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Clinical assessment of ASD in adults using self- and other-report: Psychometric properties and validity of the Adult Social Behavior Questionnaire (ASBQ)



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ABSTRACT

The aim of this study was to develop and validate the Adult Social Behavior Questionnaire (ASBQ), a multidimensional Autism Spectrum Disorder (ASD) questionnaire that contains both a self report version and a version to be completed by someone close. Psychometric qualities, convergence between self report and other report ratings, and scores in a group diagnosed with ASD and multiple comparison groups were examined.

Principal Component Analyses yielded a structure with six dimensions (reduced contact, reduced empathy, reduced interpersonal insight, violation of social conventions, insistence on sameness, and sensory stimulation/motor stereotypies) for both self- and other-report versions. Reliability estimates and correlations between self- and other-ratings were good and the score profile on the 44-item ASBQ differentiated a group with ASD from a non-clinical group and patients with depression, schizophrenia and ADHD.

We conclude that the ASBQ is a short and easy to apply questionnaire that captures the heterogeneous nature of ASD. It yields a score profile among six ASD problem domains both from the perspective of the patient and from a significant other.

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1. Introduction

The behavioral problems of Autism Spectrum Disorders (ASD) generally persist into adulthood (Howlin, Goode, Hutton & Rutter, 2004). ASD are highly heterogeneous and the degree of continuity of the autistic problem domains across the lifespan is unclear. The diagnostic and assessment process of ASD in adults is complicated by the fact that it is hard to distinguish milder forms of ASD problems from other psychiatric conditions and from the spectrum of normal behavior. There is a

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scarcity of measures to capture the multiple dimensions of ASD symptomatology in adulthood, especially when the aim is also to distinguish milder variants of this disorder. A complicating factor is that in adult psychiatry self-report measures are generally used, but particularly in ASD the validity of self-report is uncertain. Individuals with ASD are generally believed to have a limited awareness of their social and communicative impairments (Mitchell & O'Keefe, 2008). However, this is contested by other authors who report their ability to accurately reflect on inner experiences (Spek, Scholte & Van Berkelaer-Onnes, 2010). To address this issue, ASD self-report measures should be compared against the report of others (e.g. parents, siblings, spouses), thus giving insight in the necessity of a multiple-informant approach in adulthood. Unfortunately, there are limited data in the literature that make this comparison feasible. A further aspect of interest is the longitudinal pattern and stability of ASD characteristics. Given their childhood onset, ideally, ASD measures should contain both a child and an adult version to capture symptomatology across the lifespan.

A number of diagnostic self-report scales have so far been developed specifically for ASD in adults. Most commonly used in clinical practice is the Autism-Spectrum Quotient (AQ) (Baron-Cohen, Wheelwright, Skinner, Martin & Clubley, 2001). The AQ assesses autistic traits based on a dimensional approach to autism. Items were drawn from clinical experience with the description of problems met by people with Asperger Syndrome. The AQ has been validated both in its full form (50 items) as well as in shorter versions (10, 21 and 28 items), but the authors stress that only the full-scale AQ can be used as a diagnostic instrument (Hoekstra et al., 2011). Construct validity of the AQ-50 varies according to the characteristics of the studied population. Sensitivity and specificity are high when comparing patients with Autistic Disorder and Asperger Disorder with healthy controls (Hoekstra, Bartels, Cath, & Boomsma, 2008), but little difference in AQ scores was found between patients with mild ASD and clinical controls (Ketelaars et al., 2008) (sensitivity .76–.95; specificity .52–.98). The Ritvo Autism Asperger Diagnostic Scale– Revised (RAADS-R) (Ritvo et al., 2011) is designed to be a tool in assisting the clinician in the diagnostic process. This scale is self-rated by the patient in the presence of the clinician. In two validation studies of patient populations with Asperger Syndrome and Autism, the RAADS-R has shown good psychometric characteristics (Ritvo et al., 2011; Andersen et al., 2011) (sensitivity .91–.97; specificity .93–1) with highly significant mean score differences between ASD and comparison subjects (clinical and non-clinical). Both the AQ and the RAADS-R do not, however, provide self-report as well as other report versions, nor do they cover the whole range of behavioral problems that may be relevant in milder and subtler variants of ASD. The third scale, the Social Responsiveness Scale for Adults (SRS-A), is a quantitative measure of autistic traits that does fulfill the aforementioned criteria (Constantino et al., 2003). Unfortunately, only preliminary data on the psychometric qualities of this instrument have been published as of yet (Bolte, 2011). Note that, overall, there is a striking absence of studies that compare scores on these questionnaires in an ASD group against other clinical groups to determine how well they capture ASD symptomatology specifically.

The use of multi-informant data in the assessment of psychopathology is recommended in children and adolescents, but in adults with developmental disorders and personality disorders as well (Barkley, Knouse, & Murphy, 2011; Bernstein et al., 1997). However, the level of agreement between self- and other-ratings of behavioral and emotional problems in children and adults is generally low to moderate (Achenbach, McConaughy & Howell, 1987; Achenbach, Krukowski, Dumenci & Ivanova, 2005). For instance, a recent study measuring the convergence of self- and spouse-report of personality disorder criteria in an adult nonclinical sample found an average correlation of .31 (South et al., 2011; South, Oltmanns, Johnson & Turkheimer, 2011). Factors that might limit agreement in adults include deficient self-awareness, trait visibility effects (i.e. easily observable traits and symptoms yield better inter-rater correlations than do more internal traits), and personal characteristics of the informants (Ferdinand, van der Ende & Verhulst, 2006; South et al., 2011).

