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Movie for the Assessment of Social Cognition (MASC): Spanish Validation

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Abstract We present the Spanish validation of the "Movie for the Assessment of Social Cognition" instrument (MASC-SP). We recruited 22 adolescents and young adults with Asperger syndrome and 26 participants with typical development. The MASC-SP and three other social cognition instruments (Ekman Pictures of Facial Affect test, Reading the Mind in the Eyes Test, and Happé's Strange Stories) were administered to both groups. Individuals with Asperger syndrome had significantly lower scores in all measures of social cognition. The MASC-SP showed strong correlations with all three measures and relative independence of general cognitive functions. Internal consistency was optimal (0.86) and the test–retest was good. The MASC-SP is an ecologically valid and useful tool for assessing social cognition in the Spanish population.

Keywords Social cognition · Theory of mind · Autism · Asperger syndrome · MASC

The audiovisual instrument MASC-SP is freely available upon request from the corresponding author (G. Lahera) and I. Dziobek.

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Introduction

Social cognition is the ability to correctly process social information to infer mental states (emotions, knowledge, beliefs and intentions), both our own and those of other people, in order to predict others' behavior and act accordingly. This ability plays a fundamental role in our evolutionary development as human beings, enabling us to adapt to an increasingly complex social world. The extensive terminology associated with this concept is taken from diverse theoretical approaches, such as "theory of mind" (ToM), "mentalization," "mind reading," "folk psychology," and "intuitive psychology" (Happé 1994a).

The ToM concept was first introduced in 1978 by the ethologists Premack and Woodruff in their studies with nonhuman primates. It was developed with important contributions from the cognitive ethology, developmental psychology, and human psycholinguistics literature on preverbal social understanding (Meltzoff and Moore 1977; Trevarthen 1979; Wimmer and Perner 1983; Perner and Wimmer 1985; Dennet 1987). After the pioneering work in children with autism by the psychologists Baron-Cohen et al. (1985), the analysis of the acquisition of mentalistic abilities reached its most prosperous period, and numerous published studies demonstrated the inability of persons with autism to attribute mental states to others (Perner et al. 1989; Happé 1994b; Swettenham et al. 1996). This mind-reading deficit in individuals with autism spectrum disorder

(ASD) involves inaccurate processing and integration of socio-emotional stimuli and a consequent failure to respond appropriately to the mental states and emotions of others, leading to insufficient or deviant comprehension of social situations (Frith and Happé 1994).

The social processing deficit is core to autism and involves marked impairment in the use of multiple non-verbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction. A direct consequence of this deficit leads to a failure to develop peer relationships, a lack of spontaneous seeking to share enjoyment, interests or achievements with other people, and lack of social or emotional reciprocity. All these difficulties are DSM-IV-TR diagnostic criteria of the social domain for Autistic and Asperger Disorders (APA 2000).

Several instruments have been developed to assess ToM or different aspects of ToM. The simplest assess how the person can read emotions from faces and include the *Pictures of Facial Affect test* (POFA) (Ekman and Friesen 1976), the *Face Emotion Identification Task* and *Face Emotion Discrimination Task* (FEIT and FEDT) (Kerr and Neale 1993). They also assess how a person can recognize mental states through the eyes (e.g., *Reading the Mind in the Eyes Test*) (Baron-Cohen et al. 2001) or through the voice (*Reading the Mind in the Voice Test*) (Rutherford et al. 2002). Another set of instruments, and the most widely used, are based on the evaluation of first or second order false belief stories, such as the "Sally-Anne Task" (Baron-Cohen et al. 1985) and the "Ice Cream Van Story" (Perner and Wimmer 1985. Other tests include "advanced" ToM tests such as the Strange Stories test (Happé 1994a), the Stories from Everyday Life test (Kaland et al. 2002), the Hinting Task (Corcoran 2003; Gil et al. 2012), the Faux Pas test (Stone et al. 1998) and tasks that evaluate understanding of humor or sarcasm (Adachi et al. 2004). A disadvantage of these tests is that they often place excessive reliance on grammatical verbal skills and not on other aspects such as prosody or social cues (e.g., gestures, facial expressions, or gaze) that usually simultaneously accompany verbal utterances (Ziatas et al. 1998; Tager-Flusberg 2000; Rutherford et al. 2002; Fisher et al. 2005; Schick et al. 2007).

