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BRIEF REPORT

Brief Report: Impression Formation in High-Functioning Autism: Role of Nonverbal Behavior and Stereotype Activating Information

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Abstract Little is known about whether stereotypes influence social judgments of autistic individuals, in particular when they compete with tacit face-to-face cues. We compared impression formation of 17 subjects with high-functioning autism (HFA) and 17 age-, gender- and IQ-matched controls. Information about the profession of a job applicant served as stereotype activating information. The target person's nonverbal behavior was presented as a computer animation showing two virtual characters in interaction. Contrary to our hypothesis, HFA participants were as sensitive to nonverbal cues as controls. Moreover, HFA showed a tendency to evaluate persons more positively. This might indicate a routine HFA apply in impression formation in order to compensate for their deficit in intuitive understanding of nonverbal communication cues.

Keywords High-functioning autism (HFA) · Impression formation · Nonverbal behavior · Stereotype · Virtual characters

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Introduction

> "Autistic people have to understand scientifically what non-autistic people already understand instinctively." Marc Segar.

Autism spectrum disorders (ASD) are defined by deficits in interaction and communication with others besides stereotypic, repetitive behaviors. Many studies have been conducted focusing on the ability of persons with ASD to attribute mental states to other persons. The paradigms used in this context are usually based on pictorial or written, i.e. static, stimulus material (Baron-Cohen et al. 2001a). Beyond recognizing intentions and emotions, impression formation constitutes a further relevant domain of social cognition. Impression formation differs from mentalizing, i.e. the attribution of mental states (or Theory of Mind, ToM), because it does not require to "understand" what another person is thinking or feeling. Impression formation implies the attribution of traits to another person (Asch 1946). Nevertheless, the two concepts are related. While ToM refers to inferences about other's mental states, impression formation implies inferences about others' social traits, such as likeability or dominance. Like state inferences, trait attributions mostly occur automatically in healthy persons (Uleman et al. 1996) and serve to reduce the complexity of social

situations and disambiguate social information. Impressions can be measured with a semantic differential as developed by Osgood (1966) who found that semantic judgments based on adjectives can be statistically and semantically grouped into three factors: evaluation/valence, dominance/potency and arousal/activity. Evaluation/valence refers to characteristics such as pleasantness or other judgments on how positively or negatively a stimulus is perceived. In contrast to that, a typical item of the dominance dimension is "strong versus weak", i.e. this dimension measures how powerful, strong, dominant and so on the stimulus is perceived. Lastly, stimuli scoring high on the arousal/activity dimension are more agitated, more in motion than stimuli scoring lower here.

The quick and automatic processes of impression formation rely on different types of information or social cues. Research has repeatedly demonstrated that directly observed nonverbal behavior of a target person has a significant impact on impression formation related to that person (DePaulo and Friedman 1998). On the other hand, stereotypes, often activated by simple verbal labels, serve as indirect sources for impression formation (Banaji et al. 1993). Kunda and Sherman-Williams (1993) found that the explicit activation of the labels "housewife" versus "factory worker" lead to stereotypical judgments on the aggressiveness of a person if there is no other unambiguous information source.

Obviously, both nonverbal behavior and stereotype activating information, as used and compared in a study by Kunda and Sherman-Williams (1993), play an important role for impression formation in healthy participants. Nonverbal behavior has been found to influence emotions (Schwartz et al. 2010) and impression formation in autism (Kuzmanovic et al. 2011). Kuzmanovic et al. (2011) made use of verbal and nonverbal stimuli that were either conflicting or coherent. Results showed a reduced sensitivity to nonverbal information in case of conflicting information in high-functioning autistic (HFA) participants. The authors conclude that HFA participants are able to decode nonverbal information as long as it does not conflict with verbal information and that there may be a bias to rely more on explicit verbal than on implicit nonverbal information in autism.

