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Spanish validation of the "Reading the Mind in the Voice" task: A study of complex emotion recognition in adults with autism spectrum conditions

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ABSTRACT

Background: Social cognition includes a range of cognitive processes that help individuals understand how others think and feel. Recent proposals outline the relevance of this cognitive domain in a broad set of clinical pictures, as well as its diagnostic and prognostic value. In this study, we present the Spanish validation of the Reading the Mind in the Voice (RMV-SV) task, (Rutherford et al., 2002), an instrument for the recognition of mental states and complex emotions through prosody.

Method: A group of adults diagnosed with autism spectrum disorders (ASD, $n = 45$) were compared to a control group from the general population ($n = 51$) in several emotion-recognition tasks.

Results: The ASD group performed worse than controls overall on complex emotion and mental state recognition from voices ($\eta^2 = .322$; $p < .01$), statistically significant differences were found on 18/33 specific emotions. A positive correlation was found between verbal and non-verbal IQ and emotion recognition task scores. Using RMV-SV scores, 87.5% of the participants were correctly allocated to their original condition group.

Conclusions: The results confirmed the alteration of the recognition of mental states and complex emotions by prosody among adults diagnosed with ASD. The RMV-SV showed suitable validity

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and reliability indexes, so the adapted task could facilitate the evaluation of complex emotion recognition through prosody in Spanish.

1. Introduction

Skills development aimed at understanding one's own or somebody else's emotional state is an essential aspect by which to cope with the environmental demands required for personal and social adaptation (Hudepohl, Robins, King, & Henrich, 2015; Olsson & Ochsner, 2008). *Social cognition* is central to this field of study. It provides an in-depth view into the mental operations that underlie social interactions, including perception, interpretation and responses to the intentions, dispositions and behaviours of others (Green et al., 2008).

Traditionally, research on emotion recognition has been focused on the identification of basic emotions (surprise, disgust, fear, happiness, sadness and anger) in discrete forms of social communication (facial expression, emotional prosody or body movement), based on their transcultural relevance (Ekman, 1993) and the correlations between findings from neuroimaging studies with specific emotions (Kassam, Markey, Cherkassky, Loewenstein, & Just, 2013; Saarimäki et al., 2015). Recent theoretical and methodological contributions (Feldman Barrett, 2013) suggest that the assessment in this field of tasks of recognition of complex emotions (e.g., confusion, disappointment) is more frequent in daily life and depends on the integration of contextual information, based on cognitive assessment and beliefs (Griffiths, 1997; Harris, 1989; Izard, 2007; Zinck & Newen, 2008). Performance of these tasks includes two classic concepts in the field of social cognition, namely, the *theory of mind* (ToM) and *emotion recognition* (ER). According to recognised definitions, ER refers to the individual's ability to identify and discriminate emotional states from the observation of signs in the behaviour of others (Cotter et al., 2018; Spunt & Adolphs, 2019). ToM incorporates the capacity to attribute mental states and infer intentions, dispositions or beliefs and, on the basis of all this, describe, explain and predict behaviour (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Frith, 1992; Mathersul, McDonald, & Rushby, 2013).

Pioneering descriptions of autistic spectrum disorders (ASD) define the condition as an "affective contact disorder" (Kanner, 1943). This impression was based on studies that related ASD symptoms with difficulties in processing and interpreting information of a socioemotional nature (Kuusikko et al., 2009). It has been hypothesised that these difficulties could be the consequence of an inadequate development of ToM, which organises both the personal emotional world and the interpersonal sphere (Baron-Cohen, Leslie, & Frith, 1985; Frith, 2003; Hobson & Hobson, 2013).

