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BRIEF REPORT

Brief Report: Selective Social Anhedonia in High Functioning Autism

Coralie Chevallier · Julie Grèzes · Catherine Molesworth · Sylvie Berthoz · Francesca Happé

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Abstract Diminished social motivation is one of the most striking features in autism. Yet, few studies have directly assessed the value people with an ASD place on social interactions, or how rewarding they report it to be. In the present study, we directly measure social motivation by looking at responses to a questionnaire assessing self-reported pleasure in social and non social situations. Twenty-nine adolescents with ASD and matched controls took part in the study. Our results reveal that children with an ASD differ from the controls with respect to social enjoyment, but not with respect to physical and other sources of hedonism. Further analyses demonstrate that the degree of social anhedonia correlates with autism severity.

Keywords Anhedonia · Social motivation · Autism spectrum disorders · Social anhedonia · Social interest

C. Chevallier · C. Molesworth · F. Happé
Social, Genetic and Developmental Psychiatry Centre (MRC), Institute of Psychiatry, King's College London, London, UK

C. Chevallier
Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, USA

Present Address:
C. Chevallier (✉)
Center for Autism Research, Children's Hospital of Philadelphia, 3535 Market Street, 8th floor, Philadelphia, PA 19104, USA
e-mail: coralie.chevallier@gmail.com

J. Grèzes
Laboratory for Cognitive Neurosciences, INSERM U960, Ecole Normale Supérieure, Paris, France

S. Berthoz
Institut Mutualiste Montsouris, INSERM U669, Paris, France

Introduction

Human life is social through and through. As a result, the natural propensity to attend preferentially to the social world is present early on in development and remains a driving force behind numerous behaviours throughout life. Young infants prefer listening to human speech rather than noise, they like looking at faces, they prefer eyes directed towards them rather than looking away, they respond to their name and smile back when smiled at, etc. (Gliga and Csibra 2007). As adults, we also find smiles rewarding and viewing faces activates brain structures that also respond to rewards such as food and money (Aharon et al. 2001). Strikingly, social interest can be so rewarding that it can sometimes outweigh other incentives (e.g. monetary), while social exclusion can lead to a psychological state that resembles the one induced by physical pain (Eisenberger et al. 2003).

In contrast, people with an Autism Spectrum Disorder (ASD) are often described as lacking this natural social bias. Toddlers on the spectrum fail to orient to biological motion but attend instead to non-social contingencies (Klin et al. 2009); ASD 4 year-olds prefer non-speech signals in auditory preference tests comparing motherese to speech analogs of the same signals (Kuhl et al. 2005); finally, children and adults with ASD display atypical scanning of social scenes with increased attention to objects and decreased attention to people (Klin et al. 2002).

These experimental findings, along with clinical observations, have led to the development of the social motivation hypothesis of autism (Dawson et al. 1998; Dawson et al. 2005; Schultz 2005), which posits that autism is characterised by a primary disturbance in the motivational and executive processes that prioritize orienting to social stimuli (Dawson et al. 1998; Klin et al. 2003; Mundy

2003). In this framework, decreased expertise in social cognition would be the result of reduced time spent attending to the social world (see e.g., Dawson et al. 2002; Grelotti et al. 2005; Schultz 2005).

What are the roots of this social attention deficit? One influential hypothesis has been to posit that diminished social motivation is the result of a deficit in assigning the correct reward value to social stimuli (Dawson et al. 1998). But so far, lack of social motivation has mainly been studied by looking at its consequences in other cognitive domains (such as face perception, eye gaze patterns, or attention allocation), but few studies have *directly* assessed the value people with ASD place on social interaction, or how rewarding they report it to be. In the present study we measured social motivation in a simple and direct fashion by looking at self-reported pleasure, or lack of it, in social and non social situations.

The "Pleasure scale" is a validated self-report instrument developed by Kazdin (1989) to assess anhedonia in children. Anhedonia refers to the reduced ability to experience pleasure and is reflected in diminished interest for potentially rewarding activities (Chapman et al. 1976). The Pleasure scale was designed to evaluate the subjective experience of children in a variety of activities. Initially developed for children with clinical depression, this instrument is especially well-suited to investigate social motivation in ASD because it includes various sources of pleasure: physical pleasure, social pleasure, and other sources of pleasure. In line with the social motivation hypothesis, autism should be associated with a selective reduction of self-reported pleasure in response to social situations.

