

Using and Reasoning about Social Strategies in Autism Spectrum Disorder in Everyday Situations

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ABSTRACT

Although a substantial amount of previous work has been dedicated to the study of the possible theoretical mechanisms underpinning autism spectrum disorder (ASD), little research has examined the types of difficulties experienced by individuals in their everyday social functioning. University students with ASD and matched control participants performed the Social Strategy task. In this, they read a range of descriptions of social interactions, all ending with an awkward question asked by the story main character. The types of strategies they used to answer the awkward questions were examined. Compared to control participants, those with ASD used a more negative emotional tone in responding, generated more simple strategies including acquiescence or refusal, and fewer sophisticated strategies that considered all parties' perspectives. In a novel task condition, participants rank-ordered simple and sophisticated strategies, and gave justifications for their use. Rank-ordering did not differentiate the groups. Justifications given by those with ASD for simple strategies were more practical and less often character-based than those given by control participants; the groups did not differ in the justifications given for sophisticated strategies. The possible explanations of these findings and implications for informing current intervention programmes are considered.

Keywords: Autism spectrum disorder; Social skill; Empathy; Mentalising; Social knowledge; Social cognition

1. INTRODUCTION

It is well established that autism spectrum disorder (ASD) is characterised by difficulties in social functioning (see e.g. Travis & Sigman, 1998). Much of this work has focused on ability to empathise. It is currently unclear whether emotional empathy, i.e., the ability to resonate emotionally with others, is intact in ASD (Dziobek et al., 2008; Grove, Baillie, Allison, Baron-Cohen, & Hoekstra, 2014). There is more robust evidence of impairment in cognitive empathy, or ability to take others' perspectives (e.g., Rueda, Fernández-Berrocal, & Baron-Cohen, 2015), and this is thought to underpin most of the social difficulties associated with ASD (e.g., Baron-Cohen, 2000). Deficits in cognitive empathy have been demonstrated both on simple false-belief tasks (e.g. Happé, 1994; Wimmer & Perner, 1983), and also on more advanced tasks approximating the demands of everyday interactions (e.g., Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Loveland, Pearson, Tunali-Kotoski, Ortegon, & Gibbs, 2001; Spek, Scholte, & Van Berckelaer-Onnes, 2010).

Although individuals with ASD typically show impairment on the more advanced measures, there have still been instances where performance was similar to control participants, at least in some respects (e.g. Scheeren, de Rosnay, Koot, & Begeer, 2013). For example, adults with ASD were found to infer correctly the mental state of someone with whom they had just interacted (Ponnet, Buysse, Roeyers, & De Corte, 2005), and to link complex emotional responses to the correct situation (e.g., feigning a positive reaction to an unwanted gift; Cassidy, Ropar, Mitchell, & Chapman, 2014). It has been suggested that preserved aspects of social performance in ASD may rely on compensatory mechanisms such as knowledge acquired through prior social learning and experience (Frith, 2004; Hill & Frith, 2003). This has been supported by recent qualitative work, in which participants with ASD reported that they often observe how others act in different situations (Carrington, Templeton, & Papinczak, 2003; Müller, Schuler, & Yates, 2008).

Factors such as task demand and the availability of relevant cues are likely to influence performance in ASD. For instance, generating problem solutions in everyday situations has been shown to be impaired in those with ASD, although when presented with different alternative solutions they were able to make appropriate choices (e.g., Channon, Crawford, Orlowska, Parikh, & Thoma, 2014). In another study (Callenmark, Kjellin, Rönqvist, & Bölte, 2014), adolescents with ASD did not differ from control participants in rating the appropriateness of different social interactions when asked to

select from a range of options, but gave less sophisticated verbal rationales when required to justify such judgements. Generating rationales may place heavier demands on mentalising ability, whilst selecting from options or giving ratings may bypass the need to employ mentalistic processes, so that compensatory strategies are sufficient to provide correct approximations.