Nonetheless, literature has shown inconsistencies in the recognition of basic emotions presented within a single form of social communication that could be preserved (Castelli, 2005; Grossman, 2010; Murphy, Brady, Fitzgerald, & Troje, 2009; Tracy, Robins, Schriber, & Solomon, 2011) or compensated for (Chevallier, Noveck, Happé, & Wilson, 2011) in a percentage of the population diagnosed with ASD, whereas at the same time there are clear alterations in an extensive set of ER studies through facial expression (Harms, Martin, & Wallace, 2010; Uljarevic & Hamilton, 2013), prosody (McCann, Peppé, Gibbon, O'Hare, & Rutherford, 2007) or body movement (Centelles, Assaiante, Etchegoyhen, Bouvard, & Schmitz, 2013). This empirical disparity may be attributed to methodological nuances intrinsic to the use of basic emotion tasks in the assessment, such as ceiling effects, the use of multimodal methodology (face–voice stimuli) or the use of verbal mediation as a compensatory strategy, which may mask their deficits under certain circumstances. The optimisation of the ecological validity of the measures by using tests based on *complex emotions* (Baron-Cohen, Wheelwright, Hill et al., 2001; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001; Golan, Baron-Cohen, Hill, & Rutherford, 2007; Happé, 1994; Rutherford, Baron-Cohen, & Wheelwright, 2002) has been proposed as an alternative to solve the instability of the results (Dziobek et al., 2006; Golan, Baron-Cohen, & Hill, 2006; Golan, Baron-Cohen, Hill, & Golan, 2006; Stewart, Mcadam, Ota, Peppé, & Cleland, 2013).

This work focuses on the Spanish version of the Reading the Mind in the Voice task (Rutherford et al., 2002), a task of recognition of both mental states and complex emotions through prosody. The original instrument included 40 voice segments with a certain emotional intonation, lasting 2–3 s. The number of correct answers obtained discriminated between a sample of patients with ASD and a control group. The performance was not conditioned by variables such as intelligence or age. A later review (Golan et al., 2007) included methodological improvements that optimised their discriminative capacity and exceeded the ceiling effect, in addition to showing satisfactory psychometric indicators. This study replicates the validation of the task, comparing the performance of a group of people diagnosed with ASD to a neurotypical control group. We hypothesised an altered performance in the ER tests in the ASD group versus the control group based on previous research (Golan et al., 2007; Rutherford et al., 2002). Measures for recognition of complex emotions, and for ASD spectrum symptoms, were included in the design. We also studied the influence of relevant variables within autistic symptomatology which could effect performance scores on emotion recognition tasks. These variables included verbal and nonverbal intelligence (Fridenson-Hayo et al., 2016; Rosenblau, Kliemann, Dziobek, & Heekeren, 2017) as well as affective states (Capps, Kasari, Yirmiya, & Sigman, 1993; Samson, Huber, & Gross, 2012).

2. Materials and methods

2.1. Participants

The clinical group consisted of 45 adults (six female, 39 male) diagnosed with ASD according to DSM-5 criteria (American

Psychiatric Association, 2013). The age range was between 18 and 40 (M = 23.20, SD = 5.99). Participants were recruited from several associations, specialised clinics or mental health units in Spain. All patients were diagnosed by mental health professionals, (clinical psychologists and psychiatrists) with at least two years of sustained diagnosis. All participants completed the Kaufman Intelligence Brief Test (K-BIT) (Kaufman & Kaufman, 2000), obtaining scores above 80. The average group scores on the intelligence test were 104.96 (SD = 8.75) for verbal IQ, 106.58 (SD = 9.91) for nonverbal IQ and 104.64 (SD = 10.53) for combined IQ.

The control group consisted of 51 people (23 female, 28 male) aged 18–45 (M = 21.45, SD = 6.45) and neurotypical development, recruited from the Medicine and Health Science School of the University of Alcalá through voluntary practice. The Spanish version of the Autism Spectrum Quotient test (Baron-Cohen, 2005; Baron-Cohen, Wheelwright, Skinner et al., 2001) was used as a screening test for autistic traits. None of the participants was excluded from this group. Control group participants completed tests similar to those of the ASD group, with an average group score in the K-BIT of 108.58 (SD = 9.42) in verbal IQ, 106.75 (SD = 8, 22) in nonverbal IQ, and 107.06 (SD = 8.08) in combined IQ.

