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Original article

The validity of using self-reports to assess emotion regulation abilities in adults with autism spectrum disorder

Sylvie Berthoz [a,*], Elisabeth L. Hill [b]

[a] Department of Psychiatry, Institut Mutualiste Montsouris, 42, Boulevard Jourdan, 75674 Paris cedex 14, France
[b] Department of Psychology, Goldsmiths College, University of London, London, UK

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Abstract

***Purpose.* –** The current paper focused on the validity of using self-reports to assess emotion regulation abilities in autism spectrum disorders (ASD). To assess this we sought responses to two alexithymia self-reports and a depression self-report at two time points from adults with and without ASD.

***Materials and methods.* –** An initial sample of 27 adults with ASD and 35 normal adults completed the 20-item Toronto alexithymia scale (TAS-20), the Bermond and Vorst alexithymia questionnaire-form B (BVAQ-B), and the Beck depression inventory (BDI), at test time 1. Of these individuals, 19 ASD and 29 controls participated again after a period ranging from 4 to 12 months.

***Results.* –** ASD participants were able to report about their own emotions using self-reports. BVAQ-B showed reasonable convergent validity and test–retest reliability in both groups. Scores on both alexithymia scales were stable across the two participant groups. However, results revealed that although the TAS-20 total score discriminated between the two groups at both time points, the BVAQ-B total score did not. Moreover, the TAS-20 showed stronger test–retest reliability than the BVAQ-B.

***Conclusion.* –** ASD participants appeared more depressed and more alexithymic than the controls. The use of the BVAQ-B, as an additional assessment of alexithymia, indicated that ASD patients have a specific type of alexithymia characterised by increased difficulties in the cognitive domain rather than the affective aspects of alexithymia.
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Keywords: Emotion regulation; Alexithymia; Autism spectrum disorder; TAS-20; BVAQ

1. Introduction

Individuals with autism spectrum disorders (ASD) are generally considered to have difficulty in processing their own and other people's emotions [4,12,18]. A current theory of the social communication impairments in ASD proposes that there is an impairment in theory-of-mind, also referred to as 'mentalising'. By this, it is meant the ability to attribute mental states automatically to others and to implicitly take account of the fact that different people have different thoughts [5,6]. This impairment may cause an inability to identify and describe one's own mental states, including feelings about things. Autobiographies of apparently well-compensated individuals with ASD suggest some unusual reporting of own feelings, in conjunction with very detailed reporting of bodily sensations (e.g. [13,14]).

In a separate literature on disorders of emotion regulation, Sifnéos (1973) described a cluster of cognitive and affective features in terms of the alexithymia construct [26]. In this case, emotion dysregulation includes difficulties in identifying and describing feelings, difficulties in distinguishing feelings from the bodily sensations of emotional arousal, impaired symbolisation, as evidenced by a paucity of fantasies and other imaginative activity, and a tendency to focus on external events rather than inner experiences (concrete thought). Alexithymia has been investigated in various psychiatric populations (see [28] for a recent review), mostly using the Toronto alexithymia scales (TAS-26 and TAS-20 [2,3,29]), notably because these self-reports are the most validated instruments aimed at assigning alexithymia and because they are the easiest to use [1].

Recently the possibility of using self-report measures to understand adults with high-functioning ASD has proved promising. Baron-Cohen and colleagues have developed a

* Corresponding author.
E-mail address: sylvie.berthoz@imm.fr (S. Berthoz).

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number of self-report measures to be used in such adults. One is a self-administered instrument for measuring the degree to which an adult with normal intelligence has the traits associated with the autism spectrum (autism spectrum quotient, [7]). This scale has been reported to have good test–retest and inter–rater reliability and is reported to be a valuable instrument for quantifying, where an individual is placed on the spectrum between autism and normality. In addition, Baron-Cohen and colleagues have developed the systemising quotient and empathising quotient [8]. These are self-report measures suitable for high-functioning ASD adults, which tap the drive to analyse or construct systems and the ability to empathise respectively.

