliminated from the formulation of sentences. In addition, sentences that presented excessively specific content were also eliminated because they made it more difficult to find an elevated variance. (3) Consequently, items were expressed in a more generic, subtle and attenuated way, since this would facilitate the heterogeneity of answers. During this period of the investigation the sentences were reformulated according to the theoretical framework, constituting a total of 49 elements which expressed behaviors associated with anomalous experiences.

The fourth phase was developed between October 2013 and March 2016. The aim of this phase was to apply the new sentences on a large sample.

Finally, during the fifth and final phase of the study, the validity and reliability of the MMSI-2-R were examined.

Data analysis

The results of this study were analyzed using the statistical package *SPSS-PASW Statistics*-22 and *Jamovi* (see The Jamovi Project, 2019). The reliability of the questionnaire was calculated using *Cronbach's Alpha*, designed for ordinal values, and *McDonald's Omega*, as an alternative index. However, the analysis of construct validity was developed through the application of the Exploratory Factor Analysis (EFA), using the *Principal Axis* method. Likewise, given that items were ordinal variables, polychoric correlations were applied instead of the Pearson linear correlation. Moreover, to define the number of factors, a parallel analysis was used following the criteria of Reise, Waller, and Comrey (2000). For factorial explorations, *oblimin* rotation was used as an indirect solution. The pattern matrix was included to visualize the factorial solution. In the same way, facing the possibility that an item presented a factorial weight higher than .45 in two or more factors, it was dismissed from the matrix of definite items since it would not fulfill the discriminative properties of the EFA. As a complement, the following model fit indices were calculated: *Chi Square* with the *degrees of freedom* (*df*); normed χ^2; root mean square error of approximation (RMSEA) (<0.08); comparative fit index (CFI); and Tucker-Lewis index (TLI). These indices were carried out using the mathematical software *MPLUS* 6.11 (see Muthén & Muthén, 2007). Afterwards, the extracted internal consistency of each factor was analyzed to confirm its reliability. Lastly, the scaling of the scores from the MMSI-2-R was encoded through Percentiles (Pc) and T-scores, using the belief systems to define the normative groups. A level of 95% confidence was used for all analyses.

RESULTS

Descriptive statistics

The averages, standard deviations, variances, asymmetry, and kurtosis were calculated in Table 1A (see Appendix). Items 2, 32, and 42 presented the highest averages ($M_{2,\ 32,\ 42}$=4.83; SD_2= .617; SD_{32}= .616; SD_{42}= .618), also observed in the corresponding table. However, items 40 (M=1.93; SD= 1.035) and 15 (M=2.01; SD= 1.114) displayed the lowest averages. At the same time, the variables showed a certain degree of asymmetry, most of them being negatively asymmetrical, except for items 5, 8, 15, 30, 31, 36, 40, 43, and 46, which presented a positive asymmetrical distribution. Finally, in relation to the kurtosis, the analyzed items mainly revealed platykurtic distributions, meaning that they did not adjust to a mesokurtic pattern typical of a normal distribution.

Exploratory Factor Analysis

The Exploratory Factor Analysis started off with the examination of the correlation matrix between different items. If these items were not intercorrelated, the application of factor analysis would not be recommended due to the low probability of grouping them to a lower number of factors. In order to explore the quality of the sample, KMO (Kaiser-Meyer-Olkin) coefficients and the transformation of the Chi Square of the matrix's determinant, which allows for the corroboration of the hypothesis null sphericity, were used. On the one hand, the Kaiser-Meyer-Olkin test for sampling adequacy expressed a value of .952, which substantially exceeded the recommended value for these cases (.6). On the other hand, Bartlett's Sphericity Test displayed positive results (χ^2=245,879.843; p=.001) too. This data indicated that the correlation matrix was not identical, being able to regroup the items into new variables, called factors, based on their shared variance.

The factor analysis of the 49 items extracted up to six factors according to the parallel analysis (see Figure 1). The trend of simulated eigenvalues supports the decision that assumes a factorial solution with six factors. As a whole, all found factors explained the 87.7% of variance. To further define the found factor structure, the *oblimin* oblique rotation was used. The factor weights and extracted factors are shown in Table 1.