The present study reports on the development of the Adult Social Behavior Questionnaire (ASBQ), a quantitative measure of autistic traits with subscales that allow a differentiated description of ASD problems. We examine the ASBQ's psychometric qualities in a large clinical sample, and address convergence between the self- and other-report version as well as differentiation between ASD and other common psychiatric conditions. Although social behavior problems are present in most psychiatric disorders, we hypothesize that differences between ASD and other groups will be more pronounced for depression than for ADHD and schizophrenia, because of the greater amount of shared phenotypical characteristics of ADHD and schizophrenia with ASD (e.g. Bastiaansen et al., 2011; Gillberg, Gillberg, Anckarsater & Rastam, 2011), and further that the depression group will have scores in between the non-clinical comparison group and patients diagnosed with ADHD and schizophrenia. We hypothesize additionally that the other- more than the self-report version will differentiate between the groups since not only patients with ASD but also patients with schizophrenia and ADHD are thought to have reduced insight into their problems (Erol, Delibas, Bora & Mete, 2015; Owens, Goldfine, Evagelista, Hoza & Kaizer, 2007).

2. Materials and methods

2.1. Development of the ASBQ

Developing the Adult Social Behavior Questionnaire (ASBQ) we built on our previous work in children and adolescents, for whom we designed the Children's Social Behavior Questionnaire (CSBQ) (Hartman, Luteijn, Serra & Minderaa, 2006; Luteijn, Luteijn, Jackson, Volkmar & Minderaa, 2000; Noordhof, Krueger, Ormel, Oldehinkel & Hartman, 2015), to be completed by parents and caregivers. The instrument emphasizes both severe, core characteristics of autism proper as well as the milder and subtler variants of ASD. The CSBQ has shown good psychometric properties in multiple studies (Hartman et al., 2006; Luteijn et al., 2000; Hartman, Hermanns, de Jong, & Ormel, 2013). The format of the CSBQ was maintained in developing the ASBQ, and

questions were modified to identify autistic traits in adults. For the ASBQ, we used a top-down approach of item writing within the ASD core domains, taking the CSBQ dimensions as a starting point, and expanding on that item pool.

On the social domain (CSBQ scale “reduced contact and social interest”), we expanded upon the CSBQ items not only by writing adult equivalents of quantity of social contact, as in the CSBQ, but also composing items that capture specific aspects of the emotional quality of social contact, such as empathy and emotional reciprocity. Our reasoning was that adding items referring to quality of social contact may provide a more differentiated profile, which is especially relevant for patients with ASD who do not dislike social encounters as such, yet run into difficulties due to their limited ability to understand another person’s feelings and needs. Likewise in the communication domain [CSBQ scale “difficulties in understanding social information”], in addition to including adult counterparts of items that evolve around the understanding of social exchanges during communication, we added items that capture communication acts that are at odds with social rules and conventions. The latter were underrepresented in the original item pool of the CSBQ which probably explains why this did not surface as a separate factor in the CSBQ studies. In the stereotypies domain the CSBQ already measures two subdomains [scales “sensory and motor stereotypies”, “fear of and resistance to change”]. The latter scale consists of only three items, which makes it psychometrically suboptimal. Thus, besides sensory stimulation and motor stereotypy characteristics as they pertain to adults, we composed additional items that capture multiple aspects of the rigidity and insistence on sameness that characterizes adult patients with an ASD.

The ASBQ has two versions: a self-report version (ASBQ-SR) and other-report version (ASBQ-OR) for spouses, parents or other informants who know the patient well. Patients and informants are asked, based on the patients behavior in the preceding two months, to respond to each item by indicating whether the described behavior ‘clearly applies to you/the subject’ (score 2), “infrequently describes you/the subject” (score 1) or “does not describe you/the subject” (score 0).

2.2. Participants

The total study sample consists of patients attending outpatient mental health centers, in the age range of 17 through 87 for whom 1144 self-report forms (mean age 37 years, SD 13 years; 64% males) and 653 other-report forms (mean age 34 years, SD 12 years; 72% males) were available. The total study sample was used in the factor and reliability analyses. For 553 patients both self- and other-reports were available which were used to study informant agreement. Although no formal IQ test results were used, it should be noted that none of the patients in the study sample was classified as having a comorbid intellectual disability in thorough clinical assessment. The institutional review board (the Medical Ethical Committee of the University Medical Center Groningen) indicated that no approval of this board (or informed consent of the participants) was necessary because data were analyzed anonymously and did not substantially diverge from usual clinical practice. In order to examine the diagnostic properties of the ASBQ in different patient groups, patients were recruited from different diagnostic categories. Extensive diagnostic information that could be used for this purpose was available for the following subsamples: Subsample 1 comprised 249 patients (mean age 32 years, SD 12 years; 81% males) with a formal ASD diagnosis provided by five Dutch mental health outpatient clinics specializing in developmental disorders in non-mentally retarded adults. These were the Autism Team North Netherlands in Groningen, the Department of Psychiatry of the Radboud University Nijmegen Medical Centre, the Dr. Leo Kannerhuis in Doorwerth, GGZ Eindhoven and the Department of Psychiatry of the University Medical Centre in Groningen. Diagnostic classification of these patients was carried out by an experienced psychiatrist or psychologist after extensive clinical assessment according to the guidelines of the Dutch Association of Psychiatrist (Kan et al., 2013), consisting of assessment and observation of core autism signs and symptoms, the use of a formal assessment tool to organize and structure the diagnostic process, a developmental history (where possible involving a family member), evaluation of other psychopathology including personality disorders and appraisal of daily functioning, whereupon a checklist of DSM-IV criteria for ASD was completed. Subsample 2 comprised 34 patients (mean age 26 years, SD 9 years; 84% males) from the Department of Psychiatry of the University Medical Centre in Groningen (UMCG) who were diagnosed with ADHD (based on the same extensive diagnostic procedure as in the patients with suspected ASD) and who did not meet the DSM-IV criteria for ASD. The third subsample encompassed 59 individuals (mean age 42 years, SD 12 years; 27% males) treated in the UMCG for a depressive episode in the course of a major depressive disorder, recurrent, with a seasonal pattern. Subjects in this group were administered the MINI-International Neuropsychiatric Interview (MINI) (Sheehan et al., 1998) in order to confirm the diagnosis. The fourth subsample was from GGZ Eindhoven and comprised 21 patients (mean age 41 years, SD 8 years; 100% males) with a diagnosis of schizophrenia which was confirmed by a semi structured interview, the Schedules for Clinical Assessment in Neuropsychiatry (SCAN-2.1) (WHO, 1992). Note that the remainder of the sample as used in the factor-, reliability-, and, in part, the informant convergence analyses comprised patients from the general outpatient clinic of the UMCG ($n = 812$ for self-report ASBQ scores and $n = 290$ for other-report scores). The diagnoses of these patients were made in a regular clinical interview by well trained psychiatrists at the university clinic. We have no access to clinical diagnostic information other than the overall distribution of patients per year in this group of patients (mood disorders 18.9%; anxiety disorders 20.3%; neurodevelopmental disorders 14.7%; personality disorders 13.7%; adjustment disorders 7.1%; miscellaneous 25.1%). Finally, a non-clinical comparison sample ($n = 30$; mean age 19 years, SD .4 years; 60% males) was included from the TRacking Adolescents’ Individual Lives Survey clinical cohort (TRAILS CC; see for further description Hartman et al., 2013). The TRAILS-CC cohort is a high risk cohort: participants were originally included who had had contact before age 11 with an outpatient facility for mental health care. The cohort varies widely in the presence and severity of problems (see for further description Hartman et al., 2013). We selected participants from the healthy part of the