The present study aimed to extend our understanding of impaired vs. preserved aspects of everyday social functioning by examining both the nature of the strategies that high-functioning adults with ASD use to manage everyday social situations, and also their ability to reason about these effectively. This study extended previous work by Channon, Collins, Swain, Young, and Fitzpatrick (2012) examining how participants high vs. low in self-reported social skill responded to descriptions of interactions ending with an awkward question by the main character (the 'Social Strategy' task). Those lower in skill generated more simple strategies that either complied fully with the requests or refused outright, whereas those higher in skill generated more sophisticated strategies involving compromises or justifications, and also adopted a more polite emotional tone. Participants did not differ with respect to perceived awkwardness.

In the present study, participants with and without ASD completed the original Social Strategy task (referred to here as the 'application' condition). It was predicted that those with ASD would perform in a similar way to the low skill group in the Channon et al. (2012) study, using fewer sophisticated strategies and a less polite emotional tone, but not differing in perceived awkwardness compared to the control group. They also completed a novel condition (the 'reasoning' condition) which examined ability to reason about descriptions of simple and sophisticated strategies to manage the same situations. It was expected that, compared to control participants, those with ASD would generate fewer rationales referring to the characters on the more demanding task of explaining why people might use each strategy, but would not differ on the less demanding task of rank-ordering the strategies in terms of social appropriateness.

2. METHODS

2.1 Participants and procedure

Nineteen university students (13 males, 6 females) with ASD were recruited. They were identified by advertising within the university for students who had been given a diagnosis of Asperger's syndrome or autism by a clinician. The diagnosis of ASD was confirmed at the time of the study through the use

of a semi-structured interview to assess whether they currently met DSM-5 criteria for ASD. The interview was devised by the research team, which included two clinicians with extensive experience in the field, who trained the first author to conduct the interviews. Nineteen control participants (13 males, 6 females) were also recruited by advertisement at the same university. They met the inclusion criteria and matched the group with ASD with respect to gender and age. All control participants were screened for the presence of symptoms related to ASD using the interview procedure described above.

Inclusion criteria were fluency in English, age between 18 and 30, and a Wechsler Test of Adult Reading (WTAR) standard score of 85 or above (Wechsler, 2001). This measure was chosen since it has been shown to have good validity and reliability with respect to predicting IQ (e.g., Spreen & Strauss, 2006), and is relatively cost- and time-effective compared to other measures of intellectual ability. All participants were relatively high-functioning, since they were all students at a leading UK university. Participants who reported a history of learning disability or illness or injury involving the brain were excluded.

There was no significant difference between the groups in age (ASD group mean=22.11, $SD=3.30$, control group mean=21.58, $SD=3.02$), $t(36)=.51$, $p=.611$, $d=.17$, or WTAR standard scores (ASD group mean=115.42, $SD=8.85$, control group mean=111.00, $SD=9.82$), $t(36)=1.46$, $p=.154$, $d=.47$.

All participants read an information sheet before taking part in the study, which outlined the rationale and procedure of the study. They provided written, informed consent, and were paid at the end for their participation. The study was approved by the UCL Research Ethics Committee and carried out in accordance with the Declaration of Helsinki as revised in 2000.

2.2 The Social Strategy task, 'application' condition

The original Social Strategy task (termed here the 'application' condition) (Channon et al., 2012) assessed the types of strategies that people use to respond to everyday awkward social situations. It consists of 10 vignettes describing social interactions between participants and a main character (see Appendix A for the full list of vignettes). Each scenario ends with the character asking the participants a question, which involves either offering or requesting a favour, or an opinion. The characters' questions were designed to be socially awkward, since complying would lead to beneficial

consequences for the characters, but also to a personal cost for the participants. Participants were required to state what they would say in response to the characters' questions (see Figure 1, Question 1), and then to rate on a scale from 1 to 10 (where 1=not at all awkward, and 10=very awkward) how awkward the situation was (see Figure 1, Question 2). Participants gave their responses verbatim, which were written out by the researcher.