Figure 1. Scree-plot of parallel analysis

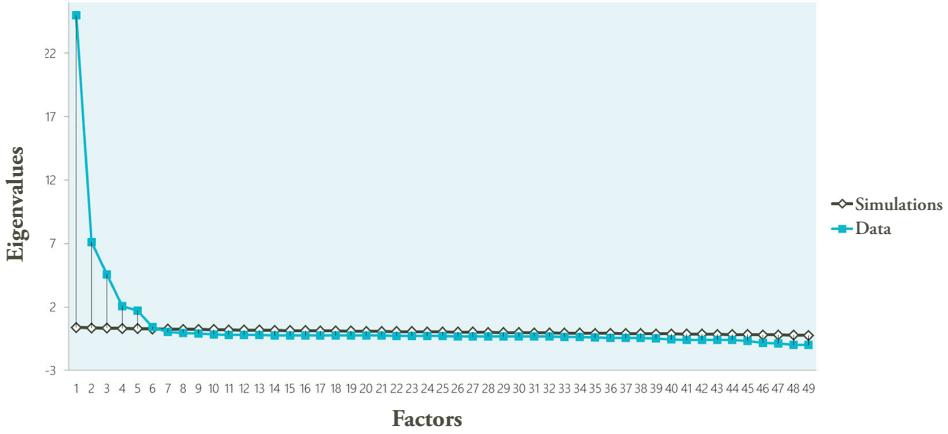

Table 1. Exploratory Factor Analysis (oblimin rotation, pattern matrix)

	Factors					
	I	II	III	IV	V	VI
Pva 1	.897					
Pva 7	.894					
Pva 24	.892					
Pva 12	.891					
Pva 34	.886					
Pva 28	.883					
Pva 16	.882					
Pva 19	.880					
Pva 33	.880					
Pva 41	.879					
Pva 6	.879					
Pva 20	.870					
Pva 27	.857					
Pva 30	.787					
Pva 18	.488					
Po 47		.977				
Po 42		.969				
Po 13		.963				
Po 2		.946				
Po 32		.940				
Po 29		.930				
Po 10		.909				
Pc 26			.917			
Pc 17			.914			
Pc 44			.909			
Pc 49			.903			
Pc 39			.903			
Pc 4			.897			
Pc 48			.895			
Pc 9			.881			
Pc 45			.877			
Pc 35			.869			
Pc 22			.827			
Pc 43			.686			
Pg 46				.996		
Pg 8				.989		
Pg 36				.986		
Pg 31				.913		
Pt 38					.979	
Pt 14					.968	
Pt 3					.962	
Pt 11					.960	
Pt 25					.956	
Pt 21					.955	
Pt 37					.953	
Pt 23					.944	
Et 5						.960
Et 40						.945
Et 15						.902
λ	24.982	7.102	4.562	2.05	1.688	0.421

The first factor (M=50.622; SD=22.278) was called Visual and Auditory Perception (Pva) and comprised 15 items. The second factor (M=33.679; SD=4.354) was called Olfactory Perception (Po) and comprised seven items. The third factor (M=5.487; SD=12.333) was called Cenesthetic Perception (Pc) and comprised 12 items. The fourth (M=9.091; SD=5.208) was called Taste Perception (Pg) and comprised four items. The fifth factor (30.702; SD=10.982) was called Touch Perception (Pt) and comprised eight items. Lastly, the sixth factor (M=5.925; SD=3.011) was called Paranoid Experience (Et) and comprised three items.

Anomalous experiences would be more intense or less relevant as the punctuations scored higher or lower respectively. The minimum and maximum scores of each factor are displayed in Table 2, in addition to the descriptive statistics. Finally, the model fit indices were minimally acceptable considering the sample size (see Brown, 2015): χ^2= 55,911, p<.001, *df*= 897; normed χ^2= 62.331; RMSEA= .058; CFI= .912; TLI= .906.

