Moral judgment in adults with autism spectrum disorders

Tiziana Zalla [a,*], Luca Barlassina [a,b], Marine Buon [c], Marion Leboyer [d]

[a] Institut Jean Nicod, Centre National de la Recherche Scientifique, Département d'Etudes Cognitives, Ecole Normale Supérieure, Paris, France
[b] Dipartimento di Filosofia, Università degli Studi di Milano, Italy
[c] Laboratoire de Sciences Cognitives et Psycholinguistique, Centre National de la Recherche Scientifique, Département d'Etudes Cognitives, Ecole Normale Supérieure, Paris, France
[d] INSERM U 955, IMRB, University Paris Est Creteil, AP-HP, Henri Mondor-Albert Chenevier Hospitals, Department of Psychiatry, Fondation FondaMental, French National Science Foundation, Creteil, France

ARTICLE INFO

ABSTRACT

The ability of a group of adults with high functioning autism (HFA) or Asperger Syndrome (AS) to distinguish moral, conventional and disgust transgressions was investigated using a set of six transgression scenarios, each of which was followed by questions about permissibility, seriousness, authority contingency and justification. The results showed that although individuals with HFA or AS (HFA/AS) were able to distinguish affect-backed norms from conventional affect-neutral norms along the dimensions of permissibility, seriousness and authority-dependence, they failed to distinguish moral and disgust transgressions along the seriousness dimension and were unable to provide appropriate welfare-based moral justifications. Moreover, they judged conventional and disgust transgressions to be more serious than did the comparison group, and the correlation analysis revealed that the seriousness rating was related to their ToM impairment. We concluded that difficulties providing appropriate moral justifications and evaluating the seriousness of transgressions in individuals with HFA/AS may be explained by an impaired cognitive appraisal system that, while responsive to rule violations, fails to use relevant information about the agent's intentions and the affective impact of the action outcome in conscious moral reasoning.

1. Introduction

Autism spectrum disorders (ASDs) are pervasive developmental disorders characterized by abnormal social interaction, verbal and non-verbal communication problems, and restricted interests. Moral reasoning is a key feature of social cognition. Thus, assessing whether individuals with ASDs have intact abilities to express and justify moral judgments is crucial for establishing the nature and the extent of their social impairments. Surprisingly, however, moral cognition has rarely been investigated in individuals with ASDs.

Research on moral cognition in subjects with typical development has focused on two perspectives. The first perspective claims that moral judgment is the product of conscious, effortful and sophisticated reasoning on the basis of explicit abstract principles (Piaget, 1965/1932; Kohlberg, 1981); the second one relies on the assumption that morality takes the form of intuitions, accomplished by rapid, automatic, and unconscious affective responses (Haidt, 2001). In contrast with the 'conscious reasoning' perspective (Kohlberg, 1981), Haidt (2001) showed that when people are confronted with moral scenarios they engage in a process called 'moral dumbfounding' in which they are unable to articulate sufficient justifications for their confidently expressed moral judgments (Haidt,

* Corresponding author. Address: Institut Jean Nicod, Centre National de la Recherche Scientifique, Ecole Normale Supérieure, 29 rue d'Ulm, 75005 Paris, France. Tel.: +33 (0)1 44 32 26 70; fax: +33 (0)1 44 32 26 99.
E-mail address: tiziana.zalla@ens.fr (T. Zalla).

2001, 2003) and that conscious reasoning only provides post hoc explanations for moral justifications. According to Haidt (2003), amongst moral emotions, prosocial emotions such as empathy, sympathy, concern and compassion, promote morally good behaviour by orienting us to the welfare of society or to the needs of persons other than the agent. In this regard, empathy can be regarded as the capacity to experience other people's emotions vicariously. Indeed, empathy is a complex process that is made up of two relatively independent components: an affective, phylogenetically early, emotional contagion system and a more advanced, cognitive perspective-taking system (De Waal, 2008). The ability to experience cognitive empathy appears late in ontogenesis: infants show emotional responsiveness to the distress of others without being able to separate their own and the other's distress (Singer, 2006), and only older children and adolescents may be able to take the other individual's perspective and display cognitive empathy (Preston & de Waal, 2002). While affective empathy refers to the capacity to experience emotional reactions to the observed experiences of others by automatically activating one's own representations for the related emotional (or arousal) states, the cognitive notion of empathy emphasizes the ability to engage in the effortful conscious cognitive process of adopting another's psychological point of view and infer their mental states (Davis, 1994). In other terms, cognitive empathy involves processes, such as perspective taking and ToM (Blair, 2005; Shamay-Tsoory, Aharon-Peretz, & Perry, 2009; Singer, 2006). Neuroimaging research further supports the view that these two components are mediated by distinct neural circuits within the frontal cortex: the affective empathy system preponderantly involves the Inferior Frontal Gyrus, whereas the more cognitive system is subserved by the ventromedial prefrontal regions (Shamay-Tsoory et al., 2009).

With respect to empathy dysfunction, the inability to share emotional states with others has been described as one of the most striking clinical features of individuals with ASDs (Kanner, 1943). Although ASDs have often been associated with an impairment in processing and naming facial expressions of emotions (Capps, Yirmiya, & Sigman, 1992; Grossman, Klin, Carter, & Volkmar, 2000; Hobson, 1986 David & Tager-Flusberg, 1997; Yirmiya, Kasari, Sigman, & Mundy, 1989), Baron-Cohen and collaborators (Baron-Cohen, 1991; Baron-Cohen, Spitz, & Cross, 1993) have shown that disturbances in understanding others' affective states arise in people with ASDs when the appreciation of the emotion requires the representation of others' beliefs, such as surprise or embarrassment (i.e. belief-based emotion), but not for emotions generated by factual events (i.e. reality-based emotions). However, Castelli (2005) showed that children with autism were as able as controls to recognize the six basic emotions from facial expressions (anger, fear, disgust, happiness, sadness, surprise) with different intensity levels. The author suggested that individuals with autism might use compensatory strategies to bypass their deficit in emotion recognition.

According to Blair (1999), while children with autism show psychophysiological responsiveness to others' distress, they lack the cognitive component of empathy which gives rise to the experienced feelings. In the same direction, those studies that differentiate between different components of empathy have revealed difficulties in cognitive, but not in affective, aspects of empathy in individuals with ASDs (Dziobek et al., 2008; Rogers, Dziobek, Hassenstab, Wolf, & Convit, 2007; Shamay-Tsoory, Tomer, Yaniv, & Aharon-Peretz, 2002; Yirmiya, Sigman, Kasari, & Mundy, 1992). Overall, these findings suggest relatively intact emotional empathic reactions to other individuals' affective states, along with impaired ToM and cognitive empathy.

In individuals with typical development, moral cognition has been primarily studied by assessing the ability to distinguish moral transgressions (e.g. hitting another person) from conventional transgressions (e.g. going to school wearing pyjamas) (for reviews, see Nucci, 2001; Smetana, 1993). Cross cultural studies have shown that 3-years-old children with typical development distinguish between these two types of transgression along a number of dimensions (Nisan, 1987; Smetana & Braeges, 1990; Turiel, 1983). Moral transgressions are considered to be more *serious*, less *permissible* and less *authority-dependent* than conventional transgressions. Furthermore, the *justifications* of why moral transgressions are wrong tend to make reference to fairness and harm to victims, while in the case of conventional transgressions the explanation statement is usually given in terms of violation of social rules. According to Turiel (1983), the distinction between moral and conventional rules is grounded partly in differences in the affective responses elicited by the protagonist's actions: transgressions of conventional rules have effects on social order and rarely cause distress to persons, whereas moral transgressions are likely to produce negative emotional effects.