In an earlier study we assessed levels of alexithymia and depression at the time of testing in a group of high-functioning ASD adults [17]. We reported the responses of 27 ASD adults, 35 controls and 49 relatives of people with ASD on two self-report measures: the TAS-20 and the Beck depression inventory (BDI) [9]. We believe this was the first study to address directly the issue of the existence of emotion processing difficulties and their relation to depression by asking high-functioning adults with ASD to report their own emotional processes. The ASD participants had higher alexithymia scores and were more depressed than a control group matched for age and gender. This study gave some encouragement to the view that such individuals are capable of responding adequately to questionnaires when asked to report their own emotions. This view has also been maintained through the use of Baron-Cohen et al.'s empathising quotient [8].

While the results of our first study were promising, a need for further investigation is evident. In particular, the outcome of responses to alexithymia measurement, first by demonstrating whether deficits in emotion regulation are stable over time in ASD and second by establishing whether the deficits can be identified when another alexithymia self-report scale is administered.

In our original study, participants completed the Bermond–Vorst alexithymia questionnaire (BVAQ) in addition to the TAS-20. However, since little is known about the validity and reliability of this scale, we did not report our findings. In the present study, we report the responses of the original sample on the BVAQ, as well as a follow-up of this sample in which 19 of the adults with ASD and 29 normal controls completed both alexithymia measures (TAS-20 and BVAQ) and the BDI. These data were collected at two time points to assess further the validity of self-reports in a high-functioning sample of adults with ASD, as well as the validity and reliability of the use of these scales in an ASD sample.

2. Materials and methods

2.1. Participants

Sixty-two individuals participated in our study at test time 1. This group comprised 27 adults with ASD and 35 normal adult controls. The adults with ASD had all received a formal diagnosis of either Asperger syndrome (n = 20) or autism (n = 7). At test time 2, 19 adults with ASD (13 with a formal diagnosis of Asperger syndrome, and six with a diagnosis of autism) and 29 normal adult controls participated. Since to complete the studies it was necessary to read and write and indeed to complete three questionnaires unaided, all participants had to be high-functioning. These adults with ASD were recruited via various support groups and community centres. All had attended mainstream school, and the majority of both groups reported attending further or higher education. The control group was recruited from the subject pool at the Institute of Cognitive Neuroscience and from local community centres. Participant details are shown in Table 1.

2.1.1. Measures

2.1.1.1. Alexithymia. Several measures of alexithymia have been developed, including interviewer-rated questionnaires, projective techniques, verbal content analysis, self-report scales, and a technique derived from cognitive science. However, only a few were devised with the aim of validating the construct and most of them suffer from various methodological flaws or lack of adequate validation data [1,15,20]. One exception is the TASs, which demonstrated psychometric properties superior to those of other alexithymia questionnaires. Originally, the TAS was designed as a 26-item scale, clustered into four factors that were theoretically congruent with the alexithymia construct [29]. However, a revised version was introduced, notably because one factor (daydreaming) was found to have little theoretical coherence with the other facets of the alexithymia construct. Thus, a new 20-item version was developed (TAS-20), excluding items assessing daydreaming and/or imaginal activity because of low corrected item-total correlations and/or high correlations with a measure of social desirability [2,3]. The TAS-20 demonstrated good internal consistency (Cronbach's alpha = 0.81) and test–retest reliability over a 3-week interval (r = 0.77), and a three-factor structure. The three factors of this revised scale relate to: (1) ability to identify feelings, (2) ability to describe feelings, (3) externally oriented thinking. The number of items per factor is seven, five, and eight items, respectively (see Table 2 for examples of items in each factor). Five items are negatively keyed. Although the TAS-20 does not measure alexithymia as it was originally conceptualised [27], it has become the most widely used instrument.

Recently, the BVAQ was developed. The development of this scale has been grounded in both theoretical and empirical domains [31]. The questionnaire is available in Dutch, English, French, Italian, Spanish, German, Polish and Russian. The BVAQ has two parallel versions (A and B), of 20-items each, and an extended test (A + B) of 40-items. This instrument, which has five factors, seems to have adequate psychometric properties but further validation is needed [26,28,29]. The BVAQ-B has been found to provide better psychometric properties than the BVAQ-A [11,23,32].