distribution, i.e. who had no lifetime diagnosis on any of the Composite International Diagnostic Interview (CIDI) diagnostic categories, no intellectual disability, and who had not received any psychological or psychiatric care since age 11, as based on both self-report and objective case-registry data (see Jörg, Ormel, Reijneveld, Jansen & Verhulst, 2012). This non-clinical group from TRAILS CC served to provide baseline ASBQ scores to be compared with scores from participants diagnosed with ASD, ADHD, depression, and schizophrenia.

Table 1Factor structure of the ASBQ; self-report ($n = 1144$).

	Factor					
	1	2	3	4	5	6
1. Reduced contact						
You do not take the initiative in contacts with other people	.55		.13	-.25		
You have little or no interest in socializing with others	.74					
You ignore invitations from others to do something with them	.71			.10		
You avoid people who try to make contact with you	.69	-.10	.11			
The only contact you have with others is when you have to buy something or arrange something, for example with people in a shop or in a government office	.63	.11				
You are a loner, even in a group you hold yourself apart	.51		.18		.13	
You do not enjoy doing things with other people, for example, doing a chore together or going somewhere together	.68			.12		
2. Reduced empathy						
You find it difficult to put yourself in someone else's shoes, for example, you can not see why someone is angry		.64	.23			
You are unaware of other people's emotional needs, for example, you do not encourage other people or reassure them	.13	.66	.15			-.11
You find it hard to sense what someone else will like or think is nice	.10	.61	.22			
You are not really bothered by someone else in pain		.76	-.22			.11
You do not notice when someone is upset or has problems		.72	.16			
The reason why you would contact others is to get things done rather than you are interested in them	.24	.51	-.11			.17
You do not show sympathy when others hurt themselves or are unhappy		.82	-.20			
3.Reduced interpersonal insight						
You do not get jokes			.69			
You take everything literally, for example, you do not understand certain expressions	-.16		.68		.14	
You are very naive; you believe everything you are told		-.19	.77		-.12	
It is easy to take advantage of you or get you to do other people's dirty work	.16	-.23	.57	.17		
You do not notice when others make fun of you			.74			
You find it hard to follow the gist of a conversation—you miss the point			.68			
You need an explanation before you understand the meaning behind someone's words		.24	.56		.17	
You give answers that are not relevant because you have not really understood the question	.11		.55			
4. Violations of social conventions						
You do not differentiate between friends and strangers, for example, you do not care who you are with				.66		
You seek contact with anyone and everyone; you show no reserve	-.10			.65		
You touch people when it is not suitable, for example, you hug virtual strangers			.19	.43	-.14	
The questions you ask are too personal, or you tell others things that are too personal		-.14	.26	.44		.13
You behave the same wherever you are; it makes no difference to you whether you are at home or somewhere else (visiting others, at work, in the streets).		.24		.53		
You ask strangers for things you need, for example for food or drink if you are hungry or thirsty			-.16	.55		
5. Insistence on sameness						
You panic when things turn out differently than you are used to			.13		.73	
You resist change; if it were left up to you, everything would stay the same					.75	
You want to do certain things in exactly the same way every time	-.11	.14			.69	
You do not like surprises, for example, unexpected visitors	.27		-.16		.64	
You do not like a lot of things happening at once		-.13	.18		.67	
You really need fixed routines and things to be predictable					.77	
You hate it when plans are changed at the last moment					.78	
It takes you ages to get used to somewhere new					.65	
6. Sensory stimulation & motor stereotypies						
You feel the urge to flap your hands or arms about when you are excited	-.10		.11	.10		.56
You feel the urge to make strange, quick movements with your hands or fingers					-.17	.67
You feel the urge to rock back and forth	.14					.60
You really enjoy making certain movements and you want to repeat them						.61
You often want to smell objects	-.12					.56
You feel the urge to often touch things to see what they feel like	-.13		-.11		.70	
You really revel in certain colors, shapes or moving objects						.57
You are fascinated by certain sounds for example the squeaking of a door, the humming of a fridge, the rustling of paper	.14				.18	.44

Table 2
Factor structure of the ASBQ; other-report ($n = 653$).