Methods

Participants

Fifty-eight male adolescents (29 with ASD and 29 Typically Developing, henceforth TD) aged 10–16 years took part in the study. The ASD and the control groups were matched on chronological age and IQ, as assessed with the Wechsler Abbreviated Scales of Intelligence, two-subtest form (Wechsler 1999) (see Table 1).

Sociodemographic data, including ethnicity or socioeconomic background, were not collected. Importantly, Kazdin's original paper highlighted no significant differences in pleasure scale scores as a function of child sex, race, and IQ, or parent age, race and measures of socioeconomic status.

The recruitment procedure was identical in the TD and ASD groups: parents of children belonging to the targeted age group (10–16) were sent an information sheet and consent form by their child's school administration, and were asked to send the consent form back to the school if they were interested in their child's taking part. Children in the ASD group were recruited from special education schools or unit. All had received a formal diagnosis of an ASD by licensed child psychologists or psychiatrists (13 Asperger Disorder/Syndrome, 13 autism, 2 atypical autism/Pervasive Developmental Disorder—not otherwise specified) according to standard diagnostic criteria (Diagnostic and Statistical Manual of Mental Disorders-IV; APA 1994) and all were high functioning. It is important to mention that, because of the extra funds authorities must provide, entry to a special autism provision in these UK educational establishments depends upon a formal diagnosis of autism or Asperger syndrome documented by medical records and made by licensed expert clinicians. In addition to this diagnostic information, we used the Autism Diagnostic Observational Schedule (Lord et al. 2000) to further characterize the current profile of the participants: 19 participants scored above ADOS cut-off for autism, 4 scored above ADOS cut-off for ASD, 6 scored below cut-off. Omitting the participants whose total ADOS score fell below cut-off for ASD did not alter the results. Thus, data are reported below for all 29 participants in the ASD group. The TD controls were recruited in mainstream schools and had no identified special needs, except for one participant with an IQ below 75.

Table 1 Participants' mean age, IQ and ADOS-G scores in the ASD group

Participant information	ASD Mean ± SD (range)	TD Mean ± SD (range)	*t*(df) value, *P* value
Age years; months	13.6 ± 1.3 (10.10–15.9)	13.11 ± 1.7 (10.00–15.9)	$t(56) = -1.01$, $p = .29$
IQ	103 ± 15 (61–130)*	108 ± 13 (68–130)*	$t(56) = -1.51$, $p = .14$
ADOS-G scores	11.5 ± 5.2 (1–19)	na	na
ADOS Calibrated	6.52 ± 2.90 (1–10)	na	na

Scores on the IQ scores were obtained using the two-subtest form of the WASI. ADOS-G scores are derived from the diagnostic algorithm and represent the current profile of the participant (Lord et al. 2000). ADOS calibrated severity scores are based on the ADOS-G scores and approximate an autism severity metric (Gotham et al. 2009)

* One participant in each group scored below 75 in the IQ test. Excluding these two participants did not alter the result pattern

Material

The Pleasure scale (Kazdin 1989) consists of 39 items pertaining to physical, social, or other sources of pleasure, rated by children for how happy each would make them feel. 'Physical pleasures' include the pleasure of eating, touching, feeling, movement, smell and sounds (e.g. "You are cycling down the street very fast while still in good control of yourself"). 'Social pleasure' items cover the interpersonal pleasure of being with people, talking, exchanging expressions of feelings, doing things with others, and interacting in multiple other ways (e.g. "You accidentally overhear your teacher telling the principal what a terrific student you are"). 'Other pleasures' include non physical and non social pleasures such as intellectual pleasure and the pleasure of achievement (e.g. "Your pet finally learns the new trick that you have been trying to teach it"). Items were separated on an a priori basis according to whether they were conceptually more related to physical, social, or other sources of pleasures.

