Autism spectrum traits predict higher social psychological skill

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Social-cognitive skills can take different forms, from accurately predicting individuals' intentions, emotions, and thoughts (person perception or folk psychology) to accurately predicting social phenomena more generally. Past research has linked autism spectrum (AS) traits to person perception deficits in the general population. We tested whether AS traits also predict poor accuracy in terms of predicting generalized social phenomena, assessed via participants' accuracy at predicting social psychological phenomena (e.g., social loafing, social projection, group think). We found the opposite. In a sample of ∼6,500 participants in 104 countries, AS traits predicted slightly higher social psychological skill. A second study with 400 participants suggested that heightened systemizing underlies this relationship. Our results indicate that AS traits relate positively to a form of social cognitive skill—predicting social psychological phenomena—and highlight the importance of distinguishing between divergent types of social cognition.

social psychological skill | autism | autism traits | person perception | social cognition

Past research has reliably linked features of autism spectrum disorder (ASD) in the nonclinical population to social-cognitive difficulties in person perception (also known as intuitive or folk psychology). Individuals in the general population display autism spectrum (AS) traits to varying degrees (1), and such traits are linked to inaccurately judging other individuals' intentions, thoughts, emotions, and desires. For instance, in a sample of over 1,000 nonclinical participants, AS traits strongly predicted reduced empathy (2). And AS traits in the general population have been linked to deficits in inferring others' mental states (theory of mind) (3), social mimicry (4), and emotion recognition and processing (5).

Here we examine whether AS traits also predict deficits in an alternate type of social-cognitive skill, one we term "generalized social prediction." Unlike person perception, generalized social prediction entails individuals' accuracy at inferring overarching social phenomena (e.g., social loafing, misattribution, deindividuation, self-serving bias) and is reflected in people's social schemas (6), theories about the social world (7), and assumptions about human nature (8). That is, while person perception involves predicting the emotions, thoughts, and intentions of other specific individuals in a given moment (9), generalized social prediction entails predicting the thoughts, feelings, and behaviors of people in general. For instance, judging a specific individual as happy when she is surrounded by similar others given her facial, body language, and auditory cues (person perception) differs from predicting the social phenomenon of similarity attraction—that people, in general, are happy when interacting with similar others (generalized social prediction). And, on a broader level, judging the emotional state or intentions of specific individuals differs from accurately predicting humans' generalized social behavior. Notably, the distinction between person perception and generalized social prediction echoes the evolution of the field of psychology itself. At its onset, psychologists attempted to predict the behavior of individuals (10); now, they attempt to predict overarching psychological phenomena.

Gollwitzer and Bargh (11) recently developed a measure to assess the accuracy of people's generalized social prediction. They measured participants' skill at predicting social psychological phenomena (e.g., social loafing, bystander effect, misattribution, outgroup bias) independent of participants' psychological background. Notably, such social psychological skill is based on an objective accuracy criterion—social psychological phenomena are empirically substantiated.* For instance, by assessing whether people correctly predict the phenomenon of social projection, "People tend to overestimate the amount that other people share their beliefs and attitudes: True – False" (12), one can begin to quantify the accuracy of people's generalized social prediction.

Although past research has linked AS traits to deficits in person perception, as noted earlier, it remains unclear whether AS traits also predict deficits in generalized social prediction. Here, we test this question by examining whether AS traits relate to individuals' accuracy at predicting social psychological phenomena—their social psychological skill. Importantly, testing this question should help illuminate 1) the specific type of social-cognitive deficits captured by AS traits and 2) whether person perception and generalized social prediction are empirically divergent social-cognitive skills.