Recently, Nichols (2002, 2004) has elaborated a model according to which moral judgment is based on the interaction of two independent cognitive mechanisms: (a) a Normative Theory, i.e., an internally represented set of norms prohibiting behavior that harms others; (b) an Affective System that confers a special status on these norms, distinguishing them from mere conventional norms. Accordingly, he claimed that the moral/conventional distinction taps a distinction between affect-backed and affect-neutral norms. From this perspective, other affect-provoking transgressions will be distinguished from conventional transgressions. In line with his prediction, Nichols (2002) found that disgust transgressions, which also elicit strong affective reactions, are considered less permissible, more serious and less authority-contingent than conventional transgressions, suggesting that both moral norms and norms prohibiting disgusting behaviours are affect-backed normative rules.

In a previous study, Blair (1996) tested two groups of children with ASDs on the moral/conventional task. The first group passed both the Sally-Ann and the Smarties false belief tests, while the second group failed the two tests. Since both groups were able to draw the distinction between moral and conventional transgressions, Blair concluded that moral judgment is spared in autism and that it is independent of ToM abilities. Leslie and collaborators (2006) replicated Blair's findings on a sample of children with autism who failed both aforementioned false belief

tests. Like Blair, Leslie and colleagues drew the conclusion that basic moral judgment is preserved in autism and that it may function somewhat independently of ToM.

The ability to understand another person's action from that person's intentions and desires plays an important role in moral judgments. For example, wrong intentional actions are judged to be worse than similar unintentional ones (Lagnado & Shannon, 2008) and, similarly, attempted but failed harmful acts are judged to be more morally blameworthy than accidentally harmful acts (Young & Saxe, 2009). Developmental studies have shown that children's motive-based moral reasoning was positively correlated with their false-belief understanding, suggesting a relation between children's theory of mind and the domain of moral judgment (Baird & Astington, 2004). This close connection between moral judgment and ToM is further supported by recent neuroimaging evidence (Young, Camprodon, Hauser, Pascual-Leone, & Saxe, 2010; Young, Cushman, Hauser, & Saxe, 2007). Moral judgments require that participants balance evaluations of the actual outcomes against considerations of the agent's desires, beliefs and intention, which rely upon ToM reasoning.

Difficulties with ToM tasks are largely documented in individuals with ASDs (Baron-Cohen, 1989, 1995; Baron-Cohen, Leslie, & Frith, 1985, 1986; Leslie, 1987). In false belief tasks, the attribution of the agent's intentions relies on a more competent belief-desire reasoning ability since the default true-belief attribution has to be inhibited to select the appropriate mental content (Friedman & Leslie, 2004; Wimmer & Perner, 1983). However, ToM impairment in ASDs may extend well beyond belief understanding, and include difficulties with the attribution of desires and intentions (Phillips, Baron-Cohen, & Rutter, 1998).

Given the relevance of intention to the determination of moral appreciation, it is somewhat surprising that moral judgment has been found to be substantially intact in people with ASDs (Blair, 1996; Leslie, Mallon, & Dicorcia, 2006). However, in Blair's (1996) and Leslie Mallon, and Dicorcia's (2006) studies, participants were not asked to explain why they judged transgressions to be wrong. This is crucial missing information, since a competent moral judge is not only able to distinguish moral from conventional transgressions, but also to provide appropriate justifications for her judgments. Indeed, according to Grant and collaborators (2005), when asked to justify moral judgments, children with autism gave justifications of poor quality and, more recently, Moran and collaborators (2011) showed that ToM impairments in individuals with high functioning autism affected their moral judgments as they were less willing than adults with typical development to exculpate agents for accidental harm caused on the basis of innocent intentions.

Within the domain of ASDs, high functioning autism (HFA) commonly refers to individuals meeting criteria for autism with normal intellectual functioning and a history of speech and language delay. Asperger Syndrome (AS, DSM-IV, American Psychiatric Association, 2000; ICD-10, World Health Organization, 1992) describes individuals with no delayed language function and with normal intellectual abilities. Although individuals with HFA or AS can often solve first-order (e.g. "Sally thinks it's x, when really

it's y") and second-order false beliefs tests (e.g. "Sally thinks Mary thinks x, but both Sally and Mary are wrong") (Bowler, 1992; Dahlgren & Trillingsgaard, 1996; Happé, 1995; Leekam & Prior, 1994), they might fail tasks that require more complex reasoning about others' mental states, based on detection of sarcasm, irony or bluff (Happé, 1994) or on recognition of Faux Pas (Baron-Cohen, O'Riordan, Jones, Stone, & Plaistead, 1999; Zalla, Stopin, Ahade, Sav, & Leboyer, 2009).

In a previous study, using a more advanced ToM test, the Faux Pas recognition task (Baron-Cohen, O'Riordan, Jones, Stone, & Plaistead, 1999), Zalla and collaborators (2009) have showed that individuals with HFA/AS have difficulty distinguishing intentional from non-intentional behaviors. A faux pas is a particular case of a non-intentional action, since it occurs when a speaker says something that might hurt or be unpleasant to the listener, although the speaker never intended it to do so. Participants were presented with stories describing interpersonal interactions in everyday life situations in which a faux pas occurred, and control stories containing a minor conflict or accident.[1] Here is a typical faux pas story: "Jill had just moved into a new apartment and she had bought new curtains. When Jill had just finished hanging the new curtains, her best friend, Lisa, came over to visit the new apartment. After a tour of the apartment, Lisa said: "Those curtains are horrible. I hope you're going to get some new ones!". Obviously, Lisa's statement reflected her mistaken belief that the curtains had been left by the previous owner, and she did not have the intention to hurt Jill. Hence, a full-fledged understanding of faux pas situations requires the ability to understand the speaker's state of mind and appreciation of the emotional impact of the statement on the listener. Interestingly, although individuals with HFA/AS generally acknowledged that Lisa said something awkward, they were unable to provide correct justifications of why what Lisa did was awkward, they failed to understand that Lisa had a mistaken belief which was what had caused her faux pas and interpreted Lisa's statement as caused by her intention to hurt Jill. Typically, individuals with HFA/AS provided explanations in terms of malicious intentions. They judged that the speaker committing the faux pas intended to humiliate and offend the listener and, interestingly, they failed to describe appropriately the emotional impact on the listener. By contrast, for control participants a faux pas is a non-intentional by-product of an intentional act based on some false beliefs. These results revealed that while individuals with HFA/AS are able to detect social rule violations, both their abilities to interpret an action outcome as intentional or accidental and to provide an empathic appreciation of the listener's emotional state (knowledge about emotions) were diminished. It is noteworthy, however, that the empathy question in the Faux

---

[1] For each story, the following six questions were asked: (1) the detection question: "In the story did someone say something that they should not have said?"; (2) the person identification question: "Who said something they should not have said?"; (3) the content question: "What did they say that they should not have said?"; (4) the explanation question: "Why shouldn't they have said it?"; (5) the belief question: "Did they know/remember that?"; (6) the empathy question: "How did the listener feel?"

Pas was not specifically designed to assess either the cognitive or the emotional components of empathy. In a recent study (Zalla & Leboyer, 2011), we showed that, although under certain circumstances, individuals with HFA/AS and people with typical development have similar intuitive judgments of intentionality, over-assignment of praise judgments and the reduced use of folk-psychological concepts in moral judgment in individuals with HFA/AS likely reflect difficulties using intentionality information for moral reasoning.

In the present study, we investigated whether adults with HFA/AS are able to distinguish moral, conventional, and disgust transgressions using the task developed by Nichols (2002). In so doing, we aimed to assess whether impairments in ToM, as measured by the Faux Pas recognition test (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997), would affect the ability of individuals with HFA/AS to draw the distinction between these three types of normative transgressions. Participants were given a set of six transgression scenarios, each of which was followed by questions about permissibility, seriousness, authority contingency and justification. If one hypothesizes that ToM is a crucial component of moral cognition, one should expect that individuals with HFA/AS would encounter difficulties in distinguishing types of transgressions and in giving appropriate normative justifications for moral scenarios.