Table 1
Mean (S.D.) total scores on the BVAQ-B, TAS-20 and BDI as well as on the BVAQ-B cognitive and affective scores and the subscale scores for the BVAQ-B and TAS-20. Participant details are also given.

	ASD adults		Control group	
	Time 1, $n = 27$	Time 2, $n = 19$	Time 1, $n = 35$	Time 2, $n = 29$
% male	55.56	63.20	45.71	37.30
CA (years)	35.07 (12.26)	38.21 (12.55)	32.18 (11.25)	33.76 (11.81)
% in education post-16 years	81.48	89.47	94.29	96.55
BDI [a] (max = 63)	13.78 (6.89)	12.16 (8.47)	5.74 (4.78)	5.93 (6.06)
BVAQ-B total (max = 100)	51.26 (12.26)	51.47 (9.50)	44.57 (8.21)	45.66 (9.74)
Range (20–100)	26–79	29–71	29–61	30–64
Poor verbalising (*max = 20*)	*11.93* (*3.29*)	*11.84* (*3.4*)	*9.78* (*2.57*)	*9.0* (*2.78*)
Poor fantasies (*max = 20*)	*9.70* (*3.5*)	*10.47* (*3.92*)	*9.54* (*3.67*)	*10.59* (*2.96*)
Poor insight (*max = 20*)	*11.26* (*3.65*)	*10.89* (*3.3*)	*9.77* (*2.98*)	*9.41* (*3.63*)
Poor emotional excitability (*max = 20*)	*9.59* (*3.81*)	*9.00* (*2.49*)	*8.86* (*2.51*)	*9.31* (*2.84*)
Concrete thinking (*max = 20*)	*8.78* (*3.38*)	*9.26* (*3.62*)	*7.06* (*2.27*)	*7.0* (*2.46*)
BVAQ-B cognitive score (max = 60)	31.96 (9.03)	32.0 (7.02)	26.17 (5.22)	24.41 (6.49)
BVAQ-B affective score (max = 40)	19.3 (5.63)	19.47 (4.39)	18.4 (5.39)	19.9 (4.34)
TAS-20 total (max = 100)	60.44 (10.84)	59.74 (13.74)	42.51 (9.09)	38.93 (9.28)
Range (20–100)	33–82	36–87	25–59	20–55
Difficulty identifying feelings (*max = 35*)	*20.93* (*5.73*)	*21.05* (*7.4*)	*15.11* (*5.27*)	*13.72* (*5.16*)
Difficulty describing feelings (*max = 25*)	*17.59* (*3.4*)	*17.58* (*4.72*)	*11.71* (*3.49*)	*11.17* (*3.59*)
Externally oriented thinking (*max = 40*)	*21.93* (*6.28*)	*21.11* (*5.8*)	*15.69* (*4.47*)	*15.72* (*5.03*)

[a] Note that data for one ASD adult were not available at time point 1.

Table 2
Examples of items for each subscale of the TAS (three subscales) and the BVAQ (five subscales). Equivalent subscales are shown side by side. Respondents must indicate on a scale of one to five whether they strongly agree to strongly disagree (respectively) with each statement

20-Items TAS	BVAQ-B
Difficulty identifying feelings:	Poor insight:
I am often confused about what emotion I am feeling	When I feel lousy, I know whether I am afraid or dejected or sad [a]
When I am upset, I don't know if I am sad, frightened or angry	When I am fed-up, it remains unclear to me whether I am sad or afraid or unhappy
Difficulty describing feelings:	Poor verbalising:
I find it hard to describe how I feel about people	People often say that I should talk about my feelings
I am able to describe my feelings easily [a]	I can express my feelings verbally [a]
Externally oriented thinking:	Poor analysing:
I find examination of my feelings useful in solving personal problems [a]	There is not much to understand as far as emotion are concerned
I prefer to watch 'light' entertainment shows rather than psychological dramas	I think you should keep in tune with your feelings [a]
	Poor fantasising:
	I like to think up bizarre imaginative stories [a]
	Fantasising about imaginary things or events is a waste of time, I think
	Poor emotional excitability:
	When I see somebody crying terribly, I remain unmoved
	When friends around me argue furiously, I become emotional [a]

[a] Items that are negatively keyed.