Table 1 shows sociodemographic data. Both groups were paired by means of age; education; and verbal, nonverbal and combined IQ variables. Gender differences between groups were statistically controlled.

2.2. Instruments

2.2.1. Reading the Mind in the Voice task: Spanish version

The original test was developed by Rutherford et al. (2002), later revised by Golan et al. (2007), and assesses the recognition of complex emotions and mental states through prosody. Participants have to decide what a character is feeling or thinking as they are exposed to an interpreted text. The subjects had to choose one of four answers, of which only one was correct. Simultaneously, a consultation sheet with the definition of each of the emotional states was given. Golan´s review showed test–retest reliability indicators of .8 and discriminant capacity higher than 85% in ASD and controls.

2.2.2. Adaptation of the task to the Spanish population

Golan's methodology was followed in the Spanish adaptation (Rutherford et al., 2002). Two translators were used to develop the Spanish version, following the methodological standard (Brislin, 1970). Eight professional actors (four female, four male) interpreted the items in a neutral Spanish accent. Each of them recorded the interpretation of one half of the questionnaire according to the emotional tone of the items. Five expert clinical psychologists (two female, three male) rated the representativeness of each of the four interpretations of each item to the emotional state they intended to transmit, scoring them on a Likert scale from 1 to 4 (1 = "It does not fit the emotion"; 4 = "It fits the emotion perfectly"). The interpretation with the highest score was selected for each item. Items that did not reach the score of 2 were excluded; thus, a first version of the 39-item instrument emerged. This version was ultimately administered to a group of 19 people from the general population (nine female, 10 male, age M = 32.7, SD = 5.34), using similar conditions to those proposed in the research design. The final version included only those items whose target answer was chosen by at least half of the participants (nine or more), and if the incorrect options were not selected by more than a third of the participants (five or fewer).The final version of the instrument contained 33 items (see Electronic Supplementary Material 1 and 2).

2.2.2.1. Reading the mind in the eyes test: Spanish version (RME-SV; Fernández-Abascal, Cabello, Fernández-Berrocal, & Baron-Cohen, 2013). The Reading the Mind in the Eyes test assesses recognition of complex emotions and mental states from 36 photographs of people's gaze (Baron-Cohen, Wheelwright, Hill et al., 2001; Baron-Cohen, Wheelwright, Skinner et al., 2001), administered as a multiple-choice test with four adjectives that describe emotional states. It was provided together with an auxiliary sheet with the definitions of the adjectives listed, which could be consulted. The Spanish translation showed good psychometric indicators and one-year test–retest stability, with an interclass correlation coefficient (ICC) = .63.

2.2.2.2. Autism spectrum quotient: Spanish translation (AQ) (Baron-Cohen, 2005). This is a 50-item self-report that assesses the degree to which an adult with normal IQ has traits associated with the autistic spectrum (Baron-Cohen, Wheelwright, Hill et al., 2001; Baron-Cohen, Wheelwright, Skinner et al., 2001). Scores ranged from 0 to 50. According to Baron-Cohen´s Spanish version, scores higher than 36 were considered an indication of autism. It has shown good discriminant validity (Woodbury-Smith, Robinson, Wheelwright,

Table 1
Means, standard deviations and ranges of chronological age and IQ scores.

	ASD (n = 45)				Control group (n = 51)						
	M	*SD*	Range	%	*M*	*SD*	Range	%	$t_{(94)}$	χ^2	*p*
Age	23.20	5.99	18–40		21.45	6.24	18–45		2.29		.13
Verbal IQ	104.64	10.53	124–79		107.06	8.08	127–72		1.03		.30
Non Verbal IQ	106.58	9.91	121–88		106.75	8.22	123–86		1.33		.18
Total IQ	104.36	8.75	121–87		108.58	9.42	118–85		1.71		.09
Female				20.7				45.1		11.44	**< .01**
Higher Secondary Education				97.8				100		1.14	.28

Bold text indicates a statistically significant difference with a *p*-value less than 0.05.

& Baron-Cohen, 2005) and a test–retest validity of .7. The Spanish validation of this instrument is currently being developed. The scores showed a Cronbach's α of .92 in this study.