By DSM-IV definition, individuals with Asperger syndrome have preserved general intellectual and linguistic skills (DSM-IV-TR). However, the literature shows that, although they are able to pass traditional first and second order false belief tasks (a standard way of measuring capacity for social cognition), they have numerous mentalistic and social difficulties in their daily life (Ozonoff et al. 1991; Bowler 1992; Bauminger and Kasari 1999). Some authors explain this discrepancy by arguing that individuals with ASD may rely on logical cognitive mechanisms to face social situations, instead of intuitive-affective mechanisms, as is the case in persons with typical development (Hermelin and O'Connor 1985; Rivière and Núñez 1995). However, it should also be considered that the tasks may not be complex enough to capture the social cognition problems of participants with Asperger syndrome.

Most of the tools mentioned tend to focus on only one of the multiple dimensions of social cognition (e.g., recognition of facial emotion or false-belief understanding). Therefore, focusing on the intuitive-affective components of ToM and specifically for the subgroup of individuals with high functioning autism and Asperger syndrome, there is an increasing demand for validated assessment tools with high ecological validity that simultaneously cover numerous components of social cognition, such as facial expression, gaze, gestures, body language, understanding of pragmatic aspects of language (such as irony or sarcasm) and interpretation of contextual clues. In real social situations, all of these components occur together, and their simultaneous processing is necessary to interpret social behaviors correctly (Ozonoff et al. 1991; Bowler 1992; Happé 1994b; Jolliffe and Baron-Cohen 1999).

Few instruments provide an integrated evaluation of the different components of social cognition. The use of cartoons to evaluate their mental attribution in children, through a tool called the ATOMIC (Beaumont and Sofronoff 2008), has been applied to individuals with Asperger syndrome. Television advertisements and excerpts from films (Phillips et al. 1998; Heavey et al. 2000) fulfill face validity criteria as tools to assess ToM in close to real-life situations, and have also been used with adults. Nevertheless, only the Movie for the Assessment of Social Cognition (MASC) (Dziobek et al. 2006) has been specifically designed for this use. Thus, the MASC has the potential to provide greater breadth of information on receptive aspects of social cognition than most other research measures in current use.

The MASC was developed in 2006 in collaboration with the Max Planck Institute for Neurological Research in Germany and has the advantage of being able to assess social cognition by integrating different input channels, namely, the visual channel (face recognition, gaze, recognition of facial emotions), auditory channel (different aspects of prosody) and verbal channel (content of language). The multiple-choice format enables differentiation between three different types of mistakes: the first is an excessive ToM error (a mental state that is attributed when there is no mental explanation for the situation), the second on a reduced ToM error (when a present mental state is misattributed) and the third on a total absence of mental inference (e.g., making attributions of physical causality to social situations and mental states).

Despite Spanish being the second language in the world by number of speakers (Instituto Cervantes Annual Report 2012) and the fact that many recent epidemiological studies are showing how awareness and early detection of ASD is increasing (Pedersen et al. 2012), instruments to assess social cognitive function are scarce in Spanish. Furthermore, those available have not been through a proper validation process. To our knowledge, only the Hinting Task has been properly validated with a Spanish sample. Social cognition is an area of psychology where properly validated instruments are probably most needed, as social communication behaviors and their interpretation may vary between cultures.

Therefore, the goal of this paper was to validate the MASC in Spanish (MASC-SP) by applying it to individuals with Asperger syndrome and individuals with typical development in order to facilitate administration to Spanish speakers. A secondary goal was to study the qualitative nature of the expected deficits in individuals with Asperger syndrome.

We initially had three hypotheses: (1) The psychometric properties of MASC-SP are similar to those of the original version; (2) The MASC-SP can discriminate between individuals with typical development and individuals diagnosed with Asperger syndrome; and (3) Participants with Asperger syndrome make more "undermentalizing" errors than "overmentalizing" errors.

Methods

The initial phase of this adaptation consisted of the verbal transcription and translation of the English version of the MASC into Spanish. The instrument was ceded by Isabel Dziobek, the original author. First, two independent bilingual interpreters translated the original movie from its English version to Spanish. A panel of experts in mental health and cognitive psychology analyzed discrepancies between the translations and culturally incongruent expressions. The final version was sent to the original author for approval. Second, the instrument was dubbed by four drama professionals and subsequently edited following the same model as the German and English versions. The MASC-SP was initially administered to a sample of 10 participants with typical development in order to test its comprehensibility and adaptation to our cultural context. The few modifications made were always consistent with the expert panel consensus.

Finally, we validated the instrument following the methodology of the original study (Dziobek et al. 2006) in order to compare its psychometric properties and its capacity for discriminating between healthy individuals and participants diagnosed with Asperger syndrome.