Reliability analysis

As shown in Table 3, Cronbach's Alpha coefficient generated positive results, all of them being higher than .6, as recommended by Muñiz (2003) for these kinds of tests. In the same way, none of these elements were dismissed, to promote Cronbach's Alpha, since significant results had already been obtained. The McDonald's Omega coefficient also showed satisfactory results that were similar to the Cronbach's Alpha indices.

Thus, the data revealed by the reliability coefficients indicates that the MMSI-2-R presents satisfactory internal consistency.

Psychometric scaling

Considering that the statistical justification of the MMSI-2-R had to incorporate its metric properties in the Irwin et al. (2013) phenomenological hypothesis, three normative groups were defined according to the belief systems for paranormal phenomena, which were: believers, agnostics, and non-believers.

The direct scores were transformed into percentiles (Pc), the results of which allowed for the development of the parallel estimation of the standard derived scores, also called T-scores (M=50; SD=10). General scales were also created to facilitate a transformation of the scores.

DISCUSSION

The aim of this study was to fulfill the statistical justification of the Multivariable Multiaxial Suggestibility Inventory-2-Reduced (MMSI-2-R) through factor validation, internal consistency, and validity of the construct. The

Table 2. Direct maximum and minimum scores and descriptive statistics of the factors

	Direct scores (minimum and maximum)	Mean	SD	Asymmetry S.E. = .058	Kurtosis S.E. = .116
Pva	15-75	50.622	22.278	-.491	-1.250
Pc	12-60	51.487	12.333	-1.207	.045
Pt	8-40	30.702	10.982	-.992	-.229
Po	7-35	33.679	4.354	-4.624	23.847
Pg	4-20	9.091	5.208	1.071	-.052
Et	3-15	5.925	3.011	.191	-1.660

results obtained put forth that the MMSI-2-R presents a hexadimensional internal structure with defined and satisfactory factor patterns, as well as excellent reliability for every factor (George & Mallery, 2003).

The theoretical analysis of the factors revealed a conceptual disposition based on the Barrett and Etheridge (1994) classifications, since, up to four sensory modalities were identified: Visual and Auditory Perception (Pva), Touch Perception (Pt), Olfactory Perception (Po), and Taste Perception (Pg).

The dispositional analysis of the factors also showed similarities with the factor structures of other instruments (Bell et al., 2006; Jaén-Moreno et al., 2014). In this case, factor patterns concomitant with the Exploratory Factor Analysis could be observed, which confirmed the Spanish adaptation of the CAPS and CAPE-42 scales. On the one side, the Cenesthetic Perceptions factor (Pc) described anomalous experiences related to depersonalization and derealization processes, aspects which seem to concur with the factors extracted by Jaén-Moreno et al. (2014). On the other side, the Paranoid Experiences (Et) factor revealed symptomatic contents associated to certain paranoid features, which coincided with the scales defined by Stefanis et al. (2002). Nevertheless, it is still important to indicate the similarities found between the Pva factor and the factor about experiences associated with the temporal lobe (III factor) on the CAPS scale, the nature of which is also sensorial.

Regarding the analysis of the scales, if the contrasting groups of believers, agnostics, and non-believers are considered, it can be observed that the believer subjects tended to present higher anomalous perceptions than those of the other belief systems. The T-scores for this normative group showed a normalized scale, all of them being inferior to the standard average (M=50; SD=10), with the exception of the Pg and Et scales, the scores of which were substantially weighted above the first standard deviation (T-scores ≥ 60). However, the non-believers group presented a transformed score antagonistically opposed to that of the believers' group (since their first subjects displayed a low direct score). Just as Irwin et al. (2013) verified, scaling of direct scores reflects the unusual val-