	Factor					
	1	2	3	4	5	6
1. Reduced contact						
Will not take the initiative in contacts with other people	.79		.18	-.16		
Has little or no interest in socializing with others	.81					
Ignores invitations from others to do something with them	.71		-.10			
Avoids people who try to make contact with him/her	.74		.12			
The only contact he/she has with others is when he/she has to buy something or arrange something, for example with people in a shop or in a government office	.73					
Is a loner, even in a group holds him/herself apart	.59		.20	-.12		
Does not enjoy doing things with other people for example doing a chore together or going somewhere together	.49	.20				
2. Reduced empathy						
Finds it difficult to put him/herself in someone else's shoes, for example, he/she can't see why someone is angry		.62	.20		.11	
Is unaware of other people's emotional needs, for example, he/she does not encourage other people or reassure them	.22	.72				
Finds it hard to sense what someone else will like or think is nice	.19	.67	.11			
Is not really bothered by someone else in pain		.93	-.15			
Does not notice when someone is upset or has problems		.91				
The reason why he/she would contact others is to get things done rather than because he/she is interested in them	.15	.46	-.20	.21		
Does not show sympathy when others hurt themselves or are unhappy		.95	-.11	-.13		
Does not seem to understand what the other person's facial expressions, body language or voice intonation want to convey		.61	.32			
3.Reduced interpersonal insight						
Does not get jokes		.14	.62			
Takes everything literally, for example, does not understand certain expressions		.18	.66		.13	
Is very naive; believes everything he/she is told		-.15	.88		-.13	
It is easy to take advantage of him/her or get him/her to do other people's dirty work		-.18	.81			
Does not notice when others make fun of him/her			.80			
Finds it hard to follow the gist of a conversation—misses the point		.24	.50			
4. Violations of social conventions						
Does not differentiate between friends and strangers, for example, does not care who he/she is with			.12	.62	-.15	
Seeks contact with anyone and everyone; shows no reserve	-.23			.68		
Touches people when it is not suitable, for example, hugs virtual strangers				.45		
Asks questions that are too personal, or tells others things that are too personal	-.16	-.12	.19	.57	.14	
Behaves the same wherever he/she is; it makes no difference to him/her whether he/she is at home or somewhere else (visiting others, at work, in the street)	.17	.10		.62	-.12	
Asks strangers for things he/she needs, for example, for food or drink if he/she is hungry or thirsty			-.25	.56		
Speaks to everyone in exactly the same way, regardless of whether it is the queen, the boss at work, the neighbor or a good friend	.12			.62		
May stand too close to someone else	-.11		.61			
5. Insistence on sameness						
Panics when things turn out differently than he/she is used to		-.14			.84	
Resist change; if it were left up to him/her, everything would stay the same	.16				.66	
Wants to do certain things in exactly the same way every time				.12	.61	
Does not like surprises, for example unexpected visitors	.20		-.14		.72	
Does not like a lot of things happening at once			.13		.69	
Really needs fixed routines and things to be predictable	.12				.75	
Hates it when plans are changed at the last moment	-.14		-.11		.93	
It takes him/her ages to get used to somewhere new	.16			-.14	.66	
6. Sensory stimulation & motor stereotypies						
Feels the urge to flap hands or arms about when excited	-.13	.11				.69
Feels the urge to make strange, quick movements with hands or fingers		.16				.64
Feels the urge to rock back and forth						.58
Really enjoys making certain movements and wants to repeat them	.15				.18	.47
Often wants to smell objects					-.11	.64
Feels the urge to often touch things to see what they feel like		-.14				.68
Really revels in certain colors, shapes or moving objects	.18	-.19	.12			.44

3. Statistical analyses

3.1. Scale derivation

A comprehensive item pool of 90 core items was subjected to principal component analysis with the aim to select those items that measure the different, a priori formulated, ASD problem domains best. Selection of items was done in two steps. First, items were analyzed using PCA per ASD domain: social, communication, and stereotypies, respectively. This allowed us to determine if (and which) items empirically differentiated between the quantity of social contact and the emotional quality of contact, between the understanding of social exchanges during communication and behavior acts at odds with social rules and conventions, and between sensory stimulation and motor stereotypy and insistence on sameness, respectively. We formulated the following decision rules for selecting items. If the correlation structure of the data was according to expectation we selected those items that had a minimum factor loading of .3 on its main factor and a minimum difference of .2 with a possible secondary factor loading on the second factor. The latter rule serves to minimize cross-loadings, thus enhancing the specificity of the items for their respective problem domains (Hartman et al., 2006). We applied these selection criteria to both the self- and other-report items and prioritized items to be retained for further analysis that met these criteria in both questionnaire versions. However, if this requirement were to yield fewer than 8 items for each of the scales being developed we allowed additional informant specific items. Finally, if the intended two-factor structure for each problem domain did not emerge, we would settle for a one factor model and select items with a minimum factor loading of .3.

This first step in the analysis separates the wheat from the chaff, providing items that are, in principle, adequate candidates for measuring the proposed problem domains. However, items are not only required to be good indicators within the social, communication, and stereotypy domains but they also need to differentiate between these domains. Therefore, as the second item selection step, items that passed the first selection criteria were again subjected to principal component analysis. We now included all items of the three problem domains combined in one analysis to investigate the full structure of the self-report and other-report item pools, respectively, where the aim was to extract a factor structure that was in line with the six (or fewer if the dimensional structure were less refined) hypothesized ASD domains. To construct the definitive ASBQ subscales, we selected the best items up to a maximum of 8 per scale according to the same aforementioned criteria.

3.2. Additional psychometric analyses

In order to study the association between self-report and other-report, we calculated correlations between subscales of the ASBQ self-report and other-report versions. In addition we calculated the intraclass correlations for the subscales and total scale. Next, internal consistency was calculated for the ASBQ total scales and for the six subscales. Finally, we compared ASBQ scores of different diagnostic groups (ASD, ADHD, depression, schizophrenia) and a non-clinical control group separately for the self- and other-report versions.

4. Results

4.1. Scale derivation

The first selection of items that differentiated between quantity of social contact and the emotional quality of contact yielded 10 and 7 items, respectively, with a minimum factor loading .3 on the main factor and a minimum difference of .2 with a possible secondary loading on other factors, respectively; this was 16 items for the understanding of social communication and 10 items for the communication acts that are at odds with social rules, respectively; and 8 items for the sensory stimulation and motor stereotypies and 12 for the insistence on sameness subscales.