Participants

Twenty-two individuals diagnosed with Asperger syndrome (APA 2000) (3 female and 19 male; mean age 21.94 years, SD 6.69, range 16-41; mean years of education 13.8, SD 1.9) and 26 participants with typical development (9 women and 17 men; mean age 22.92 years, SD 4.8, range 18-33; mean years of education 14.5, SD 1.9) were enrolled. Both groups were similar with respect to age, gender, and years of education. Participants were consecutively recruited from three Spanish public centers: a Medical Care Program for Autism Spectrum Disorders (AMI-TEA) at the Hospital Universitario Gregorio Marañón in Madrid (Parellada et al. 2013), Corporació Parc Taulí in Barcelona, and the Hospital Universitario Príncipe de Asturias in Alcalá de Henares. All diagnoses of ASD were made by Spanish psychiatrists based on the developmental history of each participant and on previous medical, psychoeducational and specialized diagnostic private services reports using DSM-IV-TR criteria.[1] The diagnosis was confirmed using a structured interview (Autism Diagnostic Interview-Revised (ADI-R) (Lord et al. 1994) in 12 of the 22 individuals. The inclusion criteria for the Asperger (AS) group were as follows: (1) age 16–45 years, (2) diagnosis of Asperger syndrome according to the Diagnostic Statistical Manual, 4th Edition Text Revision (DSM-IV-TR) (APA 2000), (3) no other comorbid psychiatric diagnoses, (4) verbally fluent and Spanish as first language, and (5) signed informed consent by parents or guardians and participants older than 16, as well as assent from participants younger than 16 years. The inclusion criteria for the control group were: (1) age 16-45 years, (2) absence of psychiatric history, (3) verbally fluent and Spanish as first language, (4) signed informed consent by parents or guardians and participants older than 16, as well as assent of the participants younger than 16 years. The exclusion criteria for both groups were (1) intellectual disability, (2) other significant mental illness unrelated to Asperger syndrome and (3) any medical or neurological disease which could interfere with the development of the study. Neither patients nor controls received any kind of reward for participating. To enroll participants with similar levels of cognitive functioning, the Screen for Cognitive Impairment in Psychiatry (SCIP) (Pino et al. 2008) was administered in the Asperger sample. No subject scored under the cut-off of 70. Cognitive performance of the Asperger group is shown in Table 1. Cognitive impairment was not detected in the sample.

[1] The recruitment and evaluation phases of this project were completed in the period 2011-2012, before the publishing and adoption of DSM-5.

Table 1 Asperger group performance in the screen for cognitive impairment in psychiatry (SCIP), used to evaluate cognitive deterioration

	Mean	SD	SCIP cut-off points
SCIP total	76.00	11.4	<70
SCIP 1 (VLT-I)	21.90	3.3	<21
SCIP 2 (WMT)	20.80	3.2	<20
SCIP 3 (VFT)	15.85	4.1	<19
SCIP 4 (VLT-D)	7.30	1.7	<7
SCIP 5 (VMT)	11.15	1.8	<12

VLT verbal learning test-immediate recall, *WMT* working memory test, *VFT* verbal fluency test; *VLT-D* verbal learning test-delayed recall, *VMT* visuomotor tracking test

Measurements

The social cognition tests used were selected in order to follow an exact replication of the original MASC validation, and consisted of Happé's Strange Stories (Happé 1994a; Pousa 2002), the Reading the Mind in the Eyes Test (Baron-Cohen et al. 2001), and the Pictures of Facial Affect Test (Ekman and Friesen 1976). This would allow our data to be compared with the original data. Those tests were originally selected to ensure content and construct validity. They were administered to all participants. All instruments were administered individually by trained psychiatrists or psychologists in the same order. The mean duration of each evaluation was two hours.

The MASC is based on a film in which four characters meet for dinner. The participants are requested to carefully observe a film of approximately 15 min in order to try to understand what the characters are feeling and thinking. During viewing, participants must answer 46 multiple-choice questions about the emotions, thoughts or intentions of the protagonists. Only one answer out of four is correct. The four choices of each answer include, (1) correct attribution of ToM to the characters of the film, (2) excessive ToM errors (a mental state that is attributed when there is no reason to), (3) reduced ToM errors (a present mental state that is not attributed) and (4) total absence of mental inference (a physical causality attribution instead of a mental state). These errors could be classified as overmentalization, undermentalization and absence of mentalization. The answer time for each question is 30 s. Examples of questions are: "Why do you think that Betty has made this comment?" or "How is Michael feeling?". Two more examples of the scenes are shown in "Appendix 1". Total time for administration and scoring varied from 45 to 70 min.