Table 3. Internal consistency analysis

	Items	Item-factor correlations	Alpha if the item was eliminated
Pva Visual and Auditory Perceptions Alpha= .987 Omega= .987	Pva 6	.884	.986
	Pva 28	.878	.986
	Pva 19	.878	.986
	Pva 33	.879	.986
	Pva 16	.879	.986
	Pva 24	.956	.985
	Pva 1	.949	.985
	Pva 12	.955	.985
	Pva 7	.953	.985
	Pva 34	.951	.985
	Pva 41	.940	.985
	Pva 20	.940	.985
	Pva 27	.941	.985
	Pva 30	.847	.986
	Pva 18	.760	.987
Pc Cenesthetic Perceptions Alpha= .988 Omega= .990	Pc 26	.988	.986
	Pc 17	.983	.986
	Pc 44	.986	.986
	Pc 39	.982	.986
	Pc 49	.973	.987
	Pc 4	.977	.986
	Pc 45	.968	.987
	Pc 48	.952	.987
	Pc 9	.965	.987
	Pc 35	.945	.987
	Pc 22	.906	.988
	Pc 43	.555	.994
Pt Touch Perceptions Alpha= .996 Omega=.996	Pt 38	.983	.995
	Pt 14	.989	.995
	Pt 3	.988	.995
	Pt 11	.984	.995
	Pt 25	.985	.995
	Pt 21	.981	.995
	Pt 37	.974	.996
	Pt 23	.969	.996
Po Olfactory Perceptions Alpha= .984 Omega= .985	Po 47	.961	.979
	Po 42	.967	.979
	Po 13	.957	.980
	Po 2	.955	.980
	Po 32	.951	.980
	Po 29	.909	.983
	Po 10	.880	.985
Pg Taste Perceptions Alpha=.983 Omega= .984	Pg 46	.983	.970
	Pg 8	.972	.973
	Pg 36	.973	.973
	Pg 31	.899	.993
Et Paranoid Experiences Alpha=.949 Omega= .949	Et 5	.895	.925
	Et 40	.893	.928
	Et 15	.896	.925

Table 4. General scales of the Spanish population (men-women)

Pc	MMSI-2-R Scales						T
	Pva	Pc	Pt	Po	Pg	Et	
99	75	60	40	35	20	11-15	73
98	-	-	-	-	-	9-10	71
97	-	-	-	-	-	-	69
96	-	-	-	-	-	-	68
95	-	-	-	-	-	-	66
90	-	-	-	-	19	-	63
85	74	-	-	-	16-18	-	60
80	-	-	-	-	12-15	-	58
75	70-73	-	-	-	-	-	57
70	-	-	-	-	8-11	-	56
65	62-69	-	-	-	-	-	54
60	60-61	-	-	-	-	-	53
55	-	-	32-39	-	-	6-8	51
50	59	-	-	-	-	3-5	50
45	52-58	59	-	-	6-7	-	49
40	43-51	55-58	-	-	-	-	47
35	-	49-54	26-31	-	-	-	46
30	36-42	47-48	34-25	-	-	-	44
25	26-35	39-46	-	-	4-5	-	43
20	16-25	38	-	-	-	-	42
15	-	-	9-23	32-34	-	-	40
10	15	25-37	8	28-31	-	-	37
5	-	23-24	-	-	-	-	34
4	-	-	-	-	-	-	32
3	-	-	-	25-27	-	-	31
2	-	-	-	7-24	-	-	29
1	-	12-22	-	-	-	-	27
N	1,773	1,773	1,773	1,773	1,773	1,762	N

Table 5. General scales of the Spanish population (non-believers)

Pc	MMSI-2-R Scales						T
	Pva	Pc	Pt	Po	Pg	Et	
99	65-75	60	40	35	20	9-15	73
98	60-64	-	-	-	19	-	71
97	-	-	-	-	-	-	69
96	-	-	-	-	-	7-8	68
95	29-59	-	-	-	-	3-6	66
90	19-28	-	28-39	-	16-18	-	63
85	16-18	-	25-27	-	8-15	-	60
80	-	-	24	-	4-7	-	58
75	-	-	11-23	-	-	-	57
70	15	-	8-10	-	-	-	56
65	-	-	-	-	-	-	54
60	-	-	-	28-34	-	-	53
55	-	-	-	-	-	-	51
50	-	59	-	-	-	-	50
45	-	-	-	-	-	-	49
40	-	49-58	-	-	-	-	47
35	-	48	-	-	-	-	46
30	-	-	-	-	-	-	44
25	-	46-47	-	-	-	-	43
20	-	37-45	-	-	-	-	42
15	-	-	-	25-27	-	-	40
10	-	27-36	-	7-24	-	-	37
5	-	25-26	-	-	-	-	34
4	-	12-24	-	-	-	-	32
3	-	-	-	-	-	-	31
2	-	-	-	-	-	-	29
1	-	-	-	-	-	-	27
N	296	296	296	296	296	296	N
Mean	18.168	51.641	14.148	28.317	6.354	3.337	Mean
SD	9.884	11.667	11.205	7.883	5.087	1.315	SD