Participants were asked to rate each item on a 3-point rating scale: 1 for 'Very happy', 2 for 'Happy' and 3 for 'Neither happy nor unhappy'. High scores on this scale thus reflect diminished pleasurable responses, hence greater anhedonia. The maximum score for the full 39-item scale is 117, with a maximum of 21 for the 7-item 'Physical' subscale, 57 for the 19-item 'Social' subscale and 39 for the 13-item 'Other pleasures' subscale. In Kazdin's original description of the measure, internal consistency reliability (Cronbach's alpha) was .96 and performance on the scale was predictive of children's diagnosis of depression. More information regarding the correlational evidence supporting the construct and validity of the scale are provided in Kazdin's original paper, but, briefly, it is important to highlight that scores in the Pleasure scale correlated with other measures of pleasurable experience, including less active involvement in seeking rewarding events. Since its initial validation, the scale has been used in a range of paediatric populations (including children with cancer, Phipps and Srivastava 1999; depressed adolescent, Gutkovich et al. in press; and children in the general population, Steele et al. 1999) and it has proved to be a useful and robust tool to measure anhedonia in children and teenagers.

Procedure

The procedure was approved by the local ethics committee. Parents of all participants gave their written informed consent prior to our coming to the school and children gave informed assent prior to the beginning of the procedure. Children were tested individually in a quiet room close to their classroom. They were read each item out loud and asked to rate the situation on a rating scale, a visual cue of which was placed in front of them.

Statistical Analyses

Data were analysed using SPSS 18.0. Effect sizes (ηp^2 for F statistics and Cohen's d for t-tests) are reported together with p values for significant main effects and interactions. A ηp^2 value above .01 is typically considered to reflect a small effect, a ηp^2 above .06 to reflect a medium effect, and a ηp^2 above .14 to reflect a large effect. Cohen's d values above .20, .50 and .80 are considered to reflect small, medium and large effects respectively. All p values assume a two-tailed test.

Results

A repeated measure ANOVA with Pleasure types (Physical, Social, Other sources) as a dependent variable and Group (ASD, TD) as a categorical factor was run. This analysis revealed a main effect of group, $F(1,56) = 5.43$, $p = .023$, $\eta p^2 = .09$, a main effect of Pleasure types $F(2,112) = 528.42$, $p < .0001$, $\eta p^2 = .90$, and an interaction between Group and Pleasure types, $F(2,112) = 6.85$, $p = .002$, $\eta p^2 = .11$ (see Fig. 1).

Post hoc t tests indicate that the groups produced comparable ratings for Physical and Other sources of pleasure, but that they differed in their ratings for Social sources of pleasure (see descriptive statistics in Table 2 and distribution in Fig. 2). Further analyses revealed no ceiling or floor effects in any of the groups and conditions (one sample t tests, all $ts(28) \geq |11.61|$, all $ps < .0001$). Omitting the participants scoring below cut-off for ASD yielded the same pattern of results: there was a main effect of group, $F(1,50) = 5.33$, $p = .025$, $\eta p^2 = .10$, a main effect of Pleasure types $F(2,100) = 477.35$, $p < .0001$, $\eta p^2 = .91$, and an interaction between Group and Pleasure types, $F(2,100) = 7.50$, $p = .001$, $\eta p^2 = .13$. Again, post hoc

Fig. 1 Anhedonia scores for physical, social, and other sources of pleasure in the ASD (*light grey*) and the TD group (*dark grey*). Mean and SD are depicted. * indicates a p value $\leq .05$. Note that high scores reflect diminished self-reported pleasure (or greater anhedonia)

Table 2 Means, standard deviations and ranges of scores in the ASD and TD group for physical, social, and other sources of pleasures, and results of the associated *t* tests

Pleasure type	ASD Mean ± SD (range)	TD Mean ± SD (range)	*t*(*df*) value, *p* value, Cohen's *d*
Physical	14.5 ± 2.4 (10–18)	13.9 ± 2.60 (7–19)	$t(56) = .84$, $p = .40$, $d = .16$
Social	36.9 ± 8.3 (22–55)	31.9 ± 4.4 (25–43)	$t(56) = 2.87$, $p = .006$, $d = .77$
Other sources	21.9 ± 5.1 (14–35)	20.4 ± 2.9 (15–29)	$t(56) = 1.39$, $p = .17$, $d = .37$