2.2.2.3. Positive and negative affect schedule: Spanish adaptation (PANAS; López-Gómez, Hervás, & Vázquez, 2015). This is a 20-item self-report questionnaire (Watson, Clark, & Tellegen, 1988). In scientific literature, it is one of the most frequently used measures to assess emotions. It has shown excellent psychometric properties in the Spanish population, with a bi-factorial structure (Positive Affect and Negative Affect). This assessment measure was only used in the ASD group.

2.2.2.4. Kaufman brief intelligence test (K-BIT) (Kaufman & Kaufman, 2000). This is a brief intelligence test used in samples comprising participants between 4 and 90 years old. It is divided into two subtests: Vocabulary and Matrices. It provides two IQ indicators (verbal and nonverbal) and a combined IQ. The internal consistency and test–retest stability coefficients are higher than .85 in both subtests.

2.3. Procedure

This research was approved by the Clinical Research Ethics Committee of the General University Hospital of Elche. All procedures performed in this study were conducted in accordance with the ethical standards of the institutional research committees and the Declaration of Helsinki as revised in 2000. Informed consent was obtained from all individual participants included in the study.

The administration of the aforesaid instruments was carried out by qualified staff in each of the centres the participants attended. The first individual 60-minute assessment session included the collection of sociodemographic information, AQ, K-BIT, RME-SV and PANAS results (the latter only for the ASD group), questionnaires in pencil and paper format, together with the RMV-SV, presented on Microsoft PowerPoint 2007©. Half of the participants from the ASD group repeated the RMV-SV 15 days after the first assessment, in a 20-minute session.

2.4. Statistical analysis

Group scores were compared in the different measures used, following the strategy of data analysis of the original validation studies. The distribution of all dependent variables, except K-BIT scores, failed to fulfil the assumption of homoscedasticity, so the intergroup differences were analysed by means of an ANOVA based on the Welch test (Moder, 2010). Given the gender differences between groups, an additional intra-group comparison of performance in each task was carried out by applying the Student's *t*-test. The correlation between measures, test–retest reliability and discriminative capacity of the instrument were analysed on the basis of discriminant analysis. Calculations were made with the SPSS 19 (IBM Corp., 2010) statistical package. The statistical power of the test (1-β) was calculated from the G*Power program, version 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007).

3. Results

All participants from the control group and the ASD group, except two, exceeded the correct answers expected by chance in the RMV-SV (12 points, $p < .05$, binomial test). Only one of the participants from the ASD group scored below the RME-SV chance result (13 points, $p < .05$, binomial test). Table 2 includes score descriptions and comparisons in each test or questionnaire used in the design.

Table 2
Mean scores of males and females.

	ASD (n = 45)			Control group (n = 51)					
	M	*SD*	Range	*M*	*SD*	Range	*F*	*p*	η^2
RMV-SV	21.73	4.92	7–28	26.78	1.88	22–30	41.96	< **.01**	.32
Female	20.16	6.40	8–25	27.04	1.77	25–30			
Male	21.97	4.72	7–28	26.57	1.97	22–30			
RME-SV	22.05	4.49	11–32	27.51	3.10	13–34	46.208	< **.01**	.34
Female	22.67	3.50	19–29	27.74	3.16	21–32			
Male	21.95	4.65	11–32	27.32	3.09	22–34			
AQ	30.25	7.92	15–48	13.92	6.10	4–33	123.53	< **.01**	.57
Female	30.67	10.67	15–48	12.35	4.60	4–20			
Male	30.18	7.59	15–42	15.21	6.91	4–33			

Notes: RMV-SV = "*Reading the Mind in the Voice*" *Task*–Spanish version; RME-SV = "*Reading the mind in the eyes*"- *Test*-Spanish Version; AQ = *Autism Spectrum Quotient*-Spanish Version.
Bold text indicates a statistically significant difference with a *p*-value less than 0.05.