The BVAQ-B consists of five subscales: (1) verbalising, (2) fantasising, (3) identifying, (4) emotionalising, (5) analysing (see Table 2 for examples of items in each subscale). Each subscale is comprised of four items. Half of the items are negatively keyed. Subscales 1, 3 and 5 of the BVAQ-B correspond to subscales 2, 1 and 3, respectively, of the TAS-20. The two additional subscales correspond to: the degree to which someone is inclined to fantasise, imagine and daydream (2. fantasising); and the degree to which someone is emotionally aroused by emotion inducing events (4. emotionalising) [31].

In view of the differences in the number of factors of the two scales, we followed the methodology reported by Vorst and Bermond and computed three total scores based on the BVAQ-B subscales [31]. The standard total score equals the sum of all five subscales (BVAQ-B total). The second total score, labelled 'cognitive' score, corresponds to the sum of the scores on three subscales (identifying, verbalising, analysing). This cognitive score should be comparable to the total score of the TAS-20. The third total score, labelled 'affective' score, corresponds to the sum of the scores on the two remaining subscales (emotionalising, fantasising).

The TAS-20 and the BVAQ-B are self-report questionnaires. In both cases, the items are rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). For the BVAQ-B, we inversed the original method of scoring

the scale (in which, 1 corresponded to "strongly agree", and 5 to "strongly disagree"). This alteration was aimed at homogenising the presentation of the two alexithymia scales used in our study. Scores on the TAS-20 and BVAQ-B range from 20 to 100. For both self-reports, the scoring of the items is such that high scores are indicative of a high proneness to alexithymia.

2.1.1.2. Depression. The level of depression was assessed using the 21-item BDI [9]. In this test individuals are asked to respond to statements on the basis of how they have felt over the past week. In this way the BDI provides an indication of the presence of a depressive episode at the time of the study. Scores on this scale range from 0 to 63.

2.2. General procedure

Questionnaires were given or sent out to participants at two time points. Each time, full instructions were included as well as stamped addressed envelopes for the return of the questionnaires. Participants were encouraged to contact us if they had questions concerning completion of the questionnaires. Responses from returned questionnaires were included in the analysis only if the TAS-20 and BVAQ-B had been completed fully at both time points and if responses on these two scales were not confined to the "neither agree nor disagree" response. One adult did not complete the BDI at time point 1. The two test sessions were separated by 4–12 months. Ethics approval for the study had been obtained from the ethics committee of University College London/University College London Hospital.

3. Results

Mean total scores on the BVAQ-B, TAS-20 and BDI, as well as mean scores for the cognitive and affective scores on the BVAQ-B, and for each subscale of the BVAQ-B and TAS-20 are shown in Table 1.

3.1. Test comprehension of the BVAQ-B

We examined how well the participants had understood and completed the BVAQ-B. Given that it is a self-report questionnaire, it is particularly important to establish this in a clinical population, and especially in one such as ASD, since this test has not been used previously with this population.

Of the original 32 adults with ASD who received the questionnaires (test time 1), 27 (84.4%) returned them fully completed. Only two of these 27 participants phoned us to discuss the task instructions, which we had encouraged them to do. These questions related solely to an uncertainty about whether the BDI was concerned only with the preceding week. No questions were asked about the meaning of items on either the BVAQ-B or on the TAS-20 scales. All of the participants who had completed the first study were contacted again except for one who had requested not to be involved in further research. Of these 26 individuals, 19 (73.1%) also participated in the second study. Of the remaining seven, one refused to participate because of physical illness at the time of contact, while two had moved without leaving a forwarding address. The remaining four did not respond to two attempts at contact. Of those 19 who chose to participate in the second study, none contacted us to discuss the task instructions at the second time of testing. Confidence in the fact that this self-report questionnaire was completed appropriately by the adults with ASD was strengthened by the fact that these adults did not give the "I neither agree nor disagree" response more often than the controls. Thus, the ASD individuals appeared equally able to respond to questionnaires when asked to report about their own emotions as the comparison group. Importantly in this respect, some items of the BVAQ-B and TAS-20 are negatively keyed and in order to get a high score (indicative of alexithymia) respondents must be able to understand the questions and switch their response from one question to another. Both groups managed to respond successfully to both positively and negatively keyed items, implying that both groups understood what they were being asked to reply to, thereby suggesting the rating scales were used appropriately in all cases.