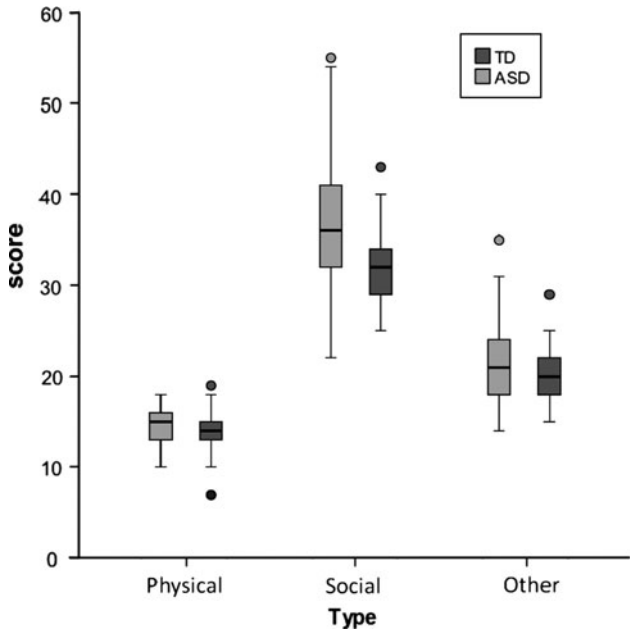

Fig. 2 *Box* and *whisker plots* depicting the distribution of scores for physical, social, and other sources of pleasure in the ASD (*light grey*) and the TD group (*dark grey*)

t tests indicated that the groups produced comparable ratings for Physical, $p = .56$, $d = .16$, and Other sources of pleasure, $p = .14$, $d = .41$, but they differed in their ratings for Social sources of pleasure, $p = .006$, $d = .77$.

Correlations were then carried out to assess the relationships between severity of autism and ratings on the various pleasure subscales in the ASD group. Following the procedure described by Gotham, Pickles and Lord (2009), calibrated ADOS scores were used as a severity metric. Spearman correlations indicated that severity was positively correlated with scores of Social pleasure, $r = .38$, $p = .045$, and Other sources of pleasure; $r = .43$, $p = .021$, but not with Physical pleasure scores, $r = .23$, $p = .22$. These correlation coefficients, however, did not statistically differ from each other (Social vs. Physical, $p = .26$, Social vs. Other, $p = .85$, Other versus Physical, $p = 22$). Importantly, there was no correlation between the Pleasure subscores and age, or IQ in both groups (all ps $> .10$). Finally, it is worth noting that, in line with Kazdin's original findings, the three subscales were highly correlated in both groups (all rs $> .46$, all ps $< .02$).

Table 3 Results for linear regressions with ADOS calibrated scores as the dependent variable and the anhedonia subscores yielding significant correlations as the independent variables

	B	SE B	*β*	*p* value	R^2
Social	.12	.06	.34	.07	.11
Other sources	.20	.10	.35	.06	.12

Given these correlations, we went on further investigating the influence of participants' anhedonia levels on the severity of autism using linear regressions, with ADOS calibrated scores as the dependent variable and the anhedonia subscores yielding significant correlations as the independent variables. These analyses revealed that social and other sources of pleasures both tended to predict autism severity (see Table 3).

Discussion

As far as we are aware, this is the first study to address the issue of diminished social interest in ASD by directly asking participants to report their own pleasurable responses to social and non social situations. In line with our predictions children with high functioning autism reported diminished enjoyment in social situations selectively. By contrast, their responses to physical and other sources of pleasure (e.g., intellectual pleasure, pleasure of achievement) were comparable to typically developing control participants. Moreover, we found that Social and Other pleasure scores correlated with autism severity and tended to be significant predictors of autism severity. These findings mesh with the original clinical description of the condition (Asperger 1944; Kanner 1943) and are in line with the behavioural evidence reviewed in the introduction, as well as with recent functional magnetic resonance imaging (fMRI) data demonstrating reduced neural responses to social stimuli in regions associated with reward processing (Scott Van Zeeland et al. 2010).

This selective social anhedonia in ASDs is clinically relevant. First, research in other psychiatric disorders, schizophrenia in particular, suggests that the lack of pleasure in relationships with other people leads to social withdrawal and inappropriate behaviour and that it

weakens feelings of joy, pride and self-respect (Chapman et al. 1976; Meehl 1962). Second, family studies and psychometric studies of high-risk individuals have repeatedly demonstrated that anhedonia, particularly in the social domain, is a reliable indicator of vulnerability to schizophrenia or schizotypy (see e.g. Cohen et al. 2010; for a review see Horan et al. 2005; for the original theoretical account see Meehl 1962). In the case of ASDs, it would thus be important to determine whether individual differences in social anhedonia play a role in comorbidities such as psychotic disorders or mood disorders, and to assess the extent to which this lack of hedonism affects clinical severity and potentiates outcome in adulthood.