These 63 items were then subjected to principal component analysis for the ultimate selection of the items for the six scales, according to the same factor loading criteria. Tables 1 and 2 provide the factor structure of the final selection of items for self- and other-report, respectively. These tables show the main factor loadings, as well as possible secondary loadings ($\geq .10$). The total number of items retained is 44 for both the self- and other-report versions, with the number of items within a scale varying between 6 and 8. Forty-one items are present in both self- and other-report, the remaining 3 being informant specific.

Based on the item content of the respective scales, the six ASD problem domains can be characterized as follows. Scale 1, *reduced contact*, captures deficits in the need and intention to interact socially, and in developing and maintaining relationships. Scale 2, *reduced empathy*, taps lack of emotional reciprocity, and problems in the recognition of emotions in others and the response to these. In scale 3, *reduced interpersonal insight*, theory-of-mind and pragmatic language capacity (ability to pick up social cues, understanding nonverbal behavior and intentions of others) are captured, while in scale 4, *violation of social conventions*, referring to behaviors at odds with social rules and cues, especially the sense of personal space of others, is the focus. Scale 5, *insistence on sameness*, taps adherence to routines, the need for predictability and fear of and resistance to change. Finally, scale 6, *sensory stimulation & motor stereotypies*, captures unusual interests in all sensory aspects of the environment, and (the inclination) to perform motor stereotypies and mannerisms. The mean factor loading

for the other- and self- report version per subscale ranges from .54 to .73, indicating good coverage of each of the problem domains in both versions.

4.2. Additional psychometric analyses

Internal consistency estimates (Cronbach's α) of the ASBQ-SR and OR were satisfactory ($>.7$) for the total scales and all but one of the subscales; for the subscale 4 (*violation of social conventions*) of the self-report version internal consistency can be considered "fair" (.60; Table 3).

Table 4 presents the convergent and divergent correlations of the ASBQ subscales between self- and other-scores. The convergent correlations measure the associations between ratings of the same subscales. These are located on the diagonal of the correlation matrix (in bold), and range from .40 to .57. As cross-informant correlations in ratings of emotional and behavioral problems in adults are generally low in size (Achenbach et al., 2005), these results can be considered satisfactory. The convergent correlations are higher in magnitude than the off diagonal divergent correlations which is according to expectation and confirms that the two informants rate certain behaviors similarly. Alternatively, the degree of agreement between scores of self and others on the same subscales using the intraclass Correlation Coefficient method ranged from .37 to .56. Different guidelines exist for the interpreting ICC, but one reasonable scale is that an ICC of less than .40 indicates poor reproducibility, and ICC values in the range of .40–.75 indicate fair to good reproducibility (Rosner, 2006). ICC values in our study are moderate and underline the fact that self- and other-ratings of autistic traits should not be considered to be interchangeable but complementary.

Table 3

Internal consistency coefficients (Cronbach's alpha) of the of the ASBQ-SR ($n = 1144$) and OR ($n = 653$) and its subscales.

	Self-report (SR)	No. items	Other-report (OR)	No. items
Contact	.82	7	.86	7
Empathy	.85	7	.91	8
Insight	.84	8	.85	6
Conventions	.60	6	.75	8
Rigidity	.86	8	.89	8
Sensory motor	.75	8	.72	7
Total	.93	44	.93	44

Contact, reduced contact; empathy, reduced empathy; insight, reduced interpersonal insight; conventions, violation of social conventions; rigidity, insistence on sameness; sensory, sensory stimulation and motor stereotypies.

Table 4

Correlations between self-report (SR) and other-report (OR) of subscale- and total scores ($n = 553$).

	Contact_OR	Empathy_OR	Insight_OR	Conventions_OR	Rigidity_OR	Sensory_OR	Total_OR
Contact_SR	.52	.25	.13	.03	.37	.14	.36
Empathy_SR	.39	.49	.21	.15	.30	.18	.43
Insight_SR	.21	.19	.43	.15	.27	.15	.33
Conventions_SR	-.06	.13	.19	.40	.07	.15	.18
Rigidity_SR	.39	.20	.22	.10	.57	.19	.41
Sensory_SR	.07	.08	.11	.19	.15	.38	.21
Total_SR	.40	.32	.30	.20	.44	.27	.46

Contact, reduced contact; empathy, reduced empathy; insight, reduced interpersonal insight; conventions, violation of social conventions; rigidity, insistence on sameness; sensory, sensory stimulation and motor stereotypies.

Table 5

Differences in self-report scores between ASD group and ADHD, depression, schizophrenia and non-clinical groups on six ASBQ-SR scales, in effect sizes (Cohen's d).

	ADHD	Depression	Schizophrenia	Non-clinical
Contact	1.19	1.04	0.65	1.34
Empathy	0.89	1.22	0.54	1.04
Insight	0.71	0.96	0.18	1.24
Conventions	0.21	0.35	0.17	0.49
Rigidity	1.08	0.95	0.23	1.73
Sensory motor	0.11	0.60	0.06	0.71
Total	1.03	1.27	0.37	1.65

ASD $n = 234$; ADHD $n = 25$; depression $n = 51$; schizophrenia $n = 21$; non-clinical $n = 30$

Contact, reduced contact; empathy, reduced empathy; insight, reduced interpersonal insight; conventions, violation of social conventions; rigidity, insistence on sameness; sensory, sensory stimulation and motor stereotypies.

Table 6

Differences in other-report scores between ASD group and ADHD, depression, schizophrenia and non-clinical groups on six ASBQ-OR scales, in effect sizes (Cohen's *d*).