2. Method

2.1. Participants

Twenty adults with a clinical diagnosis of high functioning autism (HFA) or Asperger Syndrome (AS) according to DSM-IV R (American Psychiatric Association, 2000) and ASDI (Asperger Syndrome Diagnostic Interview, Gillberg, Gillberg, Råstam, & Wentz, 2001) were recruited from Albert Chenevier Hospital in Créteil (see Table 1 for details). The inclusion criteria for the sample were based on retro-

Table 1
Means (and standard deviations) of demographic and clinical data for participants with HFA/AS and the comparison participants.

	HFA/AS participants	Comparison participants
N (male:female ratio)	17:3	28:5
Age	28.3 (6.5) (range = 17–38)	26.6 (6.5) (range = 20–47)
Education	14.1 (3.4)	13.6 (3)
ADI [B–D][*]	18.1[7.4]; 11 [6.5]; 6.1 [3.9]	
Full-scale IQ	96 (20.9)	102 (13.2)
Verbal IQ	100.3 (19.3)	100.8 (11.7)
Performance IQ	91.4 (20.5)	99.5 (12.1)
Faux Pas test (total score)	35.3 (13.8) (range = 0–52)	45.6 (11.4) (range = 25–59)
Belief (sub-score)	5.4 (2.3)	7.2 (2)
Empathy (sub-score)	4.2(2.1)	7.4 (2.4)

[*] [B] = reciprocal social interaction, [C] = communication and [D] = stereotyped behaviours.

spective parental information about the early language development of their child. All diagnoses were made by experienced clinicians and were based on clinical observations of the participants. Interviews with parents or caregivers using the ADI-R (Autism Diagnostic Interview, Lord, Rutter, & Le Couteur, 1994) confirmed the diagnoses. The cut-off points for the three classes of behaviour are [B] reciprocal social interaction 10, [C] communication 8, and [D] stereotyped behaviours 3, respectively. All participants scored above the cut-off points.

As part of the checking process, the French translation of A-TAC (Autism, tics, AD-HD and other comorbidities; Hansson et al., 2005) was completed by the parents. This screening questionnaire is focused on a number of abilities, conducts and behaviours in a child's functioning as compared to his or her peers. Parents are asked to report any problem or specific characteristic observed at any period of life, even when this is no longer present.

Thirty-three comparison participants with typical development volunteered to match the clinical group with respect to age, IQ and gender (see Table 1 for details). Prior to their recruitment, the comparison participants were screened to exclude anyone with a history of psychiatric or neurological disorders. All participants were native French speakers, and had normal/corrected to normal vision.

All participants received basic neuropsychological screening, which included Verbal and Performance IQs (WAIS-III, Wechsler, 1999). All participants had an IQ above 70. Overall, individuals with HFA/AS did not differ from the comparison participants on gender, chronological age (t-test: $t(51) = -0.9$, $p = 0.36$, $r = 0.13$), education (t-test: $t(51) = 0.54$, $p = 0.58$, $r = 0.076$), IQ level (Full-scale, Verbal and Performance: t-test: $t(50) = -1.27$, $p = .20$, $r = 0.16$; $t(50) = -0.12$, $p = .90$, $r = 0.01$; $t(50) = -1.79$, $p = 0.07$, $r = 0.23$). To evaluate mindreading abilities, participants with HFA/AS and nineteen comparison participants were administered an advanced ToM task, the Faux-pas Recognition Test (Baron-Cohen, O'Riordan, Jones, Stone, & Plaistead, 1999; Zalla et al., 2009). The group with HFA/AS performed significantly lower than the comparison group on the Faux Pas total score ($t(35) = -2.47$, $p = 0.018$, $r = -0.37$) as well as on the Belief ($t(35) = -2.46$, $p = 0.018$, $r = -0.38$) and Empathy ($t(35) = -4.13$, $p < 0.0002$, $r = -0.57$) sub-scores, consistently with what is expected from the clinical presentation of the syndrome.

The present research has been approved by the local Ethical committee (Inserm, C07-33). All participants signed informed consent before volunteering for this study, and investigation has been conducted according to the principles expressed in the Declaration of Helsinki.

2.2. Procedure

All participants were individually tested in a quiet room at the Albert Chenevier Hospital in Créteil. The scenarios used were taken from Nichols (2002) and consisted of two moral, two conventional and two disgust stories. The two moral stories involved one child hitting another child and one child pulling another child's hair. The two conventional stories involved a child wearing pyjamas to school

and an adult drinking tomato soup out of the bowl at a dinner party. In the disgust stories, a child puts her finger in her nose in class and a person at a dinner party spits in her water glass before drinking it, respectively. The order of the stories was counterbalanced. After the transgression was described, participants were asked four questions. For example, in one of the disgust scenarios, subjects were presented the following story and questions. Bill is sitting at a dinner party and he snorts loudly and then spits into his water before drinking it.

1. Was it O.K. for Bill to spit in his water? If it was not O.K. for Bill to do that, then:
2. On a scale of one to seven, how bad was it for Bill to spit in his water?
3. Why was it bad for Bill to spit in his water?
4. Now what if, before Bill went to the party, the hosts had said, "At our dinner table, anyone can spit in their food or drink." Would it be O.K. for Bill to spit in his water if the hosts say he can?

2.3. Data collection and analyses

The scoring procedure follows that of the previous studies in the literature (Blair, 1995; Nichols, 2002; Smetana & Braeges, 1990). Questions 1 (permissibility) and 4 (authority) were scored binomially, with each Yes answer being given a score of 0 and each No answer a score of 1, so the cumulative score for each domain could range from 0 to 2. Question 2 was coded by the value (between 1 and 7) given to the seriousness of the transgression, so the cumulative score for each domain could range from 0 to 14. In accordance with the previous study (Nichols, 2002), question 3 was coded according to the following justification categories: (1) Other's welfare (any reference to victim's welfare, such as "it will hurt her"; "it's not fair"); (2) Rules (any reference to rules, even if implicit, such as "it's not socially acceptable"); (3) Disorder (any reference to disorder caused by the behaviour such as "it will distract others"); (4) Rudeness (any reference to the rudeness of the behaviour, such as "its bad manners"); (5) Health (any reference to health risks involved with the behaviour, such as "bad hygiene"); (6) Disgust (any reference to the disgustingness of the behaviour, such as "it's gross"); (7) Other (any other response). Two independent coders scored the justifications, and inter-rater reliability (joint probability of agreement) was high (92% for moral items; 88% for disgusting and conventional items).

Cumulative scores from binary variables (Questions 1 and 4) were analysed using a non-parametric chi-square test for group-comparison, Non-Parametric Repeated Measures Comparisons Friedman test and Wilcoxon test for paired comparisons. The data on seriousness (Question 2) were analysed using repeated-measures ANOVA with factors Groups (2: CPs, HFA/AS) × Conditions (3: conventional, moral, disgust). Scheffe's tests were used for post hoc analysis. Unpaired t-tests were used to analyse data on category justifications (Question 3). Pearson product-moment correlation coefficients were calculated across all participants between ToM measures (belief and empathy sub-scores) and test results. The level of significance was at <0.05.