ue of these experiences for the subjects who identify as non-believers, unlike the believer subjects who perceive these experiences with a higher frequency, conceiving them as experiences related to their paranormal beliefs. As opposed to what was expected, the agnostic group presented similar T-scores to the believer group, although with certain deviations which were above average for the Pva and Pt scales. This fact emphasizes that the agnostic doubt of the existence of the paranormal promotes a psychometric behavior which intensifies the prevalence of anomalous experiences.

These observed contrasts between the different scales call into question the polarized debate between those clinical postulates, which differ from the correlation of the anomalous experiences with the presence of clinical disorders (type 1 model) and those which approve of their justification from psychopathology (type 2 model). On the one side, considering the contributions of the continuum model, experiencing anomalous perceptions below the clinical threshold would imply a risk or psychotic vulnerability. Understanding that believer subjects presented a wider spectrum of anomalous experiences than those who were non-believers, would form a population which is more possibly at risk on a clinical level. On the other side, according to Irwin's phenomenological model (2009), the development of paranormal beliefs would attenuate the psychopathological value of anomalous experiences, considering this class of beliefs to be present intrinsically, forming a recursive loop. Given that this model does not consider that anomalous experiences can be predicted and that disorders of the psychotic spectrum can be established, beliefs in the paranormal would grant the justification and normalization of such experiences, based on the meaning, interpretation, and sense they would provide to the experiences themselves. All these observations allow for the integration of the scores of the MMSI-2-R in both paradigms, thus generating an integrator dispositional model just like Yung et al. (2009) and Langer (2011) suggested.

On the one hand, researchers who need to use this instrument under the type 2 model will be able to use it from the direct scores or from the general scales. Taking into account the asymmetrical distributions represented in the scales, it is recommended that one uses the first

Table 6. General scales of the Spanish population (agnostics)

Pc	MMSI-2-R Scales						T
	Pva	Pc	Pt	Po	Pg	Et	
99	69-70	60	39-40	35	20	14-15	73
98	67	-	-	-	-	11-13	71
97	61-66	-	-	-	-	-	69
96	-	-	-	-	-	-	68
95	60	-	-	-	-	9-10	66
90	-	-	-	-	-	-	63
85	-	-	-	-	-	-	60
80	-	-	-	-	16-19	-	58
75	59	-	-	-	12-15	-	57
70	44-58	-	-	-	-	-	56
65	-	-	-	-	-	-	54
60	-	-	32-38	-	-	-	53
55	43	-	27-31	-	-	-	51
50	-	59	24-26	-	8-11	-	50
45	-	-	-	-	-	7-8	49
40	-	55-58	-	-	-	5-6	47
35	-	47-54	-	-	-	-	46
30	-	-	-	-	-	3-4	44
25	35-42	38-46	-	-	-	-	43
20	28-34	-	-	-	-	-	42
15	22-27	33-37	-	-	7	-	40
10	16-21	26-32	-	-	4-6	-	37
5	-	23-24	16-23	34	-	-	34
4	-	-	-	33	-	-	32
3	15	-	11-15	26-32	-	-	31
2	-	-	8-10	16-25	-	-	29
1	-	12-22	-	7-15	-	-	27
N	611	611	611	611	611	600	N
Mean	43.492	51.114	30.347	34.577	11.455	6.780	Mean
SD	14.645	12.731	8.559	2.712	5.131	2.969	SD

Table 7. General scales of the Spanish population (believers)