With respect to stereotype activating information, no study so far has investigated its influence on impression formation in HFA during adulthood. However, some evidence focusing on other dependent variables does exist. White et al. (2006) showed photos to participants with and without autism and asked them to judge the trustworthiness, attractiveness, social status, and age of the depicted persons. Both groups made stereotypical judgments, showing that persons with autism are able to apply social categories in person perception. Similarly, Hirschfeld et al. (2007) found that children with autism applied gender stereotypes to predict behavior in the same way as non-autistic children.

On the basis of these studies, it is an open question whether stereotype activation information combined with nonverbal information has the same effects on impression formation in adults with high-functioning autism (HFA) as in control participants. We here report an experimental pilot study with one trial. The independent variables were (a) stereotype activating information that was supposed to yield different impressions with regard to the valence dimension (Osgood 1966) as well as (b) three sequences with nonverbal information (repeated measurement) supposed to induce different dominance ratings. Former research has shown that the processing of verbal and nonverbal information is associated with the activation of different brain regions in healthy participants (Kuzmanovic et al. 2012). Our hypothesis was that stereotype activating information would play a more important role as compared to nonverbal behavior on impression formation in HFA. Due to the nature of the stimuli, we primarily expected an impact of the stereotype activating information on "valence" judgments and of nonverbal behavior on "dominance" judgments (see "Stimulus Material" section).

Methods

Study Participants

The clinical group for this study consisted of 17 participants aged 20–53 (9 males, 8 females) with the diagnosis of high-functioning autism (HFA). All participants were recruited at the autism outpatient clinic at the Department of Psychiatry of the University Hospital Cologne. 17 control participants without any neurological or psychiatric past medical history who were matched for gender, years of education, and IQ were included in this study. Autistic traits were confirmed by clinical interviews according to ICD-10 criteria by two independent clinicians. Additionally, all HFA participants were screened with the Autism Spectrum Quotient (AQ; Baron-Cohen et al. 2001b). As expected, the HFA group scored significantly higher on the AQ (41.7 ± 2.8) compared to controls (14.1 ± 4.6; F1,32, $= 4.15$, $p < .01$). Also, HFA scored significantly lower on the "reading the mind in the eyes test" (Baron-Cohen et al. 2001a) (HFA: 15.4 ± 3.9, controls: 19.6 ± 2.1, $F(1,32) = 3.175$, $p < .01$). HFA showed a similar level of education (17.7 ± 3.2 years of education) as control persons (18.9 ± 2.7 years of education; $F(1, 32) = 0.58$, not significant). Accordingly, the HFA group yielded total IQ scores (128.1 ± 12.7) that were not

significantly different from the control group (132.3 ± 8.5; $F(1, 32) = 2.536$, not significant) as assessed with the Wechsler Intelligence Scale for Adults (WAIS-R, German version HAWIE-R: Tewes 1991).

Stimulus Material

To choose appropriate stereotype activating labels (first independent variable), we examined an independent group of 20 persons aged 19–40 years (not part of the sample described above) and four different professional labels, namely teacher, engineer (as two academic professions), factory worker, and painter (as two non-academic professions). Participants then judged a person only based on this piece of information on a 7-point semantic differential covering the dimensions "valence", "dominance", and "arousal". Profiles of means showed that "engineer" versus "factory worker" led to the most distinct evaluations on the three dimensions and were thus selected as labels for the main study. Furthermore, we checked whether the labels "engineer" versus "factory worker" impacted significantly on impressions in a sample of 40 healthy participants aged 19–40 years (also not part of the sample described above). We found a significant impact of these labels on "valence" impressions, i.e. engineers were judged to be more competent [$F(1,78) = 34.495$, $p < .001$], informed [$F(1,78) = 23.113$, $p < .001$] and intelligent [$F(1,78) = 85.784$, $p < .001$].