3. Results

3.1. Permissibility

Non-parametric analyses (chi-square test) were performed on the groups' response to the permissibility question. Group-comparison analyses revealed no significant group effect on each condition (moral = χ^2 (2, N = 53) = 2.26, p = 0.32; conventional = χ^2 (2, N = 53) = 0.71, p = 0.69: disgust = χ^2 (1, N = 53)=2.62, p = 0.10). A Friedman test revealed a significant effect of condition (χ^2 (2, N = 53) = 11.4, p = 0.003) (cf. table 2). Pairwise comparisons using the Wilcoxon Signed Ranks test revealed that this effect was due to the conventional violations being regarded as significantly more permissible than the moral ($z = -3.4$, p = 0.007) and the disgust ($z = -3.65$, p = 0.0003) transgressions, while no difference was found between the moral and the disgust scenarios ($z = -0.31$; p = 0.75).

3.2. Seriousness

Repeated-measures ANOVA analysis yielded significant main effects of group ($F(1, 51) = 7.32$; p = 0.0092) and type of transgression ($F(1, 2) = 84.1$; p < 0.0001), as well as a significant Group × Type of transgression interaction ($F(2102) = 5.31$; p = 0.0064). Participants with HFA/AS judged transgressions as more serious than comparison participants (mean diff: 1.68; p = 0.0092). The effect of Type of transgression was due to moral transgressions being regarded as more seriously wrong than the conventional (mean diff: 6.03; p < 0.0001) and the disgust (mean diff: 2.8; p < 0.0001) ones, while the disgust transgressions were regarded as more serious than the conventional ones (mean diff: −3.1; p < 0.0001). Post-hoc Scheffe's tests revealed that participants with HFA/AS judged both the conventional and the disgust transgression scenarios as more seriously wrong than the comparison participants did (mean diff: 2.8; p = 0.001 and mean diff: 2.1; p = 0.03, respectively), while the two groups did not differ on their

Table 2
Mean scores (and SD) for judgments of Permissibility, Seriousness and Authority in participants with HFA/AS and comparison participants (CP).

	Moral		Conventional		Disgust	
	HFA/AS	CP	HFA/AS	CP	HFA/AS	CP
Permissibility	1.9 (0.3)	1.9 (0.3)	1.6 (0.5)	1.5 (0.6)	2 (0)	1.9 (0.3)
Seriousness	12.8 (2.3)	12.7 (1.8)	8.5 (3.9)	5.6 (2.2)	11.2 (2.9)	9.1 (3.5)
Authority	1.6 (0.8)	1.8 (0.4)	0.6 (0.8)	0.5 (0.6)	1.2 (0.8)	1.3 (0.7)

judgment of seriousness for the moral scenarios (mean diff: 0.09; $p = 0.87$).

Interestingly, while comparison participants distinguished moral, conventional, and disgust transgressions (all $p < 0.0001$), participants with HFA/AS judged conventional transgressions as being less serious than moral transgressions (mean diff. = 4.3; $p = 0.003$) and disgust transgressions (mean diff. = -2.7; $p = 0.03$), but failed to distinguish moral from disgust transgressions (mean diff.: 1.6; $p = 0.28$).

3.3. Authority contingency

Group-comparison analyses performed by using non-parametric chi-square test revealed no significant group effect on each condition (moral = χ^2 (2, $N = 53$) = 2.73, $p = 0.25$; conventional = χ^2 (2, $N = 53$) = 4.85, $p = 0.09$: disgust = χ^2 (1, $N = 53$) = 0.71, $p = 0.69$). A Friedman test revealed a highly significant effect of condition (χ^2 (2, $N = 53$) = 40.6, $p < 0.0001$) (cf. table 2). Pairwise comparisons using the Wilcoxon Signed Ranks test revealed that this effect was due to the conventional transgressions being regarded as more authority contingent than the moral ($z = -5.6$, $p < 0.0001$) and the disgust ($z = -4.26$, $p < 0.0001$) transgressions, and to the disgust transgressions being regarded as more authority contingent than the moral transgressions ($z = -3.22$; $p = 0.0013$).

3.4. Category justifications

Unpaired t-tests were performed separately on each scenario condition (Moral, Conventional, and Disgust). On the Moral scenarios, responses were classified under four category justifications: "Rules", "Others' Welfare", "Rudeness" and "Disorder". As shown in Fig. 1a, while a higher proportion of comparison participants' responses was classified in terms of Others' Welfare (CP = 0.77, SD. 0.37 vs. HFA/AS: 0.37, SD, 0.42), a higher proportion of justifications given by participants with HFA/AS was in terms of rule violations (HFA/AS: 0.43, SD. 0.37 vs. CP = 0.11, SD, 0.21). The two groups differed on the proportion of justifications in terms of Others' Welfare ($t = -3.55$; $p = 0.0008$) and rules ($t = 4.01$; $p = 0.0002$), while they did not differ on the justifications in terms of Rudeness ($t = 0.26$; $p = 0.79$) and Disorder ($t = 0.36$; $p = 0.72$) (Fig. 1a).

For the Conventional scenarios, participants' responses were classified under three category justifications: "Rules", "Rudeness" and "Health". For one of the conventional stories (*An adult drinking tomato soup out of the bowl at a dinner party*), five participants with HFA/AS and ten comparison participants judged that the behaviour was permissible, and then they did not answer the subsequent justification question (0.19 of no-answers). Only five responses were classified in terms of "other" category justification (0.11) and were not taken into consideration in the analyses (Fig. 1b). The two groups did not differ on any type of category justification provided (Rules: $t = -0.53$; $p = 0.60$; Rudeness: $t = 0.58$; $p = 0.56$; Health: $t = -0.035$; $p = 0.97$). The greatest proportion of participants provided justifications in terms of Rules (0.66; S.D., 0.38), as compared to

the Rudeness (0.22, S.D., 0.32; $p < 0.0001$) and Health (0.07; SD, 0.22; $p < 0.0001$) category justifications.

For the Disgust scenarios, justification statements were classified under four categories: "Disgust", "Rules", "Rudeness" and "Health". No significant differential pattern of responses between the two groups was observed on any category justifications (Disgust: $t = 1.5$; $p = 0.15$; Rules: $t = -3.9$; $p = 0.69$; Rudeness: $t = 0.03$; $p = 0.97$; Health: $t = -1.16$; $p = 0.25$) (Fig. 1c).

When we compared the proportion of justifications in terms of "Rules" provided by the two groups for the three conditions (moral, conventional and disgust), Repeated-Measures ANOVA yielded no significant group difference ($F(1, 51) = 2.04$; $p = 0.15$), along with a highly significant effect of condition ($F(1, 2) = 30.46$; $p < 0.0001$) and a significant interaction Group × Condition ($F(1102) = 3.55$; $p = 0.032$). A greater proportion of rule-based justifications were given for the conventional scenarios as compared to the moral (mean diff. = -0.47, $p < 0.0001$) and the disgust (mean diff. = 0.46, $p < 0.0001$) scenarios, while no significant difference was found between the moral and the disgust stories (mean diff. = -0.009, $p = 0.98$).

The interaction effect was due to participants with HFA/AS giving a greater proportion of rule-based justifications for the conventional scenarios than for the disgust scenarios (mean diff.: 0.47; $p = 0.0005$) whereas they provided a comparable proportion of rule-based justifications for the conventional and moral scenarios (mean diff.: -0.25; $p = 0.10$). In contrast, the comparison participants provided a greater proportion of rule-based justifications for conventional scenarios, as compared to both the moral (mean diff. = -0.57, $p < 0.0001$) and the disgust scenarios (mean diff.: 0.44, $p < 0.0001$). No significant difference on the proportion of rule-based justifications was found between the moral and the disgust stories in participants with HFA/AS (mean diff.: 0.22; $p = 0.15$) and the comparison group (mean diff.: -0.13; $p = 0.28$).