The original MASC instrument in German has been validated in English and applied in individuals with Asperger syndrome (Dziobek et al. 2006), schizophrenia (Montag et al. 2011), bipolar disorder (Montag et al. 2010), stress (Smeets et al. 2009), depressive disorder (Wilbertz et al. 2010; Wolkenstein et al. 2011) and personality disorders (Preissler et al. 2010; Ritter et al. 2011; Sharp et al. 2011). The test evaluates the understanding of non-verbal communication (e.g., question 2, 25 or 33), irony (e.g., question 6), sarcasm (e.g., question 26 or 39), implicit social rules (e.g., question 15), blunders or faux pas (question 20) and insinuations (question 43). In order to control variables such as memory or general understanding of a scene, six control questions that make no reference to social aspects are posed during the video (Dziobek et al. 2006).

Happé's Strange Stories Task (Happé 1994b) involves the reading of 16 stories in which the subject should finally answer a question which requires an inference of a mental or logical-physical state. The participant can hear the story until they believe they have understood the passage, and then the investigator asks the inferring question. The ToM stories include double bluff, persuasion, irony and white lie (two examples of each), and questions require an inference about the thoughts, emotions and intentions of the protagonists of the stories. According to the standards of the author, the answers are scored as 0, 1 or 2 (2 is an explicit and proper answer, 1 a partial or implied response and 0 incorrect or null response).

The Reading the Mind in the Eyes Test (Baron-Cohen et al. 2001) consists of the presentation of 36 black and white photographs of eyes that express different mental states. The participant must select one out of four mental states considering the best adjective that matches the eyes shown. Each photograph has only one correct choice. The test includes a glossary of 93 terms that describe the mental states that appeared in the multiple-choice test, which the participant can read at any time. Each correct answer scores one point. The higher the total score, the greater the mentalizing ability of the individual. We used the Spanish version approved by Baron-Cohen (Perez-Sayes et al. 2009) shown in PowerPoint format with no time limit.

The Pictures of Facial Affect Test also assesses the ability to infer mental states, although using 60 black and white photographs of full faces. The images are part of the battery of facial emotions of Ekman and Friesen (Ekman and Friesen 1976). The photographs were shown in PowerPoint format together with the six possible choices (joy, sadness, surprise, disgust, anger and fear) and no time limit. The subject had to choose the word that best suits the emotional state of the face. Each photograph has only one correct choice. Each correct answer scores one point and the higher the total score is, the greater the mentalizing ability of the individual.

Finally, cognitive performance of participants with Asperger syndrome was assessed using the brief scale for cognitive evaluation in psychiatric patients (Screen for Cognitive

Table 2 Sociodemographic characteristics of both groups

Group	N	Age Mean (SD)	Sex Male/female	Education
Asperger	22	21.0 (6.6)	4/18	3 Primary 15 Secondary 4 University
Controls	25	22.7 (4.7)	8/17	2 Primary 16 Secondary 7 University
		Mann–Whitney $p = 0.290$	Chi squared $p = 0.278$	Chi squared $p = 0.650$

Impairment in Psychiatry [SCIP]; Purdon 2005; translated and adapted to Spanish (Pino et al. 2008). The SCIP includes five subtests (Verbal Learning Test-Immediate Recall [VLT-I], Verbal Learning Test-Delayed Recall, Working Memory Test [WMT], Verbal Fluency Test and Visuomotor Tracking Test) that measure different cognitive domains. Commonly used cutoffs can be applied to discriminate between the presence and absence of cognitive impairment in a psychiatric population. We used the scoring cut-offs suggested by Rojo in the Spanish population (Rojo et al. 2010), in which a total score below 70 indicates impairment, with a sensitivity of 87.9 % and a specificity of 80.6 %.

Data Analysis

The normality of the variables was tested using the Kolmogorov–Smirnov test. Data for the MASC-SP, the Pictures of Facial Affect Test and the Reading the Mind in the Eyes Test were normally distributed. However, data from the Strange Stories Task were not. For normally distributed variables, independent t tests were used to investigate between-group differences. The Mann–Whitney test was used to assess non-normally distributed data. The internal consistency of the MASC was tested using Cronbach's alpha. The psychometric characteristics of the MASC-SP were evaluated using the receiver operating characteristic (ROC) curve, which includes measures of sensitivity and specificity of the instruments. The accuracy of the ROC curve is quantified by calculating the area under the curve (AUC). Pearson or Spearman correlations were used to assess associations between the measures administered. All data were analyzed using the Statistical Program for Social Sciences version 15.0 (SPSS) using a $\alpha = 0.05$ significance level.