Our dynamic stimuli consisted of three animated sequences showing a dyadic interaction, each lasting 1 min. In these films, virtual characters showed exactly the nonverbal behavior (body posture, body movement, gestures) that was also expressed by original human interaction partners recorded before. The virtual stimuli had been created by converting short videos (3 min) showing dyadic role-play interactions between two seated real persons into silent virtual animations (see Fig. 1). Two identical 3D mannequin models were used to replace the actors of the original videos. Similar stimuli have been used in other studies of nonverbal behaviour, e.g. Georgescu et al. (2013). The methodological background for the creation of these films has been described in more detail elsewhere (Bente et al. 2010). Bente et al. (2010) also found that these stimuli evoke culturally stable dominance impressions. In the present study, we chose three stimuli that had been found to induce low, medium and high dominance impressions.

Due to the neutral appearance of the virtual characters and the absence of sound, only the bodily nonverbal behavior (body posture, body movement, gestures) was available in the sequences. This method ensures that no additional information conveyed by the physical appearance, e.g. attractiveness or gender, was confounded with the nonverbal behavior information. Another advantage of this method is the high degree of experimental control. Bente et al. (2001) showed that virtual characters provoke the same person perception processes as videotaped humans. We therefore consider this method to be both internally and externally valid.

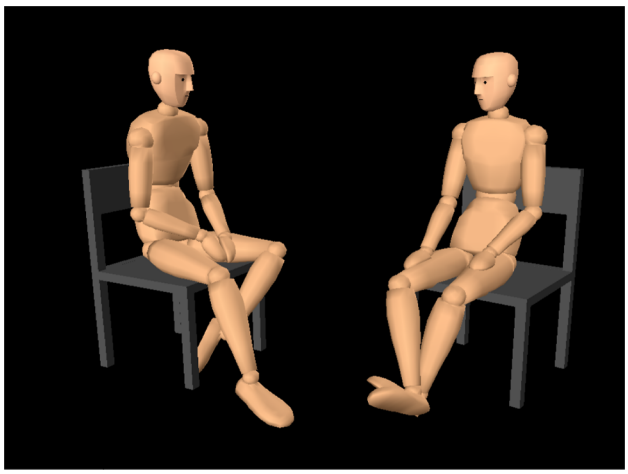

Fig. 1 Screen-shot of dyadic interaction of virtual characters

Experimental Design and Procedure

Participants were told that the films showed a job interview and the person to be evaluated was the applicant. For reasons of congruence, participants were told that the job applicant was always sitting on the left. To get appropriate material with bodily nonverbal information eliciting different evaluations, we selected three films where the person on the left had been judged to be highly dominant, neutral, or rather submissive in previous studies, thus constituting our second independent variable "nonverbal behavior".

Taken together, we included three independent variables in our design: (1) "group" (HFA versus control), (2) "stereotype" (engineer versus factory worker) and (3) "nonverbal behavior" (dominant versus neutral versus submissive). The dependent variable "impression" was measured via a 7-point semantic differential covering the dimensions "valence" (items likeable–not likeable, friendly–unfriendly, competent–incompetent, intelligent–unintelligent, informed–not informed) "dominance" (dominant-submissive, self-confident–not self-confident, strong–weak) and "arousal" (active–passive, agitated–calm) (Osgood 1966).

Data Analysis

Items for each scale (valence, dominance, and arousal) were averaged and analyzed in a 2 × 2 × 3 mixed ANOVA (group × stereotype × nonverbal behavior). Reliability for the valence (Cronbach's $\alpha = .83$) and dominance scale (Cronbach's $\alpha = .79$) was acceptable. However, reliability

for the arousal scale was poor (Cronbach's $\alpha = .02$). Thus, the arousal dimension was dropped from all further analyses.

Results

Valence

There was a significant main effect of group on the perception of the valence of the stimuli [$F(1,30) = 4.69, p = .038$, $\eta_p^2 = .135$]: On average, HFA participants evaluated all stimuli more positively than participants in the control group. All other interactions with group were not significant (all $F < 3.05$). The main effect of nonverbal behavior was significant [$F(2,60) = 5.85, p = .005, \eta_p^2 = .163$]. Pairwise comparisons revealed that all participants rated the dominant nonverbal behavior ($M = 4.37$, SD $= 0.95$) more positively than the submissive nonverbal behavior ($M = 3.71$, SD $= 0.83$), $t(33) = 2.94, p = .006$). Participants also rated the neutral nonverbal behavior ($M = 4.18$, SD $= 0.93$) more positively than the submissive nonverbal behavior ($M = 3.71$, SD $= 0.83$), $t(33) = 2.81$, $p = .008$). There was no significant difference between the dominant and the neutral nonverbal behavior ($t(33) = 0.93$, $p = .36$. The main effect of stereotype on valence ratings was not significant [$F(1,30) = 2.85$, $p = .102$], and none of the interactions reached significance (all $F < 3.05$).