Pc	MMSI-2-R Scales						T
	Pva	Pc	Pt	Po	Pg	Et	
99	75	60	40	35	20	9-15	73
98	-	-	-	-	-	8	71
97	-	-	-	-	-	-	69
96	-	-	-	-	-	-	68
95	-	-	-	-	-	-	66
90	-	-	-	-	16-19	-	63
85	-	-	-	-	8-15	-	60
80	-	-	-	-	-	-	58
75	-	-	-	-	-	-	57
70	74	-	-	-	-	-	56
65	-	-	-	-	-	-	54
60	-	-	-	-	-	-	53
55	-	-	-	-	7	-	51
50	70-73	-	-	-	-	-	50
45	-	59	-	-	-	3-7	49
40	-	56-58	32-39	-	-	-	47
35	-	49-55	-	-	-	-	46
30	62-69	48	-	-	-	-	44
25	61	46-47	-	-	-	-	43
20	60	38-45	-	-	4-6	-	42
15	-	-	-	-	-	-	40
10	52-59	25-37	-	-	-	-	37
5	29-51	23-24	-	-	-	-	34
4	-	-	-	-	-	-	32
3	26-28	-	30-31	33-34	-	-	31
2	16-25	-	17-29	31-32	-	-	29
1	15	12-22	8-16	7-30	-	-	27
N	859	859	859	859	859	859	N
Mean	66.965	51.742	36.705	34.884	8.345	6.232	Mean
SD	12.901	12.339	4.716	.750	4.593	2.983	SD

below-average standard deviation score (T-score= 40) as a critical cutting score for the Pva, Pc and Pt scales. At the same time, for the Po scale, it is recommended that one use the second below-average standard deviation score (T-score= 30), and for the Pg and Et scales, the first above average standard deviation score (T-score= 60). The T-scores located above the critical values would imply the presence of an intense manifestation of the contents in each scale as well as possible pathological risks of the psychotic spectrum.

On the other hand, professionals who apply the MMSI-2-R considering the belief systems represented here (type 1 model), will be able to do it using the scales based on the types of beliefs. The critical scores dependent on the standard deviations of the T-scores can be appreciated in Table 8.

The noteworthy limitations in relation to the factor model of the MMSI-2-R fall on four principal points. Firstly, given that the original objective of the test was to measure anomalous experiences, items which described negative symptoms of subclinical psychosis were not included in the reduced version of the MMSI-2. In relation to the detailing in the study of the concomitance between belief systems and anomalous experiences, it would be convenient to work with new groups of items and scales, which considered other psychological characteristics associated to the psychological phenotype. Secondly, it seems to be recommendable to suggest new psychometric analyses which allow exploration of the discriminative efficacy of possible psychopathological risks with higher precision, using a method of ROC curves. Thirdly, it would also be interesting to examine the subjective discomfort perceived by believer subjects regarding their anomalous experiences. This information would allow for the exploration of the degree of affectation felt

Table 8. Critical scores for the scales according to the belief systems regarding the paranormal

	Pva	Pc	Pt	Po	Pg	Et
Non-believers	≥60	≥40	≥60	≥40	≥60	≥70
Agnostics	≥60	≥40	≥40	≥30	≥60	≥60
Believers	≥40	≥40	≥30	≥30	≥60	≥60

by the subjects for these experiences, providing a new clinical hypothesis which goes into detail about the psychopathological limitations of these perceptions. Finally, although the EFA structured the first theoretical model in empirical and exploratory terms, the factorial solution should be validated later with confirmatory factor analyses (CFAs). Thus, in future research, it also seems essential to test the MMSI-2-R with new samples and CFAs. As a complementary limitation, it would have been ideal to include other constructs that are expected to be correlated with anomalous phenomena. This would improve the discriminant validity of the questionnaire, suggested as a proposal for future research.

To conclude, the evidence provided by the MMSI-2-R suggests the importance of paying attention to the belief system of each subject before estimating the possible underlying psychopathological risks for this class of experience. Moreover, the critical T-scores show and suggest new criteria that could be used in psychological assessment to explore and identify which types of anomalous experience could be classified as clinical symptoms or normalized experiences. All the same, the MMSI-2-R, which comprises 49 items and can be completed in under ten minutes, allows for exploration, in a reliable and valid manner, of the intensity and prevalence of anomalous experiences in relation to their sensory-perceptive categories.