In a nonclinical sample of 6,595 participants spread across 104 countries, we found AS traits, assessed via the Autism Spectrum Quotient (AQ-10) (13), to correlate positively with social psychological skill, $r(6593) = 0.05$, $P < 0.001$. Bayesian analyses of this finding indicated that the relationship between AS traits and social psychological skill is 348 times more likely to be positive or null than to be negative (Bayes factor $[BF]_{0-} = 347.7$). Furthermore, participants in our sample likely to be diagnosed with ASD (according to the diagnostic cut-point of the AQ-10) were more accurate at predicting social psychological phenomena, $M = 27.52$, SD = 4.97, than those unlikely to be diagnosed with ASD, $M = 26.74$, SD = 4.69, $F(1, 6{,}593) = 13.93$, $P < 0.001$, $\eta^2 = 0.002$. Supporting cross-cultural reliability, these results did not differ between the 4 countries with over 100 participants in our sample, Australia, Canada, Great Britain, and the United States, $P = 0.591$ ($AQ\text{-}10_{average}$), and $P = 0.214$ ($AQ\text{-}10_{cut\text{-}point}$).

Although the observed effect sizes are small, they dramatically differ from the significantly negative link previously documented between AS traits and accuracy in person perception (3–6). To test this claim, we conducted a brief meta-analysis of past findings linking AS traits to person perception in the general population.

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*Each of the social psychological phenomena included in the measure of Gollwitzer and Bargh (11) is a phenomenon that has been empirically replicated at least once.

This analysis indicated a moderate-to-strong negative relationship between AS traits and person perception, including empathy, theory of mind, social mimicry, and emotion recognition, $r = -0.39$, $z = -9.33$, $P < 0.001$, 95% confidence intervals [−0.31, −0.46] (n = 3,143; $k = 10$).[†] The relationship between AS traits and social psychological skill observed here, $r = 0.05$, clearly differed from this estimate, $z = 21.30$, $P < 0.001$. In sum, the importance of our finding does not lie in the small positive observed relationship. Rather, the theoretically central finding is that, while AS traits relate negatively to person perception, they do not relate negatively to social psychological skill.

Why do AS traits predict slightly higher social psychological skill? While AS traits are linked to deficits in mentalizing and affective empathy, they predict above-average systemizing—identifying rules and regularities of type systems (e.g., if x, then y) (14). Potentially, then, unlike person perception judgments, which require mentalizing and affective empathy (9), predicting social psychological phenomena relies on systemizing. Consistent with this interpretation, social psychological skill, but not person perception, is linked to skill in intuitive physics (11), which relates to systemizing (15).

To test this hypothesis, we conducted a second, preregistered study (nonclinical; $n = 400$) examining whether social psychological skill is predicted by systemizing (assessed via the Systemizing Quotient; e.g., "I am fascinated by how machines work") (16). Systemizing predicted higher social psychological skill, $r(398) = 0.15$, $P = 0.002$, and this relationship did not change when controlling for participants' background in social psychology (having taken social psychology classes), $P = 0.002$. Our findings align with AS traits relating to social psychological skill via heightened systemizing and demonstrate that systemizing predicts a form of social-cognitive skill, a heretofore unrecognized possibility (3, 14).

Although past literature has documented that AS traits predict deficits in person perception (e.g., mentalizing, emotion recognition) (2–5), we found AS traits to positively predict an alternate social-cognitive skill—social psychological skill. And our findings indicate that this link is driven by social psychological skill relating to heightened systemizing. These findings contribute to social-cognitive theories of autism by providing a constraint in terms of the social-cognitive deficits associated with AS traits: While AS traits relate to deficits in person perception tasks, they relate slightly positively to accurately inferring social psychological phenomena. Additionally, our findings contribute to a growing literature indicating that some cognitive skills remain unaffected by, or are even enhanced by, ASD (17); we find that even a form of social-cognitive skill may be enhanced by ASD.

On top of contributing to the literature on autism, our results indicate that person perception and generalized social prediction are divergent social-cognitive skills that are predicted by different processes. While accurate person perception is predicted by mentalizing and empathic abilities (9), social psychological skill was predicted by systemizing. As such, we propose 2 divergent types of social cognition: a more individual, perceptive form pertaining to the inference of individuals' intentions, emotions, and mental states and a more general, reasoning-based form pertaining to the inference of social phenomena more generally. Future research should more closely examine the potential mechanisms underlying these divergent types (e.g., causal inference, simulation/introspection) and how these mechanisms align and differ. Indeed, if certain processes are involved in accurate person perception but not in generalized social prediction, then these processes are particularly likely to be uniquely impacted by ASD.