The gender of the characters, the degree of relationship with the participants (i.e., friend, colleague, schoolmate, or neighbour) and the type of social context (i.e., family, social, or workplace) were varied across scenarios. Two different orders of presentation were used within each group, to control for order effects. After reading the task instructions, participants worked through an example scenario. Each scenario was shown one at a time in printed form on a separate page of the same booklet. Each scenario remained on display when the question was presented to avoid potential confounding effects from memory load.

2.3 Scoring of the 'application' condition

2.3.1 Social strategies

Participants' verbal responses to the characters' questions were categorised as either simple or sophisticated, on the basis of the extent to which they took into account both the participants' and the characters' interests.

Simple

Simple strategies consisted of short responses that met only either the characters' or the participants' wishes. They included two different types of responses: 'acquiescence' or 'refusal'. Acquiescence referred to responses in which participants fully agreed without qualifying their compliance, whereas refusal referred to responses in which participants refused outright to comply, without providing a justification (see Figure 1 for examples of each type of strategy).

Sophisticated

Sophisticated strategies comprised responses that showed consideration for both the participants' and the characters' perspectives. These responses negotiated a solution that limited the personal sacrifice of the participants, but also took into account the characters' expectations. They included four different types of responses. 'Qualification with excuse' and 'justification with excuse' respectively

referred to responses in which participants qualified their compliance or justified their refusal on the basis of an excuse that interpreted the undesirable aspects of the situation in a more favourable light, or that mentioned the participants' inability to comply. 'Qualification with factual feedback' and 'justification with factual feedback' respectively referred to responses in which participants qualified their compliance or justified their refusal by mentioning some or all of the undesirable aspects of the situation (see Figure 1 for examples of each type of strategy).

Participants' responses were scored by a rater who was not blind to group membership, and by a second, blind independent rater. There was an inter-rater agreement rate of 91.39 %; all disagreements were resolved through discussion. All scores were added across scenarios and converted into percentages.

2.3.2 Emotional tone

In order to examine the manner in which participants expressed their responses, the emotional tone of the written responses was rated negative, neutral or positive. Each response was assigned a score of 1 when the emotional tone was judged to be negative (blunt or denigratory responses); a score of 2 when no particular emotional tone was identified (neutral responses); or a score of 3 when the emotional tone was judged to be positive (polite or sympathetic responses). Across the ten scenarios this gave each participant a score ranging from 10 to 30; these were then converted into percentages, with higher scores indicating a more positive emotional tone. There was an inter-rater agreement rate of 93.89%; all disagreements were resolved through discussion.

2.3.3 Awkwardness ratings

Awkwardness ratings were added and averaged across scenarios.

Example scenario

Your cousin likes to come and stay with you. She is good company, but when she visits she expects you to pay to take her out to expensive places. She asks: "Can I come and visit you next weekend?"

Question 1: What would you say in this situation?

Examples of simple strategies:

Acquiescence: "Ok"

Refusal: "No, sorry"

Examples of sophisticated strategies:

Qualification with excuse: *"Of course, but I probably won't have much time to take you to places, because I'll be busy from work"*

Qualification with factual feedback: *"I'd like to see you, but I'm slightly broke at the moment, so I think that we are going to have to look after saving money when you come here - I hope you don't mind"*

Justification with excuse: *"I'm sorry, but I'm really busy next weekend, it doesn't look like I'm going to have enough time"*

Justification with factual feedback: *"I'd love for you to come, but unfortunately I can't afford to host you at the moment - I don't have enough money"*

Question 2: On a scale from 1 to 10, where 1 represents "not at all awkward" and 10 represents "very awkward", how awkward would you say this situation is?

Figure 1. Example Scenario and Questions from the 'Application' Condition of the Social Strategy Task

2.4 Social Strategy task, 'reasoning' condition

This novel condition of the Social Strategy task was designed to examine how participants judged and reasoned about different ways to deal with the same awkward situations used in the 'application' condition. Participants were first presented with an example scenario, along with a list of descriptions of six response strategies (see Figure 2). For each strategy description (e.g., 'to agree'), they were asked to generate an example of what people might say if they chose it, to ensure that they understood each of the strategy labels. They were then shown practical examples of each type of strategy.