A potential limitation of the current study is that we did not have measures of depression and anxiety for our participants. People with ASD are indeed known to be at high risk for these problems (see e.g., Hallett et al. 2010), and anhedonia is strongly related to depression (in fact, "markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation made by others") is one of the DSM IV criteria for major depressive episodes, APA 1994). Might our findings reflect general depression or anxiety in the ASD group? We believe that the specific pattern of reduced pleasure in social situations but not in physical or 'other' situations argues against this. However, it will be important to examine the relationships between reduced social motivation and depression and anxiety in future studies.

Moreover, it is worth highlighting that autism is an umbrella term covering conditions which are known for being highly heterogeneous –including in terms of the manifestations of the social impairments– and that many individuals with an ASD do enjoy and seek out friendships. It would therefore be interesting to assess larger samples to allow for comparisons between various autism subgroups. Going back to the classic trichotomy between aloof, passive, and active but odd profiles (Wing and Gould 1979), one might for example hypothesize that depression has a different impact on social motivation depending on the nature of the social impairment. Active but odd individuals, for instance, may experience greater social motivation but limited success with social interactions and therefore increased chances of feeling excluded and depressed. Assessing very large samples would also allow to separate out individuals reporting high and low social motivation and to explore phenotypic correlates of social anhedonia in autism and in ordinary development. Regarding the sample size, it is also worth mentioning that we ran multiple statistical analyses on a relatively small sample. Again, replicating and extending these results with a larger sample will therefore prove decisive in assessing the generalisability of our findings.

Finally, one potential concern is that Kazdin's answer scale does not include opportunities for negative answers. In order to conform with Kazdin's original instrument, we used the same rating scale despite its unusual metric. It is important to note, however, that the goal of the scale is to quantify pleasure, rather than to assess positive *vs.* negative responses to various situations (which would be a slightly different psychological construct). With the aim of quantifying the amount of pleasure experienced by the participant, it makes sense to have a scale that ranges from no pleasure (or neutral) to high pleasure (very happy). Arguably, the design of the scale also reduces social desirability biases. There is indeed a risk that anhedonic participants might recognise the negative end of the scale as socially undesirable (more than they would for the neutral end of the scale) and come to avoid these ratings. Including negative items might therefore generate more defensiveness in the respondent and hence a greater tendency to deny symptoms.

Despite these limitations, there are important implications related to these findings. From an educational standpoint, first, social incentives are routinely used in classroom environments by means of praise, smiley faces, or certificates. This positive social feedback encourages learning by building on children's instrinsic motivation to please others. Non social rewards, on the other hand, have been shown to have detrimental effects on children who are already socially motivated (Warneken and Tomasello 2008). For example, intrinsically motivated prosocial behaviours can be undermined by practices involving extrinsic material rewards, such as money or toys (Fabes et al. 1989; Warneken and Tomasello 2008). In mainstream environments, then, there are good psychological reasons to think that social praise should be favoured over non social rewards. In populations where social pleasure is diminished however, non social incentives may be usefully combined with social praise.

Another interesting route for intervention would be to try and think of ways of boosting social pleasure, but achieving this goal will depend on our ability to answer a more fundamental question: What is the primary deficit behind diminished social motivation in ASD? One possibility is that children with autism find the social world less pleasurable because they have difficulty understanding its workings. This view stems from the idea that deficits in Theory of Mind (ToM), i.e., in the ability to understand other people's thoughts, beliefs and intentions (Baron-Cohen et al. 1985), play an important role in explaining the social impairments in autism. Another possibility is that social motivation is diminished because there is a primary impairment in assigning the correct reward value to social stimuli, hence triggering a cascade of negative consequences for the development of social cognition (Dawson

et al. 1998; Schultz 2005). In one case, lack of social motivation is the result of impaired social cognition. In the other, lack of social motivation is the primary deficit behind impaired ToM. Further empirical investigation is needed to distinguish between these two hypotheses. Such investigation could include comparison of different clinical groups or longitudinal studies of individual differences within the autism spectrum.

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