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Competing interest statement

The authors declare no conflict of interest.

Human Ethics

Participants gave their written consent to use their anonymous data for statistical purposes. All of them were over 18 years of age and voluntarily collaborated without receiving any financial compensation. The procedures were carried out in compliance with the institutional regulations of the university and the Spanish Government Data Protection Law 15/1999. Similarly, all procedures adhere to the Helsinki Declaration of 1975, revised in 2013.

Additional information

Professionals or researchers who wish to use the MMSI-2-R questionnaire, may contact the author: Álex Escolà-Gascón (alexeg@blanquerna.url.edu).

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Appendix of extra tables

Table 1A. Descriptive statistics of the items (N=1,773)

	Mean	Standard deviation	Variance	Asymmetry S.E. = .058	Kurtosis S.E. = .116
Item 1	3.24	1.722	2.966	-.223	-1.724
Item 2	4.83	.617	.381	-4.853	25.816
Item 3	3.82	1.391	1.935	-.954	-.334
Item 4	4.27	1.103	1.216	-1.212	.053
Item 5	2.03	1.058	1.119	.260	-1.262
Item 6	3.54	1.452	2.109	-.848	-.725
Item 7	3.26	1.714	2.938	-.253	-1.704
Item 8	2.32	1.316	1.731	1.051	-.051
Item 9	4.32	1.043	1.088	-1.254	.154
Item 10	4.78	.696	.485	-3.992	16.762
Item 11	3.83	1.393	1.941	-.951	-.359
Item 12	3.25	1.720	2.958	-.236	-1.715
Item 13	4.82	.637	.406	-4.751	24.371
Item 14	3.85	1.385	1.919	-.991	-.259
Item 15	2.01	1.114	1.240	.512	-.791
Item 16	3.55	1.442	2.080	-.875	-.664
Item 17	4.28	1.093	1.194	-1.235	.118
Item 18	3.95	1.574	2.478	-1.070	-.623
Item 19	3.55	1.447	2.094	-.867	-.683
Item 20	3.23	1.720	2.957	-.217	-1.723
Item 21	3.86	1.381	1.907	-1.018	-.198
Item 22	4.22	1.148	1.319	-1.195	.075
Item 23	3.82	1.402	1.965	-.965	-.335
Item 24	3.25	1.719	2.956	-.245	-1.712
Item 25	3.83	1.395	1.947	-.966	-.331
Item 26	4.29	1.085	1.176	-1.233	.099
Item 27	3.24	1.707	2.914	-.219	-1.712
Item 28	3.55	1.445	2.088	-.866	-.680
Item 29	4.79	.708	.502	-4.384	19.807
Item 30	2.98	1.682	2.829	.093	-1.632
Item 31	2.11	1.380	1.905	1.133	-.030
Item 32	4.83	.616	.380	-4.796	25.282
Item 33	3.55	1.450	2.103	-.860	-.700
Item 34	3.24	1.711	2.928	-.232	-1.706
Item 35	4.30	1.068	1.141	-1.283	.308
Item 36	2.33	1.320	1.743	1.021	-.125
Item 37	3.83	1.402	1.965	-.986	-.306
Item 38	3.86	1.389	1.928	-1.021	-.211
Item 39	4.28	1.079	1.163	-1.204	.018
Item 40	1.93	1.035	1.072	.356	-1.391
Item 41	3.25	1.709	2.919	-.238	-1.705
Item 42	4.83	.618	.381	-4.836	25.673
Item 43	4.47	1.070	1.145	2.252	4.098
Item 44	4.29	1.083	1.172	-1.226	.077
Item 45	4.26	1.092	1.193	-1.200	.071
Item 46	2.33	1.324	1.752	1.020	-.134
Item 47	4.81	.664	.441	-4.381	20.273
Item 48	4.25	1.123	1.262	-1.221	.112
Item 49	4.27	1.106	1.224	-1.233	.135