Once they had completed the example, participants were presented with each of the ten original scenarios and asked to rank-order the descriptions of the six different types of response strategies, from the most to the least appropriate (see Figure 2, Question a), and to explain why people might choose each type of response strategy for each scenario (see Figure 2, Question b). They were instructed to base their responses on how most people would answer, to encourage them to reflect on what is generally appropriate rather than to consider only their personal preferences.

2.5 Scoring of the 'reasoning' condition

2.5.1 Strategy rank-ordering

The number of times each strategy was selected as the best was added across scenarios and converted into percentages.

2.5.2 Rationales

The rationales provided by participants to explain why people might use each type of strategy were categorised as practical (P) or character-based (CB) (see Figure 2 for examples of each type of rationale). Practical rationales referred to aspects of the situation relating to practical resources, such as time or money. Character-based rationales referred to the story characters' expectations, thoughts or feelings. Responses could score for only one of the two categories; if both were met, then the best answer would be taken, and participants' rationales would score in the CB category. There was an inter-rater agreement rate of 92.04%; all disagreements were resolved through discussion. All scores were added across scenarios and converted into percentages.

Example scenario

Your cousin likes to come and stay with you. She is good company, but when she visits she expects you to pay to take her out to expensive places. She asks: "Can I come and visit you next weekend?"

Question a: Please rank-order the following types of answers to the character's question from the most to the least appropriate:

- a) To agree
- b) To suggest a compromise based on a polite excuse
- c) To suggest a compromise based on your honest opinion about the situation
- d) To refuse based on a polite excuse
- e) To refuse based on your honest opinion about the situation
- f) To refuse

Question b: "Why might people choose a)?"

"Why might people choose b)?"

"Why might people choose ..)?"

Examples of rationales:

E.g., why might people choose to compromise based on a polite excuse?

Practical: *"If they want to save at least some money" / "They are worried about taking the time and spending money on something they don't really need"*

Character-based: *"They don't want to get into a fight with a family member" / "They don't want to risk upsetting someone they care about"*

Figure 2. Example Scenario and Questions from the 'Reasoning' Condition of the Social Strategy

Task

3. RESULTS

3.1 Data analysis

Means and standard deviations (*SD*) for each measure are shown in Table 1 for the 'application' condition, and in Table 2 for the 'reasoning' condition. A significance level of $p < .05$ (two-tailed) was adopted throughout.

3.2 Social Strategy task, 'application' condition

3.2.1 Type of strategy usage

The two groups were compared on their usage of simple and sophisticated strategies. The group with ASD was found to use a significantly lower percentage of sophisticated strategies compared to the control group, $t(36)=5.17$, $p < .001$, $d=1.68$. Whilst the group with ASD used simple strategies almost half of the time, sophisticated strategies accounted for the majority of the responses given by the control group.

3.2.2 Emotional tone

The two groups were compared on the emotional tone of their responses. The group with ASD was found to score significantly lower overall for emotional tone than the control group, $t(36)=4.38$, $p < .001$, $d=1.42$.

Table 1

Mean scores and standard deviations for the 'application' condition of the Social Strategy task.

Variable	Group with ASD		Control group	
	Mean	SD	Mean	SD
Social strategies (%)				
Simple	47.37	23.53	14.74	14.29
Sophisticated	52.63	23.53	85.26	14.29
Emotional tone (%)	59.65	11.96	75.79	10.71
Perceived awkwardness (%)	41.47	15.25	45.74	8.79

3.2.3 *Perceived awkwardness*

The two groups were compared on their ratings of perceived awkwardness. There was no significant difference between groups in their ratings, $t(36)=1.06$, $p=.298$, $d=.34$.