4. Correlation analyses

Correlation analyses (Pearson Product Moment test) were performed in both groups between the Belief and the Empathy sub-scores on the Faux Pas task and the score on Seriousness judgments, all types of rule violations combined (Moral, Conventional, and Disgust). Interestingly, a significant negative correlation emerged between the Belief sub-score and scores in Seriousness judgments in the group with HFA/AS ($r = -0.50$, $z = -2.131$; $p = 0.033$), while the two variables were positively correlated in the comparison group ($r = 0.46$, $z = 1.98$; $p = 0.048$). These correlations remained significant when the seriousness score of moral transgressions were excluded in both groups (HFA/AS: $r = -0.52$, $z = -2.17$; $p = 0.029$; comparison group: $r = 0.52$, $z = 2.32$; $p = 0.02$) (Fig. 2). Conversely, no significant correlation was found between the Empathy sub-score and score in Seriousness judgments in the HFA/AS ($r = -0.22$, $z = -0.83$; $p = 0.41$) and the comparison ($r = 0.21$, $z = 0.85$; $p = 0.39$) groups, even when moral condition was excluded (HFA/AS: $r = -0.23$, $z = -0.85$; $p = 0.39$; comparison group: $r = 0.21$, $z = 0.86$; $p = 0.39$).

a. Moral scenarios
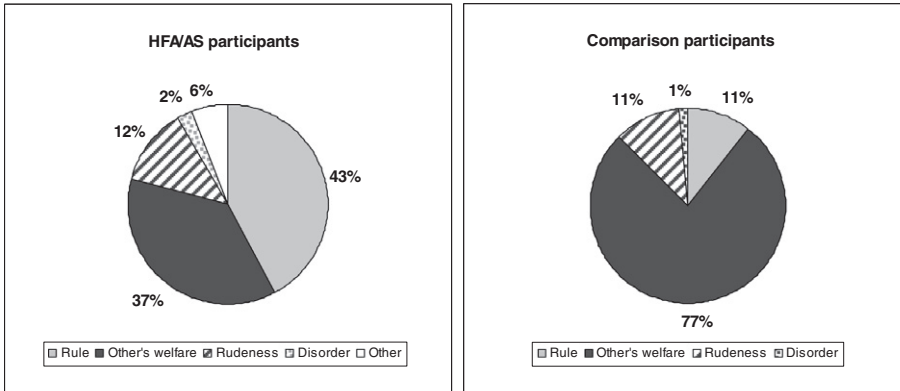
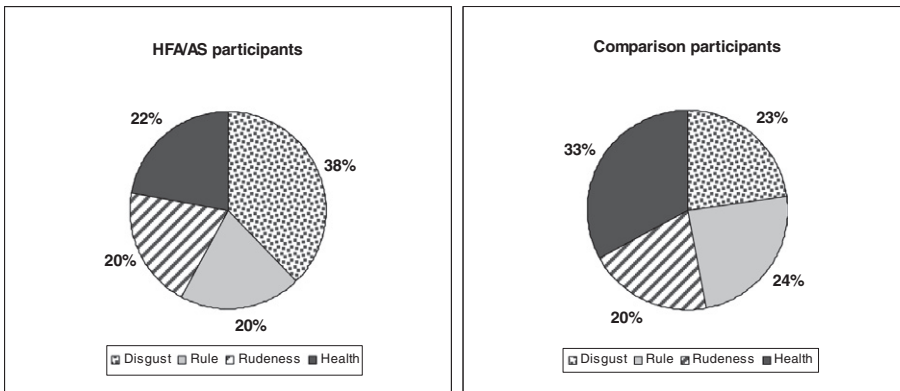## b. Conventional scenarios
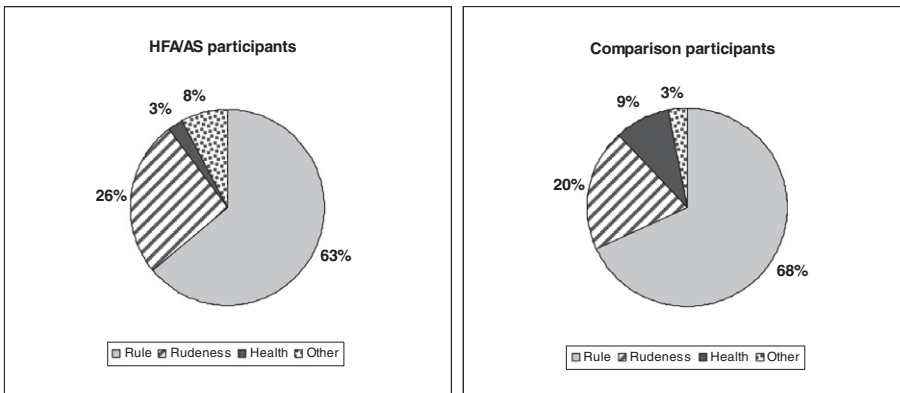
c. Disgust scenarios

Fig. 1. Distribution of category justifications produced by the two groups for (a) the moral scenarios; (b) the conventional scenarios; (c) the disgust scenarios.

5. Discussion

Moral reasoning is an important component of social cognition. In the present study, we tested the ability of adults with HFA/AS, who exhibit impairments in ToM abilities, to distinguish moral, conventional, and disgust transgressions. Participants were given a set of transgressions scenarios followed by questions about permissibility, seriousness, authority contingency, and justification. Our aim was to assess whether ToM impairments of individuals with HFA/AS would affect their abilities to provide distinctive judgments for these types of transgressions and appropriate normative justifications. According to Nichols (Nichols, 2002, 2004), moral, conventional and disgust transgressions are judged wrong because they are prohibited by a normative theory, i.e., a set of internally represented norms that distinguish permissible from impermissible acts. He also argued that moral and disgust norms are different from conventional norms in that the former are backed by affective and emotional reactions,
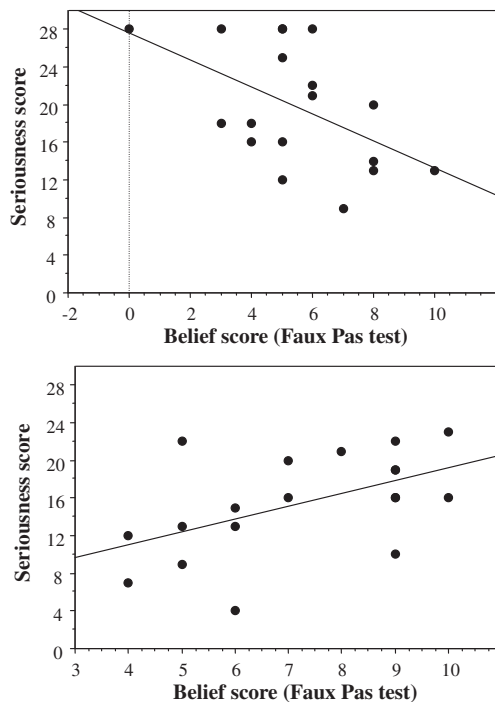
Fig. 2. Scatterplot showing a significant negative correlation between the belief sub-score at the Faux Pas test and the Seriousness evaluation (disgust and conventional transgressions combined) by the HFA/AS group (upper panel) and the comparison group (lower panel).

that is, they are part of an important class of norms, "norms with feeling". Nichols (2002) showed that, as moral transgressions, disgust-backed transgressions are distinguished from affectively neutral transgressions along the dimensions of permissibility, seriousness, authority contingency and justifications.

The present results confirm previous evidence showing that participants with typical development distinguished affect-backed norm transgressions from conventional affect-neutral norm transgressions along the four dimensions, and further reveal that moral transgressions were considered to be more serious and less authority contingent than disgust transgressions. Participants with typical development also provided different justifications for the three types of normative violations.