	ADHD	Depression	Schizophrenia	Non-clinical
Contact	1.25	1.14	1.01	1.48
Empathy	0.83	1.36	1.08	1.57
Insight	0.88	1.07	0.91	1.21
Conventions	0.23	0.78	0.63	0.85
Rigidity	1.16	0.94	1.15	1.94
Sensory motor	0.16	0.47	0.63	0.69
Total	1.25	1.49	1.41	2.07

ASD *n* = 247; ADHD *n* = 34; depression *n* = 58; schizophrenia *n* = 21; non-clinical *n* = 27

Contact, reduced contact; empathy, reduced empathy; insight, reduced interpersonal insight; conventions, violation of social conventions; rigidity, insistence on sameness; sensory, sensory stimulation and motor stereotypies.

Mean ASBQ self-report scores in the different diagnostic groups are presented in Table 7 and Fig. 1. A multivariate GLM test with sex and age as covariates showed that the five groups differed overall on the six subscales ($F(24,1219) = 7.53$, $p < .001$), as well as univariately on all subscales separately (all $p < .01$) with the exception of self-report on violation of social conventions ($p = .18$). Considering the ASBQ other-report scores in the different diagnostic groups (Table 8, Fig. 2), a multivariate GLM test with sex and age as covariates showed that the five groups differed overall on the six subscales ($F(24,1309) = 8.62$, $p < .001$), as well as univariately on all subscales separately (all $p < .001$). Qualifying the scores of the different groups, Tables 5 and 6 show the differences in ASBQ-SR and ASBQ-OR scores between the ASD group and the ADHD, depression, schizophrenia, and non-clinical comparison groups, calculated in effect sizes (Cohen's *d*).

Although few patients were older than 65 years, we checked if our findings were influenced by the possible presence of cognitive decline in this age group. This was not the case.

5. Discussion

The present study reports on the development and psychometric properties of the self-report and other-report versions of the ASBQ, applied in a large number of adults with a variety of psychiatric diagnoses. Factor analysis provided support for six homogeneous subscales that concurred in the self- and other-report versions: *reduced contact*, *reduced empathy*, *reduced interpersonal insight*, *violation of social conventions*, *insistence on sameness* and *sensory stimulation/motor stereotypies*. The content of these subscales is similar to that of the core symptom subscales of the CSBQ (t Hart-Kerkhoffs et al., 2009) and covers the entire spectrum of ASS problems. Importantly, they are also in line with the DSM-5 criteria for ASD (APA, 2013). With a total number of 44 items for self-report and other-report versions, the ASBQ is a concise and easily administered instrument for clinical as well as research settings.

Convergence between informants, i.e. the concurrence between self- and other-perspectives, is satisfactory. It is important to emphasize that the estimates of rank order convergence between patients and others in our study were higher than generally found in child psychiatry ($r = .3$ in child psychiatry (Achenbach et al., 1987); here, average $r = .5$). At the same time, these findings show that there are also considerable differences between the two informants. These findings underline the merits of a multi-informant approach. In child psychiatry, there is a general consensus that a multi-informant approach provides the most complete picture of problem type and severity. In research on adult ASD, often only self-report but not other-report questionnaires are included in the design. The present study shows that differentiation between diagnostic groups is in fact best accomplished by others and that even in adulthood both self- and other-report should be sought, clinically as well as for research purposes. In clinical practice, patients and important others could complete the ASBQ in the presence of the clinician (or bring both versions to the diagnostic interview), which would lead to a more systematic appraisal of symptom presence. This could also have additional value by examining more closely the possible discrepancies

Table 7

Means and standard deviations for each subscale and group (self-report).

	ASD	ADHD	Depr	SCZ	Non-clin
Contact	6.31 (3.62)	2.12 (2.35)	2.59 (3.37)	4.00 (2.92)	1.60 (2.44)
Empathy	5.04 (3.57)	1.96 (2.17)	0.96 (1.88)	3.14 (2.57)	1.43 (2.19)
Insight	6.18 (3.81)	3.52 (3.03)	2.67 (2.78)	5.48 (3.36)	1.63 (2.24)
Conventions	2.52 (2.33)	2.04 (1.10)	1.71 (2.07)	2.90 (2.12)	1.40 (1.65)
Rigidity	9.91 (4.13)	5.44 (4.10)	5.96 (4.29)	8.95 (4.19)	2.83 (3.76)
Sensory	3.66 (3.46)	4.04 (2.84)	1.67 (2.39)	3.86 (3.66)	1.30 (1.88)
Total	33.61 (14.41)	19.12 (10.26)	15.55 (13.30)	28.33 (13.12)	10.20 (12.25)

ASD *n* = 234; ADHD *n* = 25; depression (Depr) *n* = 51; schizophrenia (SCZ) *n* = 21; non-clinical (non-clin) *n* = 30

Contact, reduced contact; empathy, reduced empathy; insight, reduced interpersonal insight; conventions, violation of social conventions; rigidity, insistence on sameness; sensory, sensory stimulation and motor stereotypies.