The current results may even apply to the clinical domain. In study 1, participants likely to be diagnosed with ASD—participants who scored higher than the diagnostic cutoff point on the AQ-10—exhibited greater social psychological skill. This potential link likely only applies to individuals with ASD who have normal intelligence, however; individuals with lower-than-average intelligence would likely exhibit poor social psychological skill given the cognitive demands associated with this skill (11).

Our findings may also help explain why individuals with ASD exhibit adequate person perception performance in settings that allow for deliberation, reflection, and reasoning (e.g., extended time) (18). Individuals with ASD may be recruiting their knowledge of social psychological phenomena as a form of compensatory learning to understand other individuals' mental states. For instance, consider discerning someone's intentions. Individuals without ASD are able to automatically discern, for instance, that another individual shares their intentions via highly automatic social processes (e.g., social projection) (12). Those with ASD, however, are unable to automatically do so and, thus, may instead deliberately and systematically apply their social psychological skill to intuit others' intentions. This interpretation aligns with a common strategy for clinical intervention in ASD, teaching social skills in terms of explicit social rules rather than mental state inference (19).

We consider some limitations. For instance, we did not assess the AQ in study 2. Ideally, we would have shown that controlling for participants' systemizing reduces the link between AS traits and social psychological skill. Future research should test this. Similarly, we did not directly assess whether AS traits predict deficits in person perception as compared to social psychological skill. Instead, we relied on a metaanalytic estimate of past studies to infer this dissociation (see results of study 1). Although this meta-analysis allowed for the inclusion of various person perception measures, future research should still demonstrate the inferred dissociation in a single sample.

We found that AS traits in the general population are not associated with deficits in generalized social prediction, as quantified by social psychological skill. Our results provide insight into the specific social-cognitive processes that AS traits affect, suggest potential intervention possibilities by highlighting a social-cognitive skill positively predicted by AS traits, and demonstrate the importance of considering divergent social-cognitive skills in psychological research.

Methods

Participants. In study 1, 6,904 participants were recruited via an online social psychological skill quiz (23–25 March 2018).[‡] Participants' location was identified via latitude and longitude coordinates[§]; 309 participants were excluded for failing to complete the entire social psychological skill or AQ-10 measures. In study 2, we recruited 411 participants on Mechanical Turk (187 Female; $M_{age} = 37.75$, $SD_{age} = 12.28$); 11 participants were excluded for failing an attention check. All data and analysis files can be found at https://osf.io/4pd2m/?view_only=db1650b2e86240ddb7a6158a96f6abf5 (20). The studies were approved by the Yale University institutional review board (IRB) and followed American Psychological Association ethical standards. Informed consent was waived in study 1, given the data collection format (an online quiz); the study was categorized as exempt by the IRB. Informed consent in study 2 was collected at the start of the study.

[†]For the complete meta-analysis methods and articles included, see the Open Science Framework link in *Methods*. We stopped searching for studies linking AQ to person perception after identifying the first 10 relevant studies because the purpose of our analysis was solely to illustrate the large difference (in terms of effect size) in the link between AS traits and person perception and the link between AS traits and social psychological skill.

[‡]Demographic information was unfortunately not recorded, due to the method of data collection (an online quiz).

[§]Some participants were missing latitude and longitude values; location was identified for 4,463 participants. The cross-cultural analyses only included these participants.

Materials.

Social psychological skill. In both studies, the social psychological skill measure included 40 true/false and multiple-choice questions about social psychological phenomena (e.g., social loafing, bystander effect, outgroup bias), for instance, for social loafing: "In most cases, people expend less effort when in a group than when alone: True – False." Past research has documented the validity (e.g., temporal, internal) of this measure (11). Each correct item scored a point, for a total 40 possible points; study 1: $M = 26.81$, SD = 4.72, $\omega = 0.74$; study 2: $M = 24.38$, SD = 5.51, $\omega = 0.83$. The full quiz can be viewed at https://osf.io/4pd2m/?view_only=db1650b2e86240ddb7a6158a96f6abf5 (20).