Interestingly, a different pattern of responses was observed for the group with HFA/AS: adults with HFA/AS judged conventional and disgust transgressions to be significantly more serious than did the comparison group, and failed to distinguish disgust transgressions from moral transgressions along the seriousness dimension. Furthermore, when asked to justify why moral transgressions were wrong, 77% of the comparison group's statements fell into the "Others' Welfare" category (e.g., 'it will hurt her'; "she will suffer"; "it is not fair to hurt others"), whereas only 37% of the answers given by individuals with HFA/AS referred to Others' Welfare. In fact, as for both moral and conventional transgressions, they favored explana-

tions in terms of "Rules" and, accordingly, failed in drawing the moral/conventional distinction along the dimension of justification. However, like the comparison group, they were able to detect transgressions and to judge that moral and disgust transgressions were less permissible and less authority-dependent than conventional transgressions. Remarkably, low performance on the Belief sub-score on the Faux Pas test correlated with higher seriousness rating in the group with HFA/AS whereas the inverse negative correlation was observed in the comparison group, suggesting that ToM abilities differentially affect moral judgment in the two populations.

Three main considerations emerge from these findings. First, adults with HFA/AS have acquired a normative theory that enables them to reason according to normative rules when asked to apply this knowledge to real-life situations. Second, individuals with HFA/AS were able to distinguish affect-backed norms from conventional affect-neutral norms along the dimensions of permissibility, seriousness and authority-dependence which, at first sight, seems to suggest that they might be able to use affective responsiveness to make distinctive judgments. Furthermore, within the category of affect-backed norms, moral transgressions were judged as being less authority contingent than disgust ones. Third, participants with HFA/AS provided justifications in terms of rules rather than in terms of Others' Welfare revealing that emotion information is not used for conscious processes of moral reasoning.

In previous studies, Blair (1996, 1999) found that individuals with ASDs exhibit intact physiological responsivity to the distress of others and concluded that an increased aversive arousal, which is specific to moral transgression, is a prerequisite for the development of the moral/conventional distinction. The author concluded that moral judgment is spared in autism and that it is independent of ToM abilities, since both groups of children with ASDs with and without ToM impairments, were able to perform the moral/conventional task successfully (Blair, 1996).

Relatively preserved emotional and empathic processing in response to others' distress in people with ASDs is consistent with a large body of evidence. For example, Yirmiya and collaborators (1992) showed that children with high-functioning autism exhibit considerable ability to respond empathetically to the feelings of others. In a more recent study, in a multidimensional study of empathy, Dziobek et al. (2008) reported that individuals with AS showed equivalent emotional empathy compared to a control group, although they had difficulties with the cognitive aspects of empathy. Similarly, using a multi-dimensional measure to assess both the cognitive and affective components of empathy simultaneously, Rogers and collaborators (2007) reported that while individuals with Asperger syndrome scored lower than the control group on measures of cognitive empathy, a notion that overlaps considerably with ToM, there were no differences between the groups on a measure of emotional empathy. Indeed, when individuals with AS were given the information that allows them to understand the point of view of others, they were shown to report similar levels of compassion and concern as unaffected individuals. Overall, these findings confirm the

proposal that cognitive and affective empathy represent two separate, although related, constructs (Davis, 1983) and that impairment in cognitive empathy in people with ASDs is likely associated with diminished ToM abilities. ToM is a fundamental component of cognitive empathy. For this reason, the notions of "cognitive empathy" (i.e., the ability to understand another person's perspective or feelings) and "ToM" (i.e., the ability to attribute intentions and beliefs to oneself and to others) are often used interchangeably (e.g., Baron-Cohen & Wheelwright, 2004).

According to Nichols (2002), when normative prohibitions are paired with affective response, as is the case with moral and disgust transgressions, the affects provide a reinforcement for the prohibitions that induces a deeper aversion for actions that violates these norms, and this emotional reaction might confer a non-conventional status to the moral and disgust norms. It is likely that, in the present study, intact emotional responsiveness to socioaffective cues in individuals with HFA/AS would enable them to make the distinction between the affect-backed and the conventional affect-neutral norm transgressions but not between different types of affect-backed prohibitions. The fact that individuals with HFA/AS failed to provide moral justifications in terms of "Others' Welfare", but gave appropriate disgust-based justifications rules out the hypothesis of a general difficulty with affect-backed transgressions and points to the notion that different types of emotional or empathic experiences are involved in moral and disgust transgressions. Indeed, a fundamental difference between moral and disgust transgressions is that an action is considered disgusting regardless of whether it is intentional or unintentional, whereas the moral status of an action crucially depends on the evaluation of the agent's intentions or motives, as well as on the representation of the victim's distress. Therefore, we argue that while the affective component of the empathy is sufficient to distinguish affect-backed from affect-neutral norms, an intact cognitive empathy, which is specifically involved in moral appraisal, is required to distinguish moral from disgust violations.

The hypothesis of a crucial role of the ToM deficit in normative judgments is further supported by the significant correlations between the Belief (attribution) sub-score on the Faux Pas test and the seriousness rating in both groups, while no correlation was found between the Empathy sub-score and the seriousness rating. In particular, in our group with HFA/AS, the Belief sub-score on the Faux Pas test correlated negatively with the seriousness evaluation, whereas a positive correlation between the two variables was found in the comparison participants. These findings suggest that ToM abilities differentially affect moral judgment in the two groups. Specifically, the fact that lower performance on the Belief questions in participants with HFA/AS was associated with higher score in seriousness rating of disgust and conventional transgressions might be explained by a strict adherence to societal rules and norms. Since rule-based processes are relatively preserved in individuals with ASDs, they do not have difficulties performing reasoning tasks when rule application is

explicit (Minshew & Goldstein, 1998) and likely use an overt and effortful learned rule-based mechanism to compensate for their diminished social understanding. A general heuristic based on responsiveness to normative violations would result in blame judgments of the agent for committing a prohibitive act, which are not mitigated by the appreciation of the agent's intentions and of the emotional impact of the offensive behavior. Therefore, the more they are able to engage in mental state reasoning, the less they rely on a strict application of normative rules in their evaluation. Conversely, in people with typical development, greater performance on the Belief (attribution) questions was associated with lower score in seriousness rating of disgust and conventional transgressions likely suggesting that mental state reasoning plays a role in mitigating their evaluative judgments of involuntary or inoffensive normative transgressions.

Similarly, in a recent study (Zalla & Leboyer, 2011), we found that praise judgments by people with HFA/AS were not tuned by information about the agent's intentions, desires or skills. Similarly, as previously reported (Zalla et al., 2009), when asked to judge actions that are socially inappropriate, such as a faux pas situation, individuals with AS seemed to attach more importance to normative transgressions than to the agent's intentional states that generated the faux pas. They failed to regard the faux pas as an unintentional act, and since they detected that some wrong or inappropriate action occurred in the story, they tended to blame the protagonist as if she/he had done it on purpose. Therefore, difficulties using information about the agent's intentions in performing transgressive behaviors and the emotional impact of the harmful action on the victim in normative reasoning might result in a reduced tolerance for rule violations in people with ASDs. It is possible that the lack of correlation between the Empathy sub-score and the seriousness score is due to the empathy measure including both types of empathy: the emotional and the cognitive ones, and that only the latter plays a role in the seriousness evaluation of normative violations.