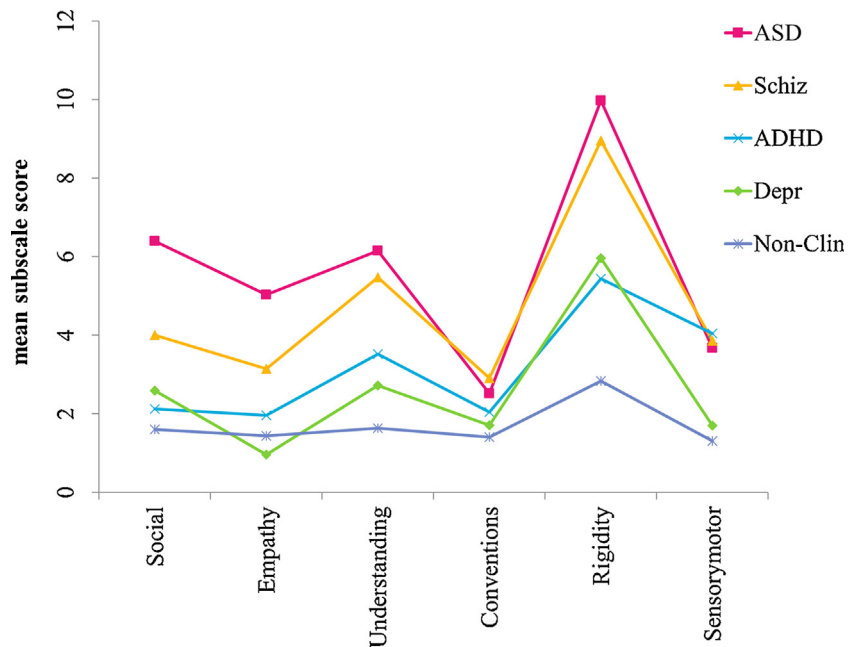


Fig. 1. Comparison of mean ASBQ self-report scores in ASD, schizophrenia, ADHD, depression, and non-clinical groups. Contact, reduced contact; empathy, reduced empathy; insight, reduced interpersonal insight; conventions, violation of social conventions; rigidity, insistence on sameness; sensory, sensory stimulation and motor stereotypies.

Table 8

Means and standard deviations for each subscale and group (other-report).

	ASD	ADHD	Depr	SCZ	Non-clin
Contact	6.45 (3.78)	1.88 (2.42)	2.35 (2.76)	2.62 (3.69)	1.07 (1.71)
Empathy	7.71 (4.46)	3.94 (4.92)	1.99 (2.87)	2.95 (3.63)	1.00 (1.45)
Insight	5.52 (3.43)	2.59 (2.41)	2.02 (2.64)	2.43 (2.99)	1.52 (1.81)
Conventions	3.72 (3.36)	2.82 (2.66)	1.24 (2.17)	1.62 (2.52)	0.96 (1.40)
Rigidity	10.81 (4.26)	5.51 (4.76)	6.74 (4.65)	5.81 (5.51)	2.78 (2.90)
Sensory	2.26 (2.66)	1.85 (1.97)	1.07 (1.70)	0.63 (1.29)	0.48 (1.05)
Total	36.48 (14.40)	18.61 (13.93)	15.46 (12.66)	16.08 (15.10)	7.82 (7.23)

ASD $n=247$; ADHD $n=34$; depression (Depr) $n=58$; schizophrenia (SCZ) $n=21$; non-clinical (non-clin) $n=27$

Contact, reduced contact; empathy, reduced empathy; insight, reduced interpersonal insight; conventions, violation of social conventions; rigidity, insistence on sameness; sensory, sensory stimulation and motor stereotypies.

between self- and other-report of problems (Sizoo et al., 2015). Thus, the ASBQ self- and other-report may aid in the full diagnostic process by a systematic multi-informant assessment of symptom presence along the six ASBQ problem domains.

The differences in total scale and subscale averages between the ASD patients and a diversity of comparison groups provide further initial support for the validity of the ASBQ. The average scores of adults with ASD were overall substantially higher than those of adults with depressive disorder, ADHD, schizophrenia, as well as non-clinical participants. In line with the expectation of reduced self-insight, this difference was more pronounced more for other- than for self-report of ASD behavior. Differentiation from other patient groups was most clear for the total score and, consistent with the core problems of ASD in adulthood, *reduced contact* and *reduced empathy*. Except for self-report in patients with schizophrenia (medium effect size), all effect sizes of these differences between the ASD group and other diagnostic and non-clinical groups were large. Other-report average scores on the *interpersonal insight* and *insistence on sameness* scales similarly differentiated the ASD and the comparison groups, again with large effect sizes. The same was true for the self-report averages of these scales for ASD compared with the depression and ADHD, and the non-clinical groups. Like reduced contact, these are core aspects of ASD, altogether providing further support for the ASBQ's validity.

However, self-report of *interpersonal insight* and *insistence on sameness* did not differentiate the ASD group from the schizophrenia group, i.e. both groups scored high on these scales. These small differences in self-reported problems between the ASD and schizophrenia groups resulted from higher self- than other-report scores in patients with schizophrenia. The literature on the agreement between self- and other-ratings of psychosocial functioning in patients with schizophrenia shows mixed results (Eichenberger and Rössler, 2000; Schaub, Brüne, Bierhoff & Juckel, 2012). The high self-report scores in

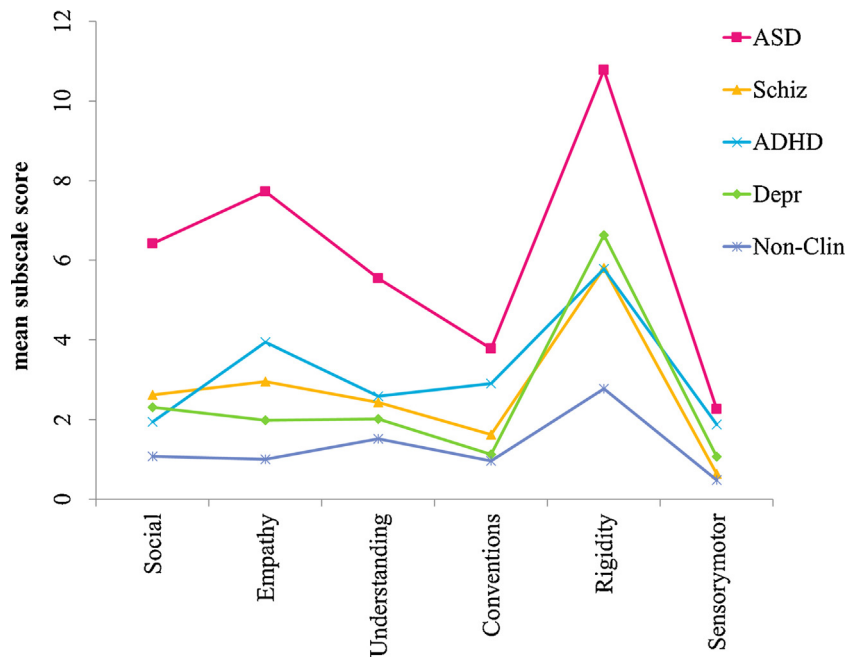


Fig. 2. Comparison of mean ASBQ other-report scores in ASD, schizophrenia, ADHD, depression, and non-clinical groups. Contact, reduced contact; empathy, reduced empathy; insight, reduced interpersonal insight; conventions, violation of social conventions; rigidity, insistence on sameness; sensory, sensory stimulation and motor stereotypies.

patients with schizophrenia with regard to reduced interpersonal insight and insistence on sameness are remarkable, and further study with the ASBQ on how patients with schizophrenia perceive their own problems would be necessary to clarify the convergence of self- and other-report.