Results

Experimental and control groups were similar with respect to sociodemographic characteristics, with no significant difference in mean age (Mann–Whitney; $p = 0.290$), gender ratio (Chi squared; $p = 0.278$), or level of education (Chi square; $p = 0.650$) (Table 2).

Table 3 Performance of the Asperger group and control group on the social cognition tests

Group	MASC-SP score Mean (SD)	Ekman test Mean (SD)	Eyes test Mean (SD)	Happé stories Mean (SD)
Asperger	25.55 (7.3)	44.7 (5.5)	20.63 (4.8)	12.35 (2.4)
Controls	33.56 (4.3)	49.8 (3.6)	26.68 (2.2)	15.25 (0.9)
Mann–Whitney $p =$	0.000	0.001	0.000	0.000

Table 4 Intercorrelations between social cognition tests

	MASC-SP	Ekman test	Eyes test	Happé stories
MASC-SP	1	0.569	0.767	0.680
POFA	0.569	1	0.483	0.446
Eyes Test	0.767	0.483	1	0.697
Happé	0.680	0.446	0.697	1

Pearson's correlation

Table 3 shows a significantly inferior performance for the experimental group compared with the control group in all social cognition tests. A significant correlation was demonstrated between the four measures of social cognition (Table 4).

The internal consistency of the MASC-SP was calculated using Cronbach's alpha. Its value for the set of 45 items was 0.86, with a range of Cronbach's alpha (if each item is removed) of between 0.86 and 0.87, which is interpreted as satisfactory internal reliability (> 0.80; Nunnally 1978) and in which there is no superfluous or useless item.

Test–retest reliability was ascertained by retesting five individuals with Asperger syndrome and five controls. Retesting took place three to six months after the initial assessments, with an average interval of 4.1 months for the group with Asperger syndrome and 3.8 months for the controls. The Asperger group mean scores were 31.7 ($SD = 5.1$) and 32.6 ($SD = 3.1$), the control group's mean scores for the initial testing and retesting were 36.2 ($SD = 3.8$) and 38.6 ($SD = 1.8$), respectively, and there were no significant within-subject differences in the test scores obtained.

The area under the ROC curves was 0.814 for the MASC-SP, 0.795 for the Pictures of Facial Affect Test, 0.912 for the Reading the Mind in the Eyes Test and 0.806 for the Strange Stories Task, where an AUC of 0.50

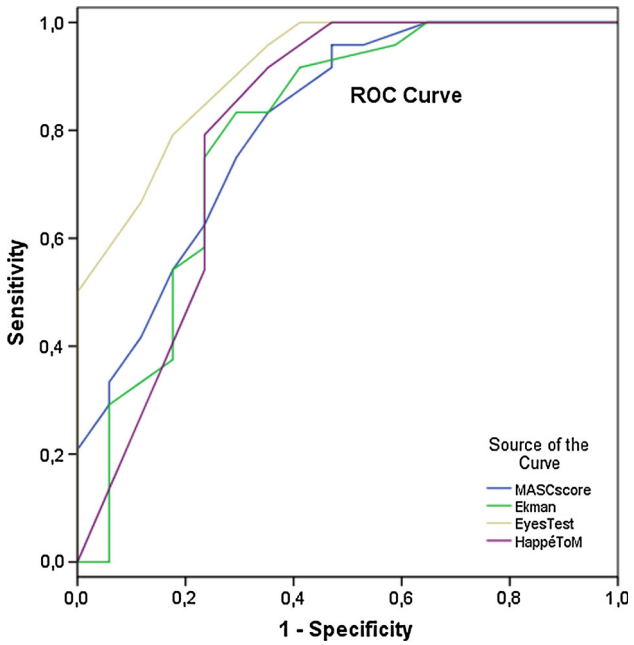

Fig. 1 ROC curves for all social cognition measures (MASC, eyes test = reading the mind in the eyes test, Ekman = POFA, Happé ToM = strange stories task)