A final hint that adds further support to the view the participants' comprehension of the BVAQ-B was satisfactory comes from the fact that some of the adults with ASD spontaneously sent letters to us along with their completed questionnaires. These letters described their difficulties and frustrations in the area of emotion processing. We quote illustratively, and directly, from two of these letters. "I get so mad when people say "got no feelings, can't relate to me". I have feelings—told very deep...Trouble is wires crossed so show all this in perhaps odd bizarre fashion or in misplaced way." (a 34-year-old woman with Asperger syndrome). "When I am able to get people to understand me, my view of life is positive, but when I am battling against the prejudice I feel very low. This feeling comes from the powerlessness to change my situation in which I find myself...In formal situations this is not a major problem, but in informal ones it is a crushing one." (a 31-year-old woman with Asperger syndrome).

3.2. Convergent validity

The convergent validity of the BVAQ-B was assessed by comparing the responses of all participants (ASD and control group together) on the BVAQ-B and the TAS-20 at each time point. Pearson product moment correlations were conducted to compare the total BVAQ-B and TAS-20 scores at test time 1 [$r(60) = 0.62$, $P < 0.001$] and test time 2 [$r(46) = 0.45$, $P < 0.001$]. These analyses were repeated for the two participant groups separately [ASD time 1, $r(25) = 0.77$, $P < 0.001$; ASD time 2, $r(17) = 0.48$, $P < 0.05$; control time 1, $r(33) = 0.41$, $P < 0.01$; control time 2, $r(27) = 0.31$, $P = 0.056$].

Similarly, the equivalent subscales of the BVAQ-B and TAS-20 were correlated at each time point, first for all participants together: BVAQ-B 'verbalising' versus TAS-20 'describing feelings' [time 1, $r(60) = 0.64$, $P < 0.001$; time 2, $r(46) = 0.57$, $P < 0.001$], BVAQ-B 'identifying' versus TAS-20 'identifying feelings' [time 1, $r(60) = 0.72$, $P < 0.001$; time 2, $r(46) = 0.65$, $P < 0.001$] and BVAQ-B 'analysing' versus TAS-20 'externally oriented thinking' [time 1, $r(60) = 0.66$, $P < 0.001$; time 2, $r(46) = 0.65$, $P < 0.001$]. The correlations were repeated, considering each group separately: BVAQ-B 'verbalising' versus TAS-20 'describing feelings' [time 1: ASD, $r(25) = 0.59$, $P < 0.001$; control, $r(33) = 0.52$, $P < 0.001$; time 2: ASD, $r(17) = 0.46$, $P < 0.05$; control, $r(27) = 0.14$, $P < 0.05$], BVAQ-B 'identifying' versus TAS-20 'identifying feelings' [time 1: ASD, $r(25) = 0.71$, $P < 0.001$; control, $r(33) = 0.72$, $P < 0.001$; time 2: ASD, $r(17) = 0.55$, $P < 0.01$; control, $r(27) = 0.77$, $P < 0.001$], and BVAQ-B 'analysing' versus TAS-20 'externally oriented thinking' [time 1: ASD, $r(25) = 0.55$, $P < 0.01$; control, $r(33) = 0.73$, $P < 0.001$; time 2: ASD, $r(17) = 0.67$, $P < 0.05$; control, $r(27) = 0.49$, $P < 0.01$]. Thus, there were significant correlations between each equivalent factor at both time points.

The cognitive score on the BVAQ-B was correlated with total score on the TAS-20 at each test time. When all participants were included in the same analysis, there was a significant correlation between these two scores at both tests [time 1, $r(60) = 0.76$, $P < 0.001$; time 2, $r(44) = 0.67$, $P < 0.001$]. Score on these two measures also correlated significantly at both test times when the two groups were considered separately [time 1: ASD, $r(25) = 0.74$, $P < 0.001$; control, $r(33) = 0.73$, $P < 0.001$; time 2: ASD, $r(17) = 0.66$, $P < 0.01$; control, $r(27) = 0.47$, $P < 0.01$].