It might be objected that the fact that individuals with HFA/AS had difficulties providing appropriate moral justifications does not reflect a deficit in moral cognition. In fact, it has been proposed that moral judgments are based on intuitive, tacit processes, while explicit justifications only count as post hoc rationalizations (Cushman, Young, & Hauser, 2006; Haidt, 2001, 2003). However, as the present findings showed, while it is possible that affective responses (i.e., feeling of aversiveness) might operate tacitly and enable to distinguish affect-backed violations from conventional violations in both groups, emotion information is available for conscious processes of moral reasoning and is consistently cited during justification by people with typical development. Conversely, moral justifications in participants with HFA/AS were little influenced by the appreciation of the victim's affective states, indicating that such information was not consciously accessible or, if available, it was not used in conscious reflection of moral reasoning in adults with HFA/AS. In our view, the fact that

individuals with HFA/AS are able to distinguish non conventional from conventional prohibitions might suggest that emotional appraisal is relatively preserved whereas difficulties to distinguish moral and conventional violations patently arise when they are asked to provide explicit and conscious justifications for their judgments. Thus, it is possible that although some intuitive moral knowledge might be preserved in people with ASDs, they would lack a conscious cognitive appraisal system that takes into account affective and intentional information (e.g. Hauser, Cushman, Young, Jin, & Mikhail, 2007; Mandler, 1984).

Conscious experiences are thought to reflect the simultaneous representation in working memory of the contents of the outputs of a variety of cognitive and affective systems (e.g. Ledoux, 2000). In the case of moral judgments, information about intentions, desires and mental states of one's self and others, is what is require to turn emotional arousal into sharable subjective experience and feelings. An impairment of this appraisal system would prevent from distinguishing adequately moral transgressions from other types of normative transgressions.

In accordance with our interpretation, Moran and collaborators (2011) found that individuals with HFA have difficulties in making moral judgments that rely on ToM. Importantly, however, these individuals succeeded in ToM tasks. To account for such apparently paradoxical results, Moran et al. (2011) hypothesized that adults with high-functioning autism may be able to encode others' mental states, but have difficulties in using such information in concert with other types of information.

Although the present results reach significance and partially replicate previous findings using this or similar tasks (Blair, 1996; Nichols, 2002; Smetana & Braeges, 1990), there are a couple of shortcomings with this experiment that need to be acknowledged here. First, the fact that only two scenarios per condition were used might weaken our conclusions and call for follow-up research. The second related issue concerns the possible ceiling effects on permissibility for moral and disgust transgression in both groups due to the restricted range of scores for this measure (0–2). Although this is a clear methodological limitation, results on permissibility are in accordance with our predictions and partly replicated previous findings. As previously shown (Blair, 1996), participants with HFA/AS were able to distinguish moral from conventional violations, and as expected (see Nichols, 2002), people with typical development made the disgust/conventional distinction on all the four criteria, as did the group with HFA/AS. Indeed, the present task was originally conceived to test the hypothesis that participants would distinguish disgust transgressions from neutral conventional transgressions on all the criterion judgments, while no specific hypothesis on the moral/disgust distinction was posited. Nevertheless, although results on permissibility are not crucial for the issues discussed in the present work, a larger number of scenarios per condition would potentially reveal subtle group differences in the way people might further distinguish moral from disgust violations as well as additional difficulties in people with ASDs related to the establishing of this distinction.

In conclusion, the present study reveals that difficulties providing appropriate moral justifications and evaluating the seriousness of transgressions at a fine-grained level in individuals with ASDs may be explained by an impaired cognitive appraisal system that, while responsive to rule violations, fails to integrate and use relevant information about the agent's intentions and affective states in conscious moral reasoning.

Theoretically, the present results address important issues about the psychological mechanisms underlying moral and intentional judgments. Although a normative theory, information about actions, intentions, and the appreciation of the emotional impact of the action outcome contribute to judgment of seriousness on normative evaluations, it remains unclear how these types of information interact to enable the distinctive kinds of judgments subjects make about different types of transgressions. Further studies are needed in order to determine how individuals with ASDs might develop moral intuitions despite their deficit in cognitive empathy and to what extent impairments in ToM would affect the development of moral cognition.

References

American Psychiatry Association (2000). *Diagnostic and statistical manual of mental disorders (4th ed.). DSM-IV-TR (Text Revision)* (4th ed.). Washington, DC: American Psychiatry Association.

Baird, J. A., & Astington, J. W. (2004). The role of mental state understanding in the development of moral cognition and moral action. *New Directions for Child and Adolescent Development, 103*, 37–49.

Baron-Cohen, S. (1989). The autistic child's theory of mind: A case of specific developmental delay. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 30*, 285–297.

Baron-Cohen, S. (1991). Do people with autism understand what causes emotion? *Child Development, 62*, 385–395.

Baron-Cohen, S. (1995). *Mindblindness. An essay on autism and theory of mind*. Cambridge: MIT Press.

Baron-Cohen, S., Jolliffe, T., Mortimore, C., & Robertson, M. (1997). Another advanced test of theory of mind: Evidence from very high functioning adults with autism or Asperger Syndrome. *Journal of Child Psychology and Psychiatry, 38*, 813–822.

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "Theory of Mind"? *Cognition, 21*, 37–46.

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1986). Mechanical, behavioural and intentional understanding of picture stories in autistic children. *British Journal of Developmental Psychology, 4*, 113–125.

Baron-Cohen, S., O'Riordan, M., Jones, R., Stone, V., & Plaistead, K. (1999). Recognition of faux pas in normal children and children with Asperger syndrome. *Journal of Autism and Developmental Disorders, 29*, 407–418.

Baron-Cohen, S., Spitz, A., & Cross, P. (1993). Can children with autism recognize surprise? *Cognition and Emotion, 7*, 507–551.

Baron-Cohen, S., & Wheelwright, S. (2004). The empathy quotient: an investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. *Journal of Autism and Developmental Disorders, 34*(2), 163–175.

Blair, R. J. R. (1995). A cognitive developmental approach to morality: investigating the psychopath. *Cognition, 57*, 1–29.

Blair, R. J. R. (1996). Brief report: Morality in the autistic child. *Journal of Autism and Developmental Disorders, 26*, 571–579.

Blair, R. J. R. (1999). Psychophysiological responsiveness to the distress of others in children with autism. *Personality & Individual Differences, 26*, 477–485.

Blair, R. J. R. (2005). Responding to the emotions of others: Dissociating forms of empathy through the study of typical and psychiatric populations. *Consciousness and Cognition, 14*, 698–718.

Bowler, D. M. (1992). "Theory of mind" in Asperger's Syndrome. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 33*, 877–893.

Capps, L., Yirmiya, N., & Sigman, M. (1992). Understanding of simple and complex emotions in non-retarded children with autism. *Journal of Child Psychology and Psychiatry, 33*, 1169–1182.

Castelli, F. (2005). Understanding emotions from standardized facial expressions in autism and normal development. *Autism, 9*(4), 428–449.

Cushman, F., Young, L., & Hauser, M. D. (2006). The role of reasoning and intuition in moral judgments: Testing three principles of harm. *Psychological Science, 17*, 1082–1089.

Dahlgren, S. O., & Trillingsgaard, A. (1996). Theory of mind in non-retarded children with autism and Asperger's syndrome: A research note. *Journal of Child Psychology and Psychiatry, 37*, 759–763.

David, R. M., & Tager-Flusberg, H. (1997). An investigation of attention and affect in children with autism and Down Syndrome. *Journal of Autism and Developmental Disorders, 27*, 385–396.

Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology, 44*, 113–126.

Davis, M. H. (1994). *Empathy: A social psychological approach*. Madison, WI: Brown & Benchmark.

De Waal, F. B. (2008). Putting the altruism back into altruism: The evolution of empathy. *Annual Review of Psychology, 59*, 279–300.

Dziobek, I., Rogers, K., Fleck, S., Bahnemann, M., Heekeren, H. R., Wolf, O. T., et al. (2008). Dissociation of cognitive and emotional empathy in adults with Asperger syndrome using the Multifaceted Empathy Test (MET). *Journal of Autism and Developmental Disorders, 38*, 464–473.

Friedman, O., & Leslie, A. M. (2004). Mechanisms of belief-desire reasoning: Inhibition and bias. *Psychological Science, 15*, 547–555.