3.3 Social Strategy task, 'reasoning' condition

3.3.1 *Type of strategy rank-ordering*

The two groups were compared on their rank-ordering of simple and sophisticated strategies as the most appropriate. There was no significant difference between groups in the frequency of rank-ordering sophisticated strategies as the most appropriate, $t(36)=.99$, $p=.328$, $d=.32$. Both groups tended to rank-order sophisticated strategies as the most appropriate overall.

3.3.2 *Types of rationales*

The two groups were compared on the types of verbal rationales they generated to explain why people might use simple and sophisticated strategies. A repeated-measure 2x2 ANOVA (group by type of strategy) was conducted to examine the percentage of rationales classified as practical vs. character-based. The main effect of type of strategy was not significant, $F(1,36)=1.76$, $p=.193$. There were a significant main effect of group, $F(1,36)=10.10$, $p=.003$, and a significant group by type of strategy interaction, $F(1,36)=6.33$, $p=.016$. Post-hoc t-tests using a corrected significance level ($.5/2=.025$) showed that the group with ASD provided a significantly lower percentage of character-based rationales to justify the use of simple strategies, $t(36)=4.14$, $p<.001$, $d=1.34$; there was no significant difference between groups in percentage of character-based rationales to justify the use of sophisticated strategies, $t(36)=1.48$, $p=.149$, $d=.48$.

3.3.3 *Effect of WTAR standard scores and gender*

All the analyses described in this section were repeated with participants' WTAR standard scores and gender as covariates, to control for the influence of these variables on the results. Inclusion of these factors did not alter the pattern of findings.

Table 2

Mean scores and standard deviations for the 'reasoning' condition of the Social Strategy task.

Variable	Group with ASD		Control group	
	Mean	SD	Mean	SD
Type of strategy				
rank-ordering (%)				
Simple	31.05	21.83	25.26	13.07
Sophisticated	68.95	21.83	74.74	13.07
Character-based				
rationales (%)				
Simple	46.84	14.74	66.58	14.63
Sophisticated	56.18	15.01	63.68	16.32
Practical				
rationales (%)				
Simple	53.16	14.74	33.42	14.63
Sophisticated	43.82	15.01	36.32	16.32

4. DISCUSSION

In this study, participants with ASD and a control group performed two conditions of the Social Strategy task (Channon et al., 2012): 'application' and 'reasoning'. The 'application' condition examined how they responded to everyday awkward scenarios, whereas the 'reasoning' condition explored how they reasoned about different types of strategies.

A key finding in the 'application' condition was that, as expected, the group with ASD generated fewer sophisticated strategies to respond to the awkward questions and were less courteous in emotional tone. With respect to perceived awkwardness, it could be argued that people with ASD should experience higher levels since they may feel less capable of dealing with social situations, or, alternatively, that they should experience lower levels since their awareness of the nuances

characterising the social situations may be reduced. The similar awkwardness ratings provided by the two groups suggested that those with ASD did not differ in their perceptions of this.

These findings replicate and extend those of Channon et al. (2012), who showed that people with low levels of self-reported social skill generated fewer sophisticated strategies with a less positive emotional tone than participants with high levels of self-reported social skill. This suggests that the Social Strategy task is potentially a sensitive tool to identify quantitative and qualitative differences in performance both in those low vs. high in self-reported social skill and also in those with vs. without ASD.

With respect to the 'reasoning' condition of the current study, both groups rank-ordered sophisticated strategies above simple strategies. This suggested that the group with ASD recognised these as the most skilled ways to deal with the characters' awkward questions, despite having generated fewer of them in the 'application' condition. By contrast, control participants were able not only to recognise the appropriateness of sophisticated strategies when asked to rank-order them, but also to generate more sophisticated strategies in the 'application' condition.