Finally, for each self-report measure, Pearson product moment correlations were used to investigate the association between the total score and the subscale scores at each test time. This analysis was applied to the ASD and control group separately, as well as for both groups combined (see Table 3). All but three comparisons achieved significance, with most being at the $P < 0.001$ level. The exception to this was (i) at test 2 in the ASD group, for the correlation between total BVAQ-B and score on the emotionalising subscale; (ii) at test 1 in the control group, for the correlation between total BVAQ-B score and score on the poor insight subscale; and (iii) at test 2 in the control group for the correlation between total TAS-20 score and score on the externally oriented thinking subscale.

Table 3
r and *P* values for Pearson product moment correlations between BVAQ-B total score and each BVAQ-B subscores, as well as TAS-20 total score and each TAS-20 subscores at time 1 and time 2. Shaded TAS-20 and BVAQ-B subscales are considered equivalent

	ASD group	Control group	All participants
BVAQ-B			
Time 1			
Poor verbalising	0.75***	0.63***	0.74***
Poor fantasies	0.58**	0.72***	0.60***
Poor insight	0.71***	0.19	0.52***
Poor emotional excitability	0.66***	0.63***	0.65***
Poor analysing	0.79***	0.79***	0.81***
Time 2			
Poor verbalising	0.62**	0.63***	0.66***
Poor fantasies	0.61**	0.41*	0.47***
Poor insight	0.46*	0.62***	0.59***
Poor emotional excitability	0.33	0.75***	0.56***
Poor analysing	0.75***	0.7***	0.74***
TAS-20			
Time 1			
Difficulty identifying feelings	0.67***	0.74***	0.78***
Difficulty describing feelings	0.80***	0.78***	0.88***
Externally oriented thinking	0.67**	0.55***	0.73***
Time 2			
Difficulty identifying feelings	0.87***	0.48**	0.79***
Difficulty describing feelings	0.84***	0.61***	0.84***
Externally oriented thinking	0.57**	0.27	0.58***

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

3.3. Discriminant validity

To test whether the BVAQ-B and the TAS-20 could discriminate equally between the ASD and the control group, total scores of each group on each test were compared. Since both age and depression have been shown to be associated with alexithymia in the general population [19,22,25], one factor ANOVAs comparing age and BDI scores of the two groups (ASD, control) were conducted. There was no significant difference between the ages of the two groups at either test time [time 1: $F(1,59) = 0.92$, $P > 0.1$; time 2: $F(1,46) = 1.55$, $P > 0.1$]. There was a significant difference in the intensity of depression in the two groups at both test times [time 1: $F(1,60) = 29.38$, $P < 0.001$; time 2: $F(1,46) = 8.82$, $P < 0.01$], reflecting significantly greater levels of depression at the time of each test in the ASD adults. There was a significant difference between the gender distribution across the two groups at test 2 [$\chi^2(1) = 4.81$, $P < 0.05$], with males representing the greater proportion of the ASD group. This difference was not significant at test 1 [$\chi^2(1) = 0.59$, $P > 0.1$].

Given the size of the sample, statistical analysis was not conducted on the subscales of each test. Since there was a significant difference between the two groups in terms of the intensity of depression at both test points and the gender distributions at the second test, logistic regression analyses adjusting for depression and gender were applied to the data for the BVAQ-B and TAS-20 total scores at each test time separately (with the total BDI score for the corresponding test time included in the analysis). For the BVAQ-B there was a significant difference between the two groups at test time 1, with the ASD group exhibiting a significantly higher level of alexithymia than the controls, once the level of depression and participants' gender had been controlled for [Exp(B) = 1.09, CI (1.02–1.18), $P < 0.02$]. However, there was no difference between the two groups at the second test [Exp(B) = 1.05, CI (0.98–1.14), $P = 0.17$]. For the TAS-20,

Table 4
Pearson product moment correlations and *P* values for scores at test 1 versus test 2 for the ASD and comparison groups separately, as well as for all participants together for BVAQ-B total, TAS-20 total, the five BVAQ-B subscores and the three TAS-20 subscores. Shaded BVAQ-B and TAS-20 subscales are considered equivalent