Dominance

There was no significant main effect of group [$F(1,30) = 0.86$, $p = .361$, $\eta_p^2 = .028$]. None of the interactions involving the factor group were significant (all $F < 4.07$). There was a significant main effect of nonverbal behavior [$F(2,60) = 92.44$, $p < .001$, $\eta_p^2 = .755$]. Pairwise comparisons showed that all participants rated the dominant nonverbal behavior ($M = 5.19$, SD $= 0.96$) to be more dominant than the submissive nonverbal behavior ($M = 2.21$, SD $= 0.72$, $t(33) = 14.48, p < .001$). Participants also rated the neutral nonverbal behavior ($M = 3.59$, SD $= 1.17$) to be more dominant than the submissive nonverbal behavior ($M = 2.21$, SD $= 0.72$, $t(33) = 5.91, p < .001$). Participants also rated the dominant nonverbal behavior ($M = 5.19$, SD $= 0.96$) to be more dominant than the neutral nonverbal behavior ($M = 3.59$, SD $= 1.17$, $t(33) = 6.91$, $p < .001$). The main effect of stereotype was not significant [$F(1,30)$, $p = .755$], and none of the interactions reached significance (all $F < 4.07$) (Table 1).

The absence of significant interactions suggests that the effects of stereotype and nonverbal behavior were similar for each group. Table 2 and 3 show the valence and dominance ratings for each group, Fig. 2 the plots for these ratings.

Table 1 Main effect of group

Effect of group	HFA (SD)	Control (SD)	$F(1,30)$	p	η_p^2
Valence	4.28 (0.59)	3.89 (0.56)	4.69	.038	.135
Dominance	3.75 (0.62)	3.57 (0.59)	0.86	.361	.028

Discussion

In this study we examined the effect of nonverbal and stereotype activating information on impression formation in HFA and control participants. We found that participants with HFA generally made more positive judgments. However, the influence of nonverbal information was similar in both groups. No effect of stereotype could be shown.

Effect of Diagnostic Group

The only significant main effect of the factor group showed that HFA evaluated the stimuli in general more positively than controls. It is conceivable that HFA generally tend to evaluate other individuals more positively and tend to use stereotypes preferably to form positively biased social judgments. This tendency is maybe due to an uncertainty in impression formation and the own awareness thereof in HFA participants, leading to the application of a routine or algorithm, which results in more positive evaluations of others. Other authors have found less biased processing in autism than controls (Morsanyi et al. 2010) when it comes to heuristics using contextual information, such as in the conjunction fallacy. Nevertheless, participants in our study may have applied the simple heuristic to give rather positive ratings, a process that does not require any contextual processing but is more like a simple addition of values to ones own estimate. Another option to explain this finding is that virtual characters as used in this study are less complex and less socially demanding than real human beings in natural interactions, which might lead HFA participants to feel more comfortable with this kind of social cue.

Influence of Stereotype in HFA Versus Controls

Stereotypes did not influence impression formation, neither in control participants nor in HFA participants. Both diagnostic groups probably considered the direct information source "nonverbal behavior" to be more important than the indirect stereotype activating information. However, the mean values of valence and dominance reveal that participants formed their impressions in the expected direction, i.e. evaluated engineers more dominant and positive, even if the interaction of group and stereotype was not significant. The absence of a different effect of stereotpye in participants with autism might be due to