The finding that those with ASD did not differ from control participants in their awkwardness ratings in the 'application' condition or in their rank-ordering of strategies in the 'reasoning' condition is consistent with previous evidence that they can perform similarly to control participants on less demanding tasks (e.g., Channon et al., 2014). For instance, Callenmark et al. (2014) found that adolescents with ASD could evaluate the appropriateness of different social behaviours using a multiple-choice answering format, but provided rationales of poorer quality compared to control participants when required to justify their judgements. The authors suggested that the use of a multiple-choice format may have reduced the task demands, and thus accounted for intact performance by the group with ASD.

On the more demanding task of generating rationales for using different strategies, the picture of findings is more complex, since the groups were similar on the sophisticated strategies but not on the simple ones. Whilst the control group generated more reasons involving the characters to justify the use of simple strategies, the group with ASD made more references to the practical aspects of the situations. Both groups, however, gave similar numbers of practical and character-based rationales for the sophisticated strategies, suggesting that they reasoned about these in similar ways. The

reason for this apparent discrepancy is unclear, but it is conceivable that the provision of sophisticated strategy descriptions served to cue participants to consider compromises or justifications for refusals, thereby drawing to their attention the need to take into account the characters' viewpoints as well as their own. Thus, those with ASD appeared to lack either ability or inclination to consider the characters spontaneously in their reasoning, unless cued to do so.

One limitation of the present study was the relatively small sample size, although many previous studies have used similar number of participants (e.g., Castelli, 2005, with respect to emotion recognition; Zalla et al., 2009, with respect to faux pas recognition). When sample sizes are limited, it is important to examine effect sizes (Baer & Ahern, 1993; Cohen, 1992). In the current experiment, these were always relatively large (d always > 1 , Cohen, 1992), suggesting that the task might still be sensitive enough to detect important group differences. Another possible limitation concerns the use of scenario-based measures. These have many strengths; for instance, since these describe real-life-type situations, they have higher ecological validity than abstract laboratory measures, whilst allowing the exploration of participants' thought processes in a more rigorous way than observational experiments. However, they still lack the high degree of experimental control associated with traditional laboratory tasks, and are likely to be less interpersonally stimulating than naturally-occurring situations. Future studies might overcome these limitations through the usage of virtual reality paradigms or role-plays. Finally, diagnosis of ASD was confirmed through the use of a semi-structured interview that has not been validated externally. However, it was also the case that all participants had already been diagnosed at an earlier age as having ASD. Although we could have chosen a standardised instrument such as the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1989), our past experience using this instrument suggested it to be rather limited and somewhat inappropriate with high-functioning adults; moreover, it does not relate directly to DSM criteria.

Social models of ASD

Various social explanations including emotional empathy, cognitive empathy and social knowledge might explain the current findings. Emotional empathy has been linked with socially sensitive behaviour (Eisenberg, Eggum, & Di Giunta, 2010; Lockwood, Seara-Cardoso, & Viding, 2014). However, impaired emotional empathy seems an implausible explanation in the light of previous literature describing impaired cognitive empathy with preserved emotional empathy in ASD (e.g.,

Dziobek et al., 2008), although some people with ASD may have both impaired cognitive and emotional empathy (Grove et al., 2014). A more plausible explanation is that those with ASD may have struggled to take into account the characters' perspectives due to impaired cognitive empathy (Frith, 2001). With respect to the 'application' condition, this might have led to a decreased propensity to generate strategies that considered both the participants' and the characters' interests. Impaired cognitive empathy might also explain why those with ASD provided fewer rationales considering the characters in the 'reasoning' condition for simple strategies, focusing more on the practical advantages. For instance, acquiescence was often seen as an efficient method of escaping the awkward situations (e.g., "Sometimes it's just easier to say yes"), or deceiving the characters asking for favours (e.g., "You can say yes now, but not actually do it in the end"). In contrast, the control group tended to refer to the impact on the characters (e.g., "The cousin is family, and they care about keeping a good relationship with them"). For refusals, where declining outright to comply with awkward requests clearly favours participants' interests, those with ASD again referred more frequently to the practical advantages of refusing (e.g., "You will save money if you say no"), whilst control participants focused more often on the characters, for instance by highlighting circumstances where the relationship would not suffer (e.g., "If they are close enough to their cousin to know that she will not be offended").