	ASD group $n = 19$	Control group $n = 29$	All participants $n = 48$
BVAQ-B total	0.81**	0.32	0.59**
Poor verbalising	0.82**	0.35	0.67**
Poor fantasies	0.66**	0.56*	0.59**
Poor insight	0.63*	0.67**	0.67**
Poor emotional excitability	0.62*	0.22	0.39*
Poor analysing	0.72**	0.20	0.70**
TAS-20 total	0.92**	0.29	0.80***
Difficulty identifying feelings	0.81**	0.70**	0.82**
Difficulty describing feelings	0.79**	0.65**	0.82**
Externally oriented thinking	0.86**	0.72**	0.82**

* $P < 0.01$; ** $P < 0.001$.

there was a significant difference between the two groups once the level of depression and participants' gender had been controlled for, with the ASD group exhibiting a significantly higher level of alexithymia than the controls. This was the case at both test times [time 1, Exp(B) = 1.22, CI (1.09–1.36), $P < 0.001$; time 2, Exp(B) = 1.17, CI (1.06–1.29), $P < 0.01$].

The groups were compared on the cognitive score of the BVAQ-B (i.e. the sum of the subscales verbalising, identifying and analysing, taken to be equivalent to the TAS-20 total score). A logistic regression analysis adjusting for depression and gender was applied to the data at each test time separately. At both test times there was a significant difference between the groups [time 1, Exp(B) = 1.16, CI (1.04–1.3), $P < 0.01$; time 2, Exp(B) = 1.13, CI (1.01–1.26), $P < 0.05$]. When using a logistic regression analysis to compare the groups on the affective score of the BVAQ-B (i.e. the sum of the subscales fantasising and emotionalising, aspects of alexithymia not included in the TAS-20), there was no significant difference between the two groups at either test time, after adjusting for depression and gender [time 1, Exp(B) = 1.1, CI (0.97–1.24), $P = 0.13$; time 2, Exp(B) = 0.99, CI (0.84–1.17), $P = 0.91$].

Analysis and discussion of the TAS-20 and BDI scores for an overlapping group of participants are given in more detail elsewhere [17].

3.4. Test–retest reliability

Test–retest reliability was assessed using Pearson product moment correlations [24]. Correlations were conducted on the responses at test 1 versus test 2 for the two groups separately, as well as for all participants together for BVAQ-B total, TAS-20 total, each of the five BVAQ-B subscales and each of the three TAS-20 subscales. The results are given in Table 4. Most correlations were significant at the $P < 0.001$ level. In the ASD group, correlation values for the BVAQ-B and the TAS-20 scores and subscores ranged between 0.62–0.82 and 0.79–0.92, respectively. In the control group, correlation values for the BVAQ-B and the TAS-20 scores and subscores ranged between 0.20–0.67 and 0.29–0.72, respectively. Taking a test–retest reliability value of $r \geq 0.70$ to be considered satisfactory (see [20]), the TAS-20 showed a more consistent degree of reliability for both the total, and individual subscale scores in all groupings analysed in comparison to the BVAQ-B.

4. Discussion

The focus of the current paper was on the validity of using self-reports to assess emotion regulation abilities in ASD. To assess this we sought responses to the BVAQ-B and TAS-20 at two time points from individuals with and without ASD.

The test comprehension of the BVAQ-B in our ASD sample was good, as it was on the TAS-20 suggesting, in line with Baron-Cohen et al. [7] that high-functioning individuals with ASD are able to respond adequately to self-report questionnaires. Furthermore, the convergent validity of the BVAQ-B with the TAS-20 was good. In accordance with previous studies that have used the TAS-20 as a gold standard [11,23,31,32], the present results support the validity of the BVAQ-B as an alexithymia questionnaire for investigation of clinical population.