Table 2 Main effect of nonverbal behavior

Effect of nonverbal behavior	Dominant (SD)	Submissive (SD)	Neutral (SD)	$F(2, 60)$	p	η_p^2
Valence	4.37 (0.95)	3.71 (0.83)	4.18 (0.93)	5.85	.005	.163
Dominance	5.19 (0.96)	2.21 (0.72)	3.59 (1.17)	92.44	< .001	.755

Table 3 Valence and dominance ratings for HFA and control group

Stereotype					
Nonverbal behavior		Factory worker		Engineer	
		M	SD	*M*	SD
Dependent variable: valence ratings					
Group					
HFA	Dominant	4.00	0.63	4.95	1.13
	Neutral	3.82	0.71	4.18	0.86
	Submissive	3.82	0.71	4.18	0.86
Control	Dominant	4.50	1.07	4.11	0.78
	Neutral	3.20	0.59	3.64	0.93
	Submissive	3.20	0.59	3.64	0.93
Dependent variable: dominance ratings					
Group					
HFA	Dominant	4.93	0.81	5.58	1.07
	Neutral	3.19	0.80	4.00	1.45
	Submissive	2.48	0.87	2.42	0.66
Control	Dominant	5.33	0.84	4.96	1.10
	Neutral	4.13	1.18	3.15	1.04
	Submissive	1.79	0.62	2.11	0.58

methodological aspects, e.g. the operationalization of stereotype, the high IQ sample and small sample sizes.

Influence of Nonverbal Behavior in HFA Versus Controls

In both groups, nonverbal behavior influenced ratings of the items "competent", "strong", "calm", "self-confident" and "active", suggesting that HFA participants in our study could focus on the relevant nonverbal stimuli while watching the animations and were able to adequately integrate the information into an impression judgment. Similarly, Kuzmanovic et al. (2011) found that HFA participants made use of nonverbal information for impression formation as long as it did not conflict with verbal information. The use of virtual characters may have facilitated the processing of nonverbal behavior for HFA participants. Saygin et al. (2010) found that ASD participants performed as well as healthy control persons in a task that required detecting the direction of a biological motion within a point light display. In our study, participants were confronted with motion perception, too. Our results show that HFA participants can in fact integrate nonverbal animated movement for the purpose of solving social cognitive tasks such as impression formation. Many studies have shown deficits in theory of mind (ToM) attribution in HFA (e.g. Heavey et al. 2000). ToM requires putting oneself in the other one's place and to make assumptions on the other's intentions, emotions and so on (Baron-Cohen, 1995). In contrast to that, impression formation can take place without taking the other one's perspective. Therefore, it might be that ToM deficits are more difficult to compensate for than problems in impression formation. Thus, even if both processes draw on intuitive cognitive systems in healthy persons, it might be easier for persons with autism to form an impression than a ToM.

Possibly, deficits in processing of nonverbal information in autism appear more distinctly in tasks asking for emotion perception (Nackaerts et al. 2012) or asking for the participants' emotional involvement (Schwartz et al. 2010). Another interpretation is that participants with ASD have more difficulties with state recognition (i.e. recognition of emotions or intentions) than with trait recognition (as required e.g. in the present study). To further investigate this, it would be interesting to conduct a study directly comparing these two components of social cognition.

Limitations

The ecological validity of our operationalization of stereotypes, nonverbal behavior, and impression formation as well as the small sample sizes may be criticized. Also, we examined a high IQ sample which might have influenced the results in both subsamples and limits the generalizability of our findings. Therefore, results must be regarded as preliminary. Further studies using both our virtual character method and animations showing natural human beings are needed to show that the impression formation processes are independent from the presentation format used in this study. These studies should also include different stereotype activating material (e.g., priming techniques) in contrast to the explicit label of the target person's profession that we employed in our study. Possibly, an alternative operationalization of stereotype would have yielded different results.