Reliance on compensatory mechanisms such as social knowledge, acquired through learning and observation, may also have contributed to the current findings. This may be instrumental in helping people with ASD to extrapolate the rules underlying appropriate social conduct (Carrington et al., 2003; Müller et al., 2008), and teaching them how to circumvent their difficulties and find solutions to social problems (Bowler, 1992; Senju, 2012). Reliance on compensatory social knowledge may have aided those with ASD with awkwardness ratings and rank-ordering, both of which are less demanding than generating free verbal responses.

Could reliance on social knowledge also explain why those with ASD generated similar numbers of character-based rationales for sophisticated but not for simple strategies? Impaired perspective-taking may have made practical rationales easier overall to access for them compared to character-based ones. However, the requirement to reflect on why people might choose compromises or justifications may have encouraged them to consider the characters' perspectives, in contrast with the simple

strategies which did not contain such cues. It might in fact be hard to imagine why someone would make the effort to offer a compromise or justification on the basis of the practical aspects of the situations alone, prompting them to think about alternative explanations. This is consistent with evidence that people with high-functioning ASD can reason about others if cued to do so (Begeer, Rieffe, Terwogt, & Stockmann, 2003).

Non-social models of ASD

Individuals with ASD have been found to be impaired on a range of tests measuring executive function (Hill, 2004), and other evidence has suggested a cognitive style whereby information tends to be processed in a piecemeal manner, focusing on details rather than wholes ('weak central coherence') (Jolliffe & Baron-Cohen, 2001). Both impaired executive function and weak central coherence have possible implications for social functioning, perhaps by influencing ability to plan, shift or inhibit behaviours or to generate appropriate responses according to the social context (Channon, Charman, Heap, Crawford, & Rios, 2001; McEvoy, Rogers, & Pennington, 1993; Russell, Saltmarsh, & Hill, 1999). With respect to the current study, impaired executive function may have hindered ability to inhibit the generation of socially inappropriate strategies, or to predict and evaluate the consequences of their usage. Weak central coherence may have influenced capacity to integrate the details of all the relevant scenario information.

The different formats of the questions posed in the 'application' and 'reasoning' conditions may have created additional cognitive demands to switch perspectives through the use of second-person questions in the 'application' condition (e.g., "what would you say in this situation?"), and third-person questions in the 'reasoning condition' (e.g., "why might people choose...?"). Moreover, the descriptions of the strategies were relatively abstract, meaning that participants had to imagine what people might actually say in the situations. Previous evidence has suggested that people with ASD show reduced ability to allocate their mental resources flexibly to guide thoughts and actions (Solomon, Ozonoff, Cummings, & Carter, 2008).

The relationship between non-social processes and social processes remains unclear, and it is beyond the scope of this study to attempt to disentangle their relative contributions to the deficits associated with ASD. Some researchers have argued that theory of mind is likely to emerge within a broader context of information processing and reasoning, meaning that social deficits might reflect

part of a more general impairment in cognition in ASD (e.g., Russell, 1997; Zelazo & Frye, 1997). Other, 'domain-specific' theories, hold that social and non-social processes are separable, and that theory of mind is likely to be the predominant explanation for the social impairments associated with ASD (Baron-Cohen, 1995; Leslie, 1987). **Social and non-social antecedents are not necessarily mutually exclusive, and might synergise and intertwine in a variety of ways in different individuals in the development of ASD.**

Another consideration is that Individuals with ASD might lack motivation to engage in socially appropriate behaviour because they find it less intrinsically rewarding than neurotypical people (Chevallier, Kohls, Troiani, Brodtkin, & Schultz, 2012). Any reward deficits may be specific to social stimuli or reflect a general reward processing deficit in ASD (Dichter et al., 2012). Recent evidence showing diminished sensitivity to both social and non-social rewards in ASD suggests a possible general deficit, but more work is needed to examine these issues in everyday situations. **Overall, ASD embraces a wide range of symptomatology and it is unlikely that one explanatory model will fit all; the challenge for the future is to map the extent to which different contributory factors can be linked to different presentations in subsets of individuals with ASD.**