3.1. Reading the Mind in the Voice task: Spanish version

The control group participants attained significantly higher scores in 18 out of 33 items, plus three items that showed marginal differences ($p = .06$). The overall score was higher in the ASD group than in the control group in items 9 (Surprise), 12 (Fury) and 28 (Resignation), without reaching statistical significance (see Table 3).

Comparison between groups showed significant differences in the performance of the test ($F[1,55,23] = 41.96$, $p < .01$, $\eta^2 = .32$) for the control group. The comparison of performance according to gender did not show differences in the control group ($t[49] = .89$, $p = .38$) or in the ASD group ($t[43] = -.83$, $p = .41$).

3.2. Reading the mind in the eyes test: Spanish version

The results showed statistically significant inter-group differences ($F[1,74,80] = 46.21$, $p < .01$, $\eta^2 = .34$), with higher scores for the control group. Gender differences were not significant in either the control group ($t[49] = .47$, $p = .64$) or the clinical group ($t[43] = .37$, $p = .72$).

3.3. Autism spectrum quotient: Spanish version

ANOVA analysis showed significantly higher scores in the ASD group ($F[1,80,18] = 123.53$, $p < .01$, $\eta^2 = .57$). There were no intra-group differences according to gender in either the control group ($t[49] = -.70$, $p = .09$) or the clinical group ($t[43] = .14$, $p = .89$).

3.4. Correlations between RMV-SV and other relevant variables

The pattern of bivariate correlations between scores in the different emotion recognition tasks and other relevant variables is

Table 3
Frequency of correct responses to the "Reading the Mind in the Voice" Task-Spanish version items.

	Control ($n = 51$)	ASD ($n = 45$)		
Item	f	f	Dif %	$\chi^2(p)$
1	16	8	13.6	2.36 (.12)
2	51	42	7	3.51 (.06)
3	46	27	30.2	**11.96 (< .01)**
4	51	36	20	**11.25 (< .01)**
5	38	32	3.4	.14 (.71)
6	39	23	25.4	**6.71 (.01)**
7	51	40	7	3.51 (.06)
8	46	33	16.9	**4.66 (.03)**
9	16	18	−8.6	.78 (.38)
10	42	27	22.4	**5.91 (.01)**
11	50	41	6.9	2.34 (.13)
12	31	32	−10.3	1.96 (.29)
13	50	38	13.6	**5.78 (.01)**
14	41	28	18.2	**3.90 (.04)**
15	44	31	17.4	**4.28 (.04)**
16	30	16	23.24	5.19 (.23)
17	46	36	10.2	1.96 (.15)
18	41	28	18.2	**3.90 (.04)**
19	43	36	2.1	.75 (.78)
20	44	27	26.3	**8.57 (< .01)**
21	48	32	23	**9.11 (< .01)**
22	41	22	31.5	**10.52 (< .01)**
23	31	27	.8	.01 (.93)
24	48	30	23	**11.82 (< .01)**
25	49	34	31.5	**7.32 (.07)**
26	32	13	33.81	**11.00 (< .01)**
27	49	33	22.8	**9.92 (< .01)**
28	28	27	−5.1	.25 (.61)
29	50	40	9.1	3.42 (.06)
30	48	39	7.4	1.56 (.211)
31	37	25	16.9	3.02 (.08)
32	50	36	18	**8.34 (< .01)**
33	39	17	38.7	**14.72 (< .01)**

Note: Dif % = Difference between percentage of correct responses in the control and ASD groups.
Bold text indicates a statistically significant difference with a *p*-value less than 0.05.

presented in Table 4. RMV-SV scores correlated positively with RME-SV scores ($r = .593$, $p < .01$), verbal IQ ($r = .439$, $p < .01$) and nonverbal IQ ($r = .275$, $p < .01$). However, the AQ score showed a negative correlation ($r = -.434$, $p < .01$). The RME-SV task was directly associated with verbal IQ variables ($r = .378$, $p < .01$) and nonverbal IQ ($r = .308$, $p < .01$), and correlated inversely with the score in AQ ($r = -.450$, p < .01) and negative affect ($r = -.339$, $p < .01$). The correlations between RME-SV and the PANAS dimensions were inverse and significant both for positive affect ($r = -.325$, $p = .03$) and for negative affect ($r = -.31$, $p = .03$).