Conclusions

Our results suggest similar modes of processing of nonverbal information for impression formation in HFA and

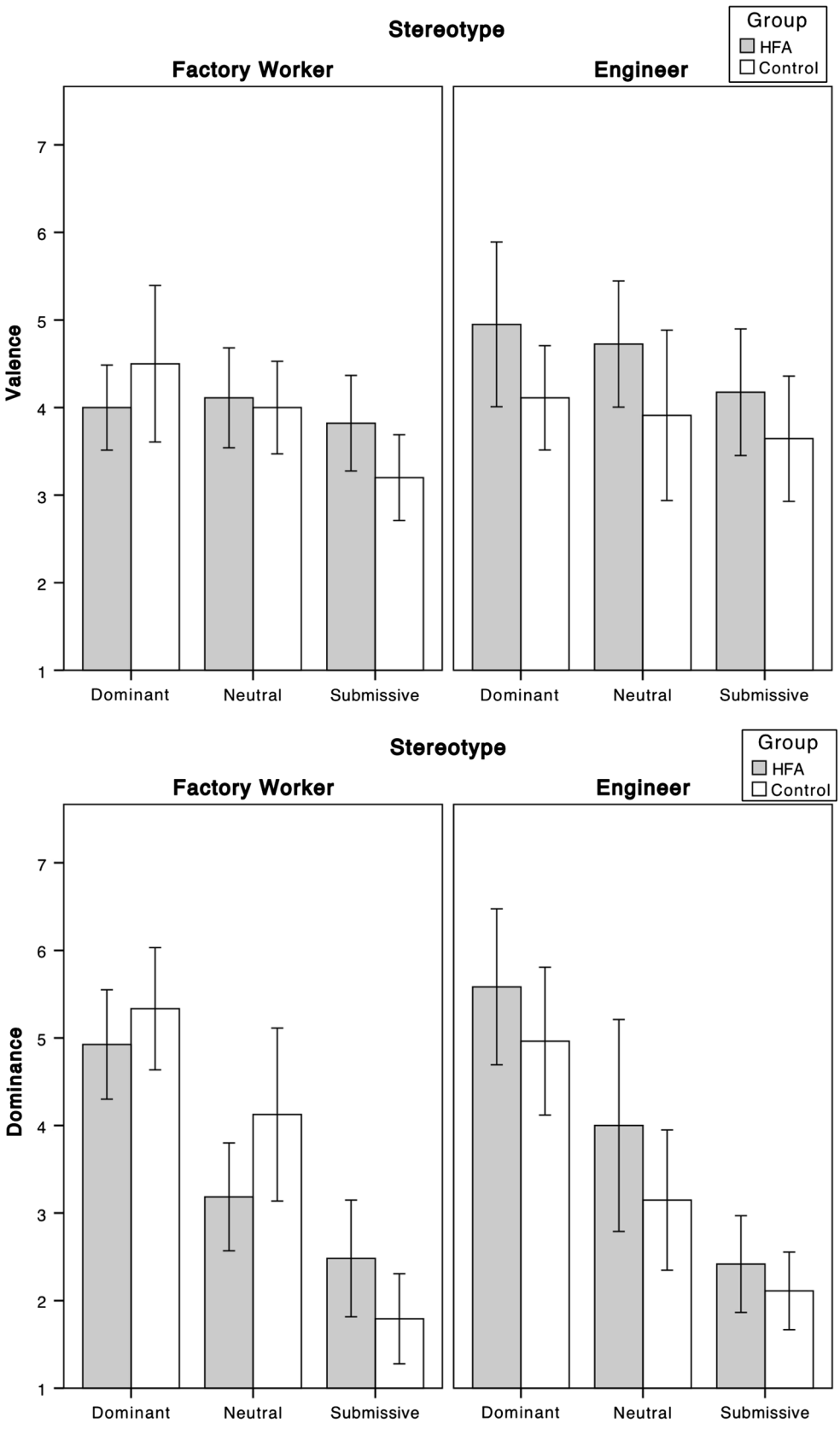

Fig. 2 Valence and dominance effects for each group. *Error bars* represent 95 % CI of the mean

control participants and do not reveal a general deficit in HFA. The bias towards more positive judgments in HFA might reflect a compensation mechanism they apply in social cognition given that they are usually fully aware of their deficits in processing intuitive and nonverbal information.

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