Clinical implications

Although difficulties associated with ASD appear in childhood, diagnosis is often not made until later in life, especially for higher-functioning people with less obvious impairments (Howlin, 2006). Since diagnosis of ASD is based on developmental history, assessing adults can be a complex task. They often struggle to recall detailed information about early development, and informants are not always available (Barnard, Harvey, Prior, & Potter, 2001). Moreover, since most available diagnostic tools were designed for children, many of their activities (e.g., playing with dolls in the ADOS; Lord et al., 1989) are unsuitable for adults. The current findings suggest that everyday life type-tasks such as the present one might be sensitive tools to profile individuals' strengths and weaknesses in social processing, thereby aiding the diagnostic process. This could in turn guide the development of intervention strategies. For instance, the present scenarios could be used to target people's ability to generate socially appropriate responses that consider both their own and others' viewpoints, and to anticipate the implications of using different responses, such as the recipients' likely reactions. Since generalisability of skills training across different situations has been often found difficult to achieve

(Howlin & Yates, 1999), teaching the principles underpinning socially skilled responses and practising these across different scenario contexts might enhance the generalisability to real-life environments.

The present task could also be refined to exploit the effect of cuing to enhance more sophisticated social skills in higher-functioning individuals. For instance, encouraging people to consider different alternative responses (e.g., through reading descriptions of these) before generating their own might improve their ability to respond in more socially appropriate ways. This may provide a stepping stone to real-life social interactions, where decisions need to be taken under time pressure, and there is less scope for providing effective cues compared to offline tasks such as the present one, potentially limiting generalisability.

5. CONCLUSIONS

In summary, this study found that, compared to neurotypical people, those with ASD used fewer sophisticated strategies and a harsher emotional tone to respond to everyday awkward scenarios. They generated fewer character-based rationales when asked to reason about the use of simple strategies, but did not differ from control participants in their rationales for sophisticated strategies, or in their ability to rank-order them. Scenario-based measures such as the Social Strategy task may contribute to improving current understanding of how people with ASD respond to and reason about everyday social situations. This has potential implications for bridging the gap between teaching abstract social skills and helping them to navigate the social world in practice.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

APPENDIX A

1. You have just moved house. A new neighbour offers to assemble some shelves for you. He does not do a very good job, as he scratches the new paintwork. He asks: "Would you like me to assemble your desk now?"
2. Your cousin likes to come and stay with you. She is good company, but when she visits she expects you to pay to take her out to expensive places. She asks: "Can I come and visit you next weekend?"
3. Your colleague is being considered for an important promotion, and gives a talk to the company. It is too long, and he makes some bad jokes where nobody laughs. He asks: "Do you think my talk went well?"
4. Your friend knits you a jumper for Christmas. The shape is rather uneven and the style is not flattering. She asks: "Will you wear the jumper when we go carol singing later?"
5. On the train home after a long day, you bump into an old schoolmate. She always only talks about herself and moans a lot. She asks: "Would you like to come over for dinner next week?"
6. You meet up with your brother. You saw him recently with his new girlfriend. Each time you or your friends tried to talk to her, she ignored you and talked only to your brother. He asks: "Did you get on well with my girlfriend?"
7. You are taking an evening course in French. A woman who is on the same course struggles with the material. She often asks you for extra help. Now she asks: "Will you help me with my essay?"
8. A friend who recently took art classes has painted a series of self-portraits. They are very poorly painted. He asks: "Would you like a painting for your living room?"
9. Your brother decides to organise a big party for your parents' golden wedding anniversary. You are very busy at work, with important deadlines to meet. He asks: "Will you send out all the invitations?"
10. Your friend wants to become a singer, and she takes part in a singing competition. Her singing is badly out of tune. She asks: "Do you think I sang well?"

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