It is generally agreed that the TAS-20 should not be used in isolation in an assessment for alexithymia [20,30]. In our study, as in previous studies, the TAS-20 discriminated clearly between a clinical and non-clinical sample (see [28] for a recent review). However, this difference was not mirrored so clearly in responses to the BVAQ-B. The uneven profile of group discrimination on the BVAQ-B was rather unexpected since the differences between the two groups were striking on the TAS-20. This was unexpected since the BVAQ-B includes two factors that are missing from the TAS-20 (fantasising and emotionalising) and for which we had expected higher scores in the ASD than in the control group. Bermond (1997) has suggested two kinds of alexithymia that may be distinguished [10]. Type I alexithymia is characterised by a low degree of conscious awareness of emotional arousal and a low degree of emotion accompanying cognitions. Type II alexithymia is characterised by a normal or high degree of conscious awareness of emotional arousal together with a low degree of accompanying cognitions. As pointed out by Vorst and Bermond (2001), the BVAQ can be used to distinguish these two types of alexithymia ([31], p. 432). The use of the BVAQ-B in our ASD population suggested that this group was more specifically impaired on the cognitive dimensions of alexithymia (i.e. identifying,verbalizing and analysing), corresponding to Type II alexithymia in Bermond's account [10].

This is the first study, not only to investigate the test–retest reliability of the BVAQ-B in any sample, but also to consider TAS-20 test–retest reliability in both a clinical and a non-

clinical sample over such a long period (intervals of 4–12 months). In the ASD group, the test–retest reliability of the TAS-20 was good for both the total score on this scale and its subscales. This was also the case when all the participants were combined (but marginally less so for the control group alone). Whereas Kooiman et al. found that only the 'difficulty to identify feelings' subscore had a test–retest reliability that reached the conventional level of adequacy [20], all the TAS-20 factors showed a satisfactory level of adequacy in our clinical group. For the BVAQ-B, test–retest reliability was also satisfactory: for the 'poor analysing' subscore for the ASD group and when all participants were combined; and for the BVAQ-B total and 'poor verbalising' subscore for the ASD participants.

As far as we are aware, this is the first set of studies to address directly the presence of alexithymia in an ASD population. Our investigations suggest that it is possible to reliably identify alexithymia in this population, since individuals with ASD appeared capable of responding adequately to questionnaires when asked to report their own emotions. Furthermore, test–retest reliability was stable over time in this population, with the caveat of the BVAQ-B in the control group. Taken together, the findings of our two studies [17] suggest that we have identified a tool to understand better the experiences of individuals with ASDs, adding to information from case reports of individuals with ASD who others have identified and treated successfully for depression [21]. Furthermore these suggestions are supported by autobiographical accounts of apparently well-compensated individuals with ASDs which indicate an ability to report own feelings, although these are reported in an unusual way (e.g. [13,14]). Thus, despite the fact that individuals with ASD are commonly believed to have difficulty processing their own and other people's emotions, we have shown that with regards to own emotion processing, it is more likely that individuals with ASD show a different way of actually processing their emotions, rather than an absence of this processing. It should be stressed that these arguments relate only to the processing of own, rather than other people's emotions. Further discussion of the existence of alexithymia in an ASD population can be found elsewhere [17].

5. Conclusion

In sum, our study suggests that emotion regulation self-report questionnaires can be used to characterise the ASD affective style. ASD participants appeared more depressed and more alexithymic (even when taking their increased level of depression into account, as it has been demonstrated that depression can constitute a confounding variable when measuring alexithymia). We should be cautious though, since our sample was relatively small. However the results can be considered reasonable in light of the report by Baron-Cohen et al. [7] that the test–retest reliability of their self-report measure, the autism spectrum quotient, was good in a sample of 17 adults with ASD. Further work is needed to replicate our effect, not only in a larger sample of ASD individuals, but also in other clinical populations, something that we are undertaking currently. Use of the alexithymia questionnaires highlighted that high-functioning adults with ASD were able to reflect on their own emotions, but that they have an increased likelihood of experiencing the cognitive impairments characteristic of alexithymia in comparison to a non-clinical adult control group. However, in the light of the findings presented here, we argue, in accordance with other authors [20,30], that alexithymia self-reports should be used conjointly with other measures when assessing alexithymia. In particular, the Observer Alexithymia Scale would be a useful addition. This scale appears to be promising for collecting and evaluating observer data on alexithymia in clinical samples [16].

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