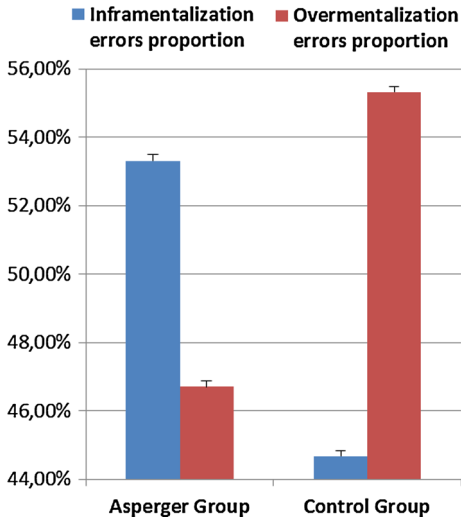

Fig. 2 Weighted percentage errors. Number of inframentalization and overmentalziation errors divided by the individual total of errors of each participant

indicates that a test's diagnostic performance is equal to chance and an AUC of 1.0 indicates perfect diagnostic performance (McNeil and Hanley 1984). These data enable us to assess the extent to which each measure could discriminate Asperger syndrome; the most useful in this respect was the Reading the Mind in the Eyes Test followed by the MASC (Fig. 1).

When MASC scores are divided according to the type of answers, all types of mistakes (excessive ToM, reduced ToM or no-ToM) are significantly more frequent in the group with Asperger syndrome (Table 5). The frequency of errors in the Asperger Syndrome group was 43.1 % for overmentalizing errors, 36.9 % for undermentalizing errors and 20.1 % for "ToM absence" errors The frequency of errors in the control group was 55.2 % for overmentalizing errors, 30.2 % for undermentalizing errors and 14.7 % for "ToM absence" errors (see MASC total scores and type of mistake in Table 5).

We conducted an intragroup analysis in order to test for significant differences in the proportion of each error type in each group separately. These three types of errors were reclassified into two categories, merging undermentalization answers and absence of mentalization answers in a new category called "inframentalization"owing to their similar nature. We then compared this new "inframentalization" category with the original overmentalization error type. Data showed that inframentalization errors were more frequent than overmentalization errors in the Asperger

Table 6 Psychometric characteristics of MASC-SP and MASC

	MASC-SP	MASC
Cronbach's α internal consistency	0.86	0.84
Test–retest reliability	Control group	Control group
	Test: 36.2 (3.8)	Test: 34 (2.3)
	Retest: 38.6 (1.8)	Retest: 35 (2.7)
	Asperger group	Asperger group
	Test: 31.7 (5.1)	Test: 21.4 (6.5)
	Retest: 32.6 (3.1)	Retest: 24 (5.1)
Area under the ROC curve	0.81 MASC	0.98 MASC
	0.91 Eyes Test	0.86 Eyes Test
	0.79 Ekman Test	0.79 Ekman Test
	0.81 Happé's Stories	0.65 Happé's Stories

Table 5 MASC-SP total scores and type of mistake (Overmentalizing, Undermentalizing, Absence of Mentalizing) in both groups

	MASC-SP Total hit score Mean (SD)	Overmentalizing errors Mean (SD)	Undermentalizing Errors Mean (SD)	Absence of mentalizing Mean (SD)
Asperger	25.55 (7.3)	8.8 (3.5)	7.5 (4.4)	4.1 (3.5)
Controls	33.56 (4.3)	6.3 (3.1)	3.4 (1.8)	1.7 (1.5)
Mann–Whitney p =	0.000	0.013	0.001	0.005

group (Fig. 2), although statistical significance was not reached (Table 6).

Furthermore, no significant correlations were found between the SCIP subtests and other tests of social cognition. MASC-SP was proven to be independent of other general cognitive functions, as there was no significant correlation between MASC score and any of the SCIP subtests: Verbal Learning Test-Immediate recall ($p = 0.257$), Working Memory Test ($p = 0.852$), Fluency Test ($p = 0.308$), Verbal Learning Test-Delayed recall ($p = 0.327$) and Visualmotor Tracking Test ($p = 0.639$).

Finally, comparison of the results in the various tests of social cognition between the three recruiting centers revealed no differences between them (Kruskal–Wallis, $p = 0.927$ for the MASC, $p = 0.435$ for the Reading the Mind in the Eyes, $p = 0.411$ for the Strange Stories Task and $p = 0.647$ for the Pictures of Facial Affect Test).

Internal consistency, test–retest reliability, and the area under the ROC curve of MASC-SP were similar to those reported in the original study (Dziobek et al. 2006).

Discussion

Following the methodology of the original article (Dziobek et al. 2006), MASC-SP was administered to a group of individuals with Asperger syndrome and a group of participants with typical development together with other instruments that assess social cognition. The main findings of our study are as follows: (1) MASC-SP has psychometric properties similar to those of the original version, (2) MASC-SP is able to discriminate between individuals with typical development and individuals diagnosed with Asperger syndrome and (3) individuals with Asperger syndrome do not make significantly more "undermentalizing" than "overmentalizing" errors.