3.5. Power, reliability and validity

The ER task is usually limited by the ceiling effect; thus, the calculation of the power of the RMV-SV task (bilateral, $\alpha = .01$) offered a *1-β* indicator = .999. Furthermore, an item-by-item descriptive analysis showed that only three out of 33 items reported 100% correct answers in the control group, and up to 12 correct answers reached 90%. No items reached 100% success and only three exceeded 90% in the ASD group, so the ceiling effect risk was dismissed in the Spanish version of the instrument (see Electronic Supplementary Material 3 for percentages of correct response by item).

Item scores in the RMV-SV were used in a discriminant analysis, showing a statistically significant discriminant function ($\chi^2(33) = 60.358$; $p < .01$). It correctly classified 87.5% of the total sample; 90.19% of the sample was correctly classified in the control group compared to 84.44% of the ASD group. Test–retest validity was calculated in a subgroup of clinical participants ($n = 24$), and a significant correlation, $r = .801$ ($p < .01$), was obtained.

4. Discussion and implications

The general objective of this research work was the translation, adaptation and validation of the Reading the Mind in the Voice task and its review. After translation and the interpretation of the items by professional actors, we strictly replicated the procedure described by Golan et al. (2007) based on the original instrument proposed by Rutherford et al. (2002) and obtained a final 33-item Spanish version. So far, this is the first known evaluation test on recognition of complex emotions and mental states through prosody in Spanish.

The ASD group participants had a lower overall score than the control group, showing worse performance, similar to the results in Anglo-Saxon samples. Reliability and discriminative capacity indicators were satisfactory. The reliability of the Spanish version was similar to the English version. The discriminative function of the translated instrument significantly improved the discriminative function of the control group participants compared to previous works. Ceiling or floor effects could be ruled out due to the score range obtained. This is usually one of the main methodological difficulties found in this type of measure.

The hypothesis made about better performance in the identification of emotion or mental states by the control group was confirmed by the analysis of the RMV-SV item-to-item scores. Significant differences were found in 19 of the 33 items. Unexpectedly, the ASD group showed a higher percentage of right answers in three of these items than the control group did. These items included the emotions of surprise, anger and resignation. Although this finding has been reported in both Anglo-Saxon versions, authors such as Doi et al. (2013) have reported an optimised performance in ER tasks for the items with the lowest emotional intensity in the ASD sample. In addition, two of these are considered basic emotions (surprise and anger). These emotions are less difficult to recognise for this population (Chevallier et al., 2011).

Research on the identification of emotional states presented through prosody in individuals diagnosed with ASD has traditionally offered inconsistent results and has included both impaired performance (Globerson, Amir, Kishon-Rabin, & Golan, 2015; Loveland et al., 1995; McCann et al., 2007) and execution similar to normal groups (Loveland, 1997, Chevallier et al., 2011; Grossman, 2010; Mazefsky & Oswald, 2007). Certain methodological issues could explain this variation (McCann & Peppé, 2003; Zinck & Newen, 2008). This study indicates that using measures with higher ecological validity do indeed elicit the difficulties in processing social

Table 4
Correlations of "Reading the Mind in the Voice" Task- Spanish Version (RMV-SV) and "Reading the Mind in the Eyes" Test- Spanish version (RME-SV) with AQ, age and IQ scores.