Considering the *violation of social conventions* scale, the other-report version differentiated the ASD group from the depression, schizophrenia, and non-clinical groups but not from the ADHD group. This overlap at the behavioral level between ASD and ADHD is a well known clinical and empirical fact (Gillberg et al., 2011). However, the underlying mechanisms for intrusive behavior in ADHD (e.g. impulsivity, disinhibition) are likely to be different from those in ASD (lack of social understanding) (Nijmeijer et al., 2009). Like the social insight scale discussed above, a limited ability of adults with ASD to recognize their intrusions into another's personal space might be the cause of their low scores on this subscale when compared to the rating of others. This limited insight into their intrusive behaviors in social situations has also been described for patients with ADHD (Nijmeijer et al., 2008).

We found low average ratings on the *sensory stimulation* and *motor stereotypies* subscale for the ASD group and small differences between groups, especially for the other-report version of the ASBQ. In part, this may reflect the fact that in adulthood, sensory-motor stereotypies have to some extent been internalized. In fact, we operationalized the behavior in this scale by using phrases such as "feels the urge to.", thus referring to internalized rather than to explicit overt motor behaviors. This is in contrast with the operationalization in childhood where parents rate the overt behaviors as manifest in children. In addition, the experiences and behavior tapped by this scale are most common in very severely impaired ASD patients (in children and adults alike), who were relatively underrepresented in our ASD sample. Research with the ASBQ in patient groups at the severe end of the autism spectrum will allow further evaluation of the validity of the *sensory stimulation* and *motor stereotypies* subscale.

Summarizing group differences, the total ASBQ score, and most of the subscales, and in particular the other-report version of the ASBQ, showed good differentiation from clinical comparison groups, as well as from the non-clinical reference group. In as much as small differences between patients with ASD and the other patient groups on particular subscales of the ASBQ emerged, these can be understood either according to shared characteristics of ASD with other diagnoses (e.g. social insight and schizophrenia, violation of social norms and ADHD), or in terms of the validity of self-report versus other-report in domains that are reflective of a specific form of psychopathology (e.g. high self-reported problems on interpersonal insight in schizophrenia). Alternatively, functional impairments as a result of various psychiatric disorders can give rise to behavior that the ASBQ taps. For instance, both schizophrenia and depression can lead to social withdrawal and ultimately to social isolation, which patients and others will score on the *reduced contact* subscale. This illustrates that questionnaires cannot be used in isolation but rather complement the diagnostic process. By interviewing the patient and the important other informant on the origin and meaning of the heightened scores, questionnaires can aid in diagnosing the patient.

The current study has several limitations. First, the diagnoses of individuals in the ASD and ADHD samples were based on (systematically applied) DSM-IV-criteria and, in contrast to patients with depression and schizophrenia, not on "gold

standard” diagnostic interviews or observations. Although there are still insufficient data evaluating the reliability and validity of the Autism Diagnostic Interview—Revised (ADI—R; (Lord, Rutter, & Le Couteur, 1994)) in adults, recent evidence suggests that the Autism Diagnostic Observation Schedule module 4 (ADOS—G; (Lord et al., 2000)) reliably identifies cases of adult ASD (Brugha et al., 2012) and supports differential diagnostics (Bastiaansen et al., 2011). Second, the groups were not matched on age, sex, IQ, language or educational level, and site, and only Caucasian adults were included, which may limit the generalization of our findings to other groups in the population. A third limitation may be that we did not include items specifying sensory under- and over-reactivity to specific stimuli, for example to cold or to specific sounds, while these have been included in the DSM-5 (APA, 2013). However, the scale *insistence on sameness* addresses extent of over-reactivity to a more global level (by, for example, too much happening at the same time), while the *sensory/motor scale* measures the extent of stimulation through sensory stimuli and motor behaviors (e.g. revels in certain colors). Last, sample sizes of the comparison samples were relatively small. This was mainly due to the fact that obtaining the other-report data from spouses or parents in patient groups where this is uncommon is not easy to organize in an adult psychiatric outpatient setting. Although limited in size, these data are an important asset of the current study, as they seem to indicate that the ASD group can be differentiated from other patient groups and that the multi-informant approach yields important extra information on severity and type of problems. Both of these topics have so far rarely been addressed or investigated in relation to adult ASD. It is nonetheless clear that differentiation from other patient groups and the normal population should be pursued in future research on the ASBQ.

In conclusion, among instruments that measure autistic traits in adults, the ASBQ is unique in that it (a) captures multiple homogenous dimensions of ASD covering the entire spectrum of the disorder and including also the milder forms, (b) contains a self-report and other-report version, which guarantees a broader scope of information, and (c) is based upon and adapted from a well-developed child version (the CSBQ), emphasizing developmental continuity. It is important to note that the ASBQ first and foremost aims to yield a multidimensional profile of the severity and type ASD behaviors present. Although it shows good discriminative properties between ASD and other diagnoses, as a questionnaire it is not intended for purposes of diagnostic classification on its own, but rather as one of the sources to assist clinicians in the diagnostic and assessment process of ASD in adults. The profile of scores on the ASBQ subscales may additionally help to plan and evaluate treatment in individuals. Finally, in research settings, the ASBQ provides quantitative characterization of autistic symptom domains that can advance uncovering the genetic and neurocognitive background of ASD.

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