Marked similarities were found between the psychometric characteristics of the original instrument and the Spanish version. Internal consistency was practically the same and test–retest reliability was quite similar. The area under the ROC curve (which determines the relative value of the measures in their ability to make a diagnostic group distinction) was slightly lower (0.84, versus 0.98), although still considered "excellent" (Hosmer and Lemeshow 2000). In our study, the most discriminating test for diagnostic group was the RME, which agrees with the Social Cognition Psychometric Evaluation Study (Expert Survey and RAND Panel; (Pinkham et al. 2013) that this is one of the best measures of social cognition. RME is a simple but advanced Theory of Mind test that detects subtle individual differences in social sensitivity and is widely used across different cultures (Vellante et al. 2013). However, the ability to recognize another person's mental state is measured by the perception of a "frozen" and artificially cropped pair of eyes. This sets up artificial constraints not present in real life. The ecologically more valid MASC-SP showed better diagnostic discrimination than the Ekman test and Happé′s Stories. Remarkably, diagnostic discrimination of Happé"s Stories in our sample was higher than reported in Dziobek's study. This could be influenced by the sample's cognitive functioning, since this task is more associated with verbal IQ (Kaland et al. 2002). Mean age difference (21.9, SD 6.7 in our study *versus* 41.6 SD, 10.4 in the original one) is also an important factor to take into account. It is possible that in the MASC, even when basic intuitive ToM processing abilities (such as correctly interpreting the meaning of a gaze or a face) are necessary for correct performance, some previous social experience is needed. Previous life experience in 40-year-old adults, in contrast with 20 year-olds, could contribute to the correct interpretation of some social cognition situations (e.g., flirting or feeling rejected by someone). Our study design does not let us conclude that social cognition, particularly the MASC, is directly influenced by autobiographical memory (AM), but many other studies have shown a strong correlation between ToM and AM in ASD (Lind and Bowler 2009; Adler et al. 2010; Crane et al. 2011) and a brain imaging overlap (Rabin and Rosenbaum 2012; Spreng and Mar 2012). Despite that, this issue still remains controversial (Rosenbaum et al. 2007).

MASC-SP was able to discriminate between individuals with typical development and individuals with Asperger syndrome. Subjects with Asperger syndrome showed social cognition deficits in the absence of general cognitive impairment. Furthermore, no significant correlations were found between the MASC score and any of the cognitive domains of the SCIP.

These similar data enable us to infer that performance in this task does not seem to be influenced by cultural issues, at least among the German, English, and Spanish populations. The MASC was initially produced with German-speaking participants and later translated into English. Psychometric validation of the English version was reported in a US sample from New York. Our Spanish sample from Madrid and Barcelona showed similar results. One of the advantages of this instrument is the theoretical universality of the social interactions (e.g., Michael is romantically interested in Sandra, Betty wants to be a good friend to Sandra, Betty seems a bit disinhibited after a drink, Michael wants to win a board game, etc.). However, whether participants from non-Western cultures would be as accurate is unclear, and a cross-cultural study is still needed.

The marked lack of valid and reliable Spanish-language social cognition instruments is an important obstacle to clinical practice and research in this field. With the purpose of more precisely evaluating social cognition, many

authors have designed tests that include understanding metaphors, jokes, hints, irony, tricks, blunders, or false beliefs, all the abilities that are integrated into this complex construct. However, most tests lack psychometric validation. To date, only the Hinting Task—a verbal assessment of ToM composed of 10 short vignettes where one of the characters drops a fairly clear hint that subjects must identify—has been validated in Spanish (Gil et al. 2012). The MASC-SP can be a useful new assessment tool, and it may improve the practice of clinicians and other professionals involved with individuals with Asperger syndrome. It has specific advantages, the main one being that its audiovisual format makes it possible to evaluate social cognition in a dynamic and fluid manner that closely resembles plausible scenes in daily social interactions. It is an easy and even playful way to assess social cognition (watching a brief movie and answering some forced-choice questions); it is not susceptible to the subject's tendency to provide socially desirable answers (in contrast to most empathy questionnaires) and it provides an accurate and sensitive profile of the subject's social cognition capacities. From the perspective of its clinical usefulness, it is a relatively short instrument that multimodally (visual and auditory input) includes traditional social cognition concepts such as first- and second-order false belief, faux pas, metaphor, and sarcasm. It elicits a broad range of information on mental state modalities, from cognitive ToM to emotional ToM, and operationalizes social cognition in a continuum, from mental state inferences that are ''insufficient'' to mental attributions that are ''too excessive.'' All this makes the MASC a useful tool not only for research purposes but for complete clinical assessment of the patient's social cognitive profile.