	RMV-SV	RME-SV
RME-SV	**.593****	
AQ	**−.434****	**−.450****
Verbal IQ	**.439****	**.378****
Non Verbal IQ	**.275****	.325
Positive affect[a]	−.134	**−.325***
Negative affect[a]	−.219	**−.318***
Age	.207	−.257

Note: AQ = *Autism Spectrum Quotient*-Spanish Version.
Bold text indicates a statistically significant difference with a *p*-value less than 0.05.
[a] Only in the ASD group.
* Correlation is significant at the .05 level (2-tailed).
** Correlation is significant at the .01 level (2-tailed).

information faced by adults diagnosed with ASD (Rosenblau et al., 2017). While basic emotions elicit distinctive responses with remarkable haste, little cognitive participation, characteristic facial expressions and body movements or tone of voice that are easily identified, in everyday life these basic emotions are seldom found in isolation. On the other hand, complex emotions require the attribution of an additional cognitive state to the recognition of an emotion, largely dependent on context and culture (Golan, Baron-Cohen, Hill et al., 2006). Therefore, alterations in the recognition of emotional prosody in ASD patients could contribute to a more difficult adaptation to social interactions.

The correlation pattern between RMV-SV scores and measures of emotional recognition or autistic symptomatology confirms the concurrent validity of the measure. Similar to previous studies (Golan et al., 2007), RMV-SV scores directly correlated with RME-SV, a similar test of emotion recognition through the eyes. Inverse correlation was highlighted with respect to the score in the AQ test, an instrument for autistic spectrum traits assessment. Literature frequently shows negative affects in people with ASD (Samson et al., 2012), but neither the negative nor the positive affect correlated with the RMV-SV scores. Both variables correlated inversely with respect to the RME-SV. This result was unexpected, and perhaps it points to the effect of affective activation on ER performance.

Several studies, including transcultural ones (Fridenson-Hayo et al., 2016), have shown the relationship between verbal intelligence measures and ER, particularly for complex emotions (Golan et al., 2007; Rosenblau et al., 2017). This association has been interpreted as secondary to the capacity for content integration and verbal input intonation, though it could also reflect compensatory strategies, based on verbal content analysis during test performance (Globerson et al., 2015). An unexpected result between non-verbal intelligence and performance in emotion recognition tests by prosody was found. This finding suggests that other skills might be involved, different to those associated with verbal intelligence. Further research is required.

There are several limitations to this study. The clinical sample selection criteria were carried out by specialist physicians, according to diagnostic criteria from international classifications, without using diagnostic assessment measures such as the Autism Diagnostic Interview-Revised (ADI-R) (Lord, Rutter, & Lecouteur, 1994) or the Autism Diagnostic Observation Schedule (ADOS) (Lord, Luyster, Gotham, & Guthrie, 2012). This would have allowed a more detailed study of particular aspects that are part of the diagnosis and its interaction with emotional prosody recognition skills. Furthermore, ecological validity of ER measures is limited by the static nature of the stimuli included in the RMV-SV, far away from daily interactions. Recently, some ER batteries have been proposed for dynamic stimuli (Golan, Baron-Cohen, Hill, 2006; Lassalle et al., 2019). Although validated in other European countries, these are yet to be translated into Spanish. An important limitation is that people in the autistic spectrum show heterogeneous clinical characteristics (Pelphrey, Shultz, Hudac, & Vander Wyk, 2011). Gender distribution of the diagnosis in the population is three to four times more frequent among males (Loomes, Hull, & Mandy, 2017), so analysis with statistical power is hindered. A final limitation is that the conclusions considered only the average-upper range of the IQ continuum. Future studies should take into account the inclusion of a wider IQ range sample to verify the relation between variables.

The RMV-SV is a reasonable measure for assessment of adults' recognition of complex emotions and mental states through prosody in Spanish. It has shown construct validity, reliability and discriminative capacity, making it suitable for use in both clinical and research contexts. We do not know of any similar measure in Spanish, so its use will complement the study of clinical syndromes that show this altered capacity, such as ASD, neurocognitive disorders, mood disorders or the schizophrenia spectrum disorders (Frühholz & Staib, 2017). Other uses of this instrument include research on aspects related to these diagnoses, such as the expanded autistic phenotype (Oerlemans et al., 2014) or the longitudinal evaluation of therapeutic interventions on one's emotion recognition skills (Berggren et al., 2017).

Data statement

Due to privacy policies of the associations and mental health units that collaborated in the study, the participants were assured that raw data would remain confidential and would not be shared.

Declaration of Competing Interest

There were no conflicts of interest for any of the authors when conducting this research.

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