Gillberg, C., Gillberg, C., Råstam, M., & Wentz, E. (2001). The Asperger syndrome (and high-functioning autism) diagnostic interview (ASDI): A preliminary study of a new structured clinical interview. *Autism, 5*, 57–66.

Grant, C. M., Boucher, J., Riggs, K. J., & Grayson, A. (2005). Moral understanding in children with autism. *Autism, 9*, 317–331.

Grossman, J. B., Klin, A., Carter, A. S., & Volkmar, V. F. (2000). Verbal bias in recognition of facial emotions in children with Asperger Syndrome. *Journal of Child Psychology and Psychiatry, 41*, 369–379.

Haidt, J. (2001). The emotional dog and its rational tail: A social intuitionist approach to moral judgment. *Psychological Review, 108*, 814–834.

Haidt, J. (2003). The moral emotions. In R. J. Davidson, K. R. Scherer, & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 852–870). Oxford: Oxford University Press.

Hansson, S. L., Svanström Röjvall, A., Rastam, M., Gillberg, C., Gillberg, C., & Anckarsäter, H. (2005). Psychiatric telephone interview with parents for screening of childhood autism-tics, attention-deficit hyperactivity disorder and other comorbidities (A-TAC): Preliminary reliability and validity. *The British Journal of Psychiatry, 187*, 262–267.

Happé, F. (1994). An advanced test of theory of mind: Understanding of story characters' thoughts and feelings by able autistic, mentally handicapped and normal children and adults. *Journal of Autism and Developmental Disorders, 24*, 129–154.

Happé, F. (1995). An advanced test of theory of mind: Understanding of story characters' thoughts and feelings by able autistic, mentally handicapped and normal children and adults. *Journal of Autism and Developmental Disorders, 24*, 129–154.

Hauser, M., Cushman, F., Young, L., Jin, K.-X., & Mikhail, J. (2007). A dissociation between moral judgments and justifications. *Mind & Language, 22*(1), 1–21.

Hobson, P. (1986). The autistic child's appraisal of expressions of emotion. *Journal of Child Psychology and Psychiatry, 27*, 321–342.

ICD-10 (1992). *Classification of mental and behavioural disorders diagnostic criteria for research*. World Health Organization.

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2*, 217–250.

Kohlberg, L. (1981). *Essays on moral development: The philosophy of moral development* (Vol. 1). New York: Harper Row.

Lagnado, D. A., & Shannon, S. (2008). Judgments of cause and blame: The effects of intentionality and foreseeability. *Cognition, 108*, 754–770.

Ledoux, J. E. (2000). Emotion circuits in the brain. *Annual Review of Neuroscience, 23*, 155–184.

Leekam, S. R., & Prior, M. (1994). Can autistic children distinguish lies from jokes? A second look at second-order belief attribution. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 35*, 901–915.

Leslie, A. M. (1987). Pretense and representation: The origins of "theory of mind". *Psychological Review, 94*, 412–426.

Leslie, A. M., Mallon, R., & Dicorcia, J. A. (2006). Transgressors, victims, and cry babies: Is basic moral judgment spared in autism? *Social Neuroscience, 1*, 270–283.

Lord, C., Rutter, M., & Le Couteur, A. (1994). Autism diagnostic interview-revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *Journal of Autism and Developmental Disorders, 24*, 659–685.

Mandler, G. (1984). *Mind and body*. Norton: New York.

Minshew, N., & Goldstein, G. (1998). Autism as a disorder of complex information processing. *Mental Retardation and Developmental Disabilities Research Reviews, 4*, 129–136.

Moran, J., Young, L., Saxe, R., Lee, S., O'Young, D., Mavros, P., & Gabrieli, J. (2011). Impaired theory of mind for moral judgment in high-functioning autism. *Proceedings of the National Academy of Sciences, 15, 7, 108*, 2688–2692.

Nichols, S. (2002). Norms with feeling: Toward a psychological account of moral judgment. *Cognition, 84*, 223–236.

Nichols, S. (2004). *Sentimental rules: On the natural foundations of moral judgment*. Oxford: Oxford University Press.

Nisan, M. (1987). Moral norms and social conventions: A cross-cultural comparison. *Developmental Psychology, 23*, 719–725.

Nucci, L. (2001). *Education in the moral domain*. Cambridge: Cambridge University Press.

Phillips, W., Baron-Cohen, S., & Rutter, M. (1998). Understanding intention in normal development and in autism. *British Journal of Developmental Psychology, 16*, 337–348.

Piaget, J. (1965/1932). *The moral judgment of the child*. New York: Free Press.

Preston, S. D., & de Waal, F. B. (2002). Empathy: Its ultimate and proximate bases. *Behavioral & Brain Sciences, 25*, 1–20.

Rogers, K., Dziobek, I., Hassenstab, J., Wolf, O. T., & Convit, A. (2007). Who cares? Revisiting empathy in Asperger syndrome. *Journal of Autism & Developmental Disorders, 37*(4), 709–715.

Shamay-Toory, S. G., Aharon-Peretz, J., & Perry, D. (2009). Two systems for empathy: A double dissociation between emotional and cognitive empathy in inferior frontal gyrus versus ventromedial prefrontal lesions. *Brain, 132*, 617–627.

Shamay-Toory, S. G., Tomer, R., Yaniv, S., & Aharon-Peretz, J. (2002). Empathy deficits in Asperger Syndrome: A cognitive profile. *Neurocase, 8*, 245–252.

Singer, T. (2006). The neuronal basis and ontogeny of empathy and mind reading, review of literature and implications for future research. *Neuroscience and Biobehavioral Reviews, 30*, 855–863.

Smetana, J. (1993). Understanding of social rules. In M. Bennett (Ed.), *The development of social cognition: The child as psychologist* (pp. 111–141). New York: Guilford Press.

Smetana, J., & Braeges, J. (1990). The development of toddlers' moral and conventional judgements. *Merrill-Palmer Quarterly, 36*, 329–346.

Turiel, E. (1983). *The development of social knowledge: Morality and convention*. Cambridge: Cambridge University Press.

Wechsler, D. (1999). *Echelle clinique de mémoire de Wechsler-révisé: Manuel*. Paris: Centre de Psychologie Appliquée.

Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition, 13*, 103–128.

Yirmiya, N., Kasari, C., Sigman, M., & Mundy, P. (1989). Facial expressions of affect in autistic, mentally retarded and normal children. *Journal of Child Psychology and Psychiatry, 30*, 725–735.

Yirmiya, N., Sigman, M. D., Kasari, C., & Mundy, P. (1992). Empathy and cognition in high-functioning children with autism. *Child Development, 63*, 150–160.

Young, L., Camprodon, J., Hauser, M., Pascual-Leone, A., & Saxe, R. (2010). Disruption of the right temporoparietal junction with transcranial magnetic stimulation reduces the role of beliefs in moral judgments. *Proceedings of the National Academy of Sciences, 107*, 6753–6758.

Young, L., Cushman, F., Hauser, M., & Saxe, R. (2007). The neural basis of the interaction between theory of mind and moral judgment. *Proceedings of the National Academy of Sciences, 104*(20), 8235–8240.

Young, L., & Saxe, R. (2009). Innocent intentions: A correlation between forgiveness for accidental harm and neural activity. *Neuropsychologia, 47*, 2065–2072.

Zalla, T., & Leboyer, M. (2011). Judgment of intentionality and moral evaluation in individuals with high functioning autism. *Review of Philosophy and Psychology*. doi:10.1007/s13164-011-0048-1.

Zalla, T., Stopin, A., Ahade, S., Sav, A.-M., & Leboyer, M. (2009). Faux Pas detection and intentional action in Asperger syndrome. A replication on a French sample. *Journal of Autism and Developmental Disorders, 39*, 373–382.