In the last few years, the study of social cognition has increased our understanding of numerous psychiatric disorders. However, evaluation instruments are clearly inadequate when it comes to reflecting subtle mentalistic deficits that cause the social difficulties of some psychiatric populations. One of the most important limitations is the *ceiling effect* that is sometimes observed in classic measures. Furthermore, the fact that these instruments are not able to reflect the deficit in mentalistic abilities and social understanding that some individuals, such as those with Asperger syndrome, show in their daily life in the same way as in the clinical setting reflects a lack of ecological validity. Another important limitation is that traditional instruments rely on linguistic comprehension or only evaluate one component of social cognition, such as gaze, voice tone, attribution of beliefs or recognition of emotions.

The most interesting finding obtained in this study was a qualitative 'deficit signature' seen in Asperger syndrome. This was seen in a combination of random errors (resulting from deficient understanding of the scene), undermentalizing errors (arising from difficulty in inferring mental states, i.e., beta (β) errors or false negatives) or overmentalizing errors (through excessive attribution of mental states, i.e., alpha (α) errors or false positives).

The intragroup analyses in our study showed that false positive and false negative errors were equally prevalent in participants with Asperger Syndrome and controls. This does not support the hypothesis that those with autism have a specific difficulty attributing mental states (Crespi and Badcock 2008). Our study suggests rather that deviant/atypical attribution may be a part of the explanation of social difficulties in this population. This increased propensity to misattribute and misinterpret mental states could be more representative of AS than an inability to make such attributions.

Comparisons between the social cognition pattern of individuals with Asperger syndrome and people with other psychiatric conditions (e.g., schizophrenia) may enable better understanding of qualitative deficits and their association with the development of psychopathology (Boada et al. in preparation).

Limitations

This study is subject to a series of limitations. Given the low prevalence of Asperger syndrome (Fombonne 2001; Fombonne and Tidmarsh 2003), recruitment was conducted at three sites, which can make for a heterogeneous sample. However, the groups were similar in sociodemographic characteristics, and no differences were found in the results for social cognition. Patients were cognitively assessed with the SCIP and not with a complete neuropsychological battery. Another limitation is that some of the patients were taking medication; therefore, variability in pharmacological regimens and the low sample size prevented us from performing an analysis of the influence of medication on the results. Finally, some of the limitations are related not to the study but to the instrument itself. Our results suggest that age could be relevant to performance on the MASC-SP, but its utility in children and adolescents under 16 years of age, and in the elderly, is unclear. Future research should apply the MASC-SP to populations of different ages and cultures in order to delimit the population target of this new instrument.

Conclusion

We validated a Spanish-language version of MASC. The present validation could facilitate the expansion of research on social cognition in a Spanish-speaking context, both in Asperger syndrome and in other psychiatric disorders.

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Appendix 1: Examples of the MASC video images (Montag et al. 2011)

English version

Cliff is the first one to arrive at Sandra's house for the dinner party. He and Sandra seem to enjoy themselves when Cliff is talking about his vacation in Sweden. When Michael arrives, he dominates the conversation, directing his speech to Sandra alone.

Slightly annoyed by Michael's bragging story, Sandra looks briefly in Cliff's direction and then asks Michael: "Tell me, have you ever been to Sweden?"

Question: Why is Sandra asking this?

(a) to integrate Cliff into the conversation *(correct)*
(b) to get back to the topic of Sweden *(undermentalizing: no ToM)*
(c) to find out if Michael was in Sweden too *(undermentalizing: reduced ToM)*
(d) to be able to compare the two men *(overmentalizing)*

Spanish versión

Cliff es el primero en llegar a casa de Sonia para la fiesta. Sandra y él parecen estar pasándoselo bien mientras Cliff cuenta sus vacaciones en Suecia. Cuando llega Michael, acapara toda la conversación y se dirige exclusivamente a Sandra.

Ligeramente aburrida por las historietas de Michael, Sandra mira ligeramente en dirección a Cliff y luego pregunta a Michael: "Dime, ¿has estado alguna vez en Suecia?"

Pregunta: ¿Por qué dice esto Sandra?

(a) para integrar a Cliff en la conversación (correcta)
(b) para volver al tema de las vacaciones en Suecia (baja mentalización; no ToM)
(c) para saber si Michael también fue a Suecia (baja mentalización; ToM reducida)
(d) para poder comparar entre los dos chicos (sobrementalización).

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