Autistic traits. Participants completed a validated, short form of the Autism Spectrum Quotient—the AQ-10 (13). We scored the AQ-10 in 2 ways. First, an average was calculated for each participant, $AQ\text{-}10_{average}$: $M = 2.05$, SD = 0.38, $\omega = 0.77$ (21). Second, each item was scored as zero or one, with one indicating that the participant endorsed the autistic trait, and then summed. Participants above the cut-point, 5, were categorized as exhibiting ASD ($n = 556$)—this cut-point best balances diagnostic sensitivity and specificity (13). The AQ-10 exhibited acceptable internal consistency, $\omega = 0.77$.[¶]

Systemizing. Participants completed a validated short form of the Systemizing Quotient (16). A simple average was calculated, $M = 2.80$, SD = 0.51. The measure exhibited high internal consistency, $\omega = 0.92$.

[¶]A principle components analysis (as well as past research) failed to reveal the predicted subcomponents. Thus, we did not examine the subcomponents.

1. J. N. Constantino, R. D. Todd, Autistic traits in the general population: A twin study. *Arch. Gen. Psychiatry* **60**, 524–530 (2003).
2. S. Wheelwright *et al*., Predicting autism spectrum quotient (AQ) from the systemizing quotient-revised (SQ-R) and empathy quotient (EQ). *Brain Res.* **1079**, 47–56 (2006).
3. S. Baron-Cohen, S. Wheelwright, J. Hill, Y. Raste, I. Plumb, The "Reading the Mind in the Eyes" test revised version: A study with normal adults, and adults with Asperger syndrome or high-functioning autism. *J. Child Psychol. Psychiatry* **42**, 241–251 (2001).
4. A. Haffey, C. Press, G. O'Connell, B. Chakrabarti, Autistic traits modulate mimicry of social but not nonsocial rewards. *Autism Res.* **6**, 614–620 (2013).
5. E. Poljac, E. Poljac, J. Wagemans, Reduced accuracy and sensitivity in the perception of emotional facial expressions in individuals with high autism spectrum traits. *Autism* **17**, 668–680 (2013).
6. R. P. Abelson, Psychological status of the script concept. *Am. Psychol.* **36**, 715–729 (1981).
7. C. S. Dweck, *Self-theories: Their Role in Motivation, Personality, and Development* (Psychology Press, Philadelphia, PA, 1999).
8. L. S. Wrightsman, *Assumptions About Human Nature: Implications for Researchers and Practitioners* (Sage Publications, Inc., Thousand Oaks, CA, ed. 2, 1992).
9. D. T. Gilbert, "Ordinary personology" in *The Handbook of Social Psychology* (McGraw-Hill, New York, NY, 1998), vol. 2, pp. 89–150.
10. R. T. LaPiere, Attitudes vs. actions. *Soc. Forces* **13**, 230–237 (1934).
11. A. Gollwitzer, J. A. Bargh, Social psychological skill and its correlates. *Soc. Psychol.* **49**, 88–102 (2018).
12. J. Krueger, R. W. Clement, The truly false consensus effect: An ineradicable and egocentric bias in social perception. *J. Pers. Soc. Psychol.* **67**, 596–610 (1994).
13. C. Allison, B. Auyeung, S. Baron-Cohen, Toward brief "red flags" for autism screening: The short autism spectrum quotient and the short quantitative checklist in 1,000 cases and 3,000 controls. *J. Am. Acad. Child Adolesc. Psychiatry* **51**, 202–212.e7 (2012).Erratum in: *J. Am. Acad. Child Adolesc. Psychiatry* **51**, 338.
14. S. Baron-Cohen, J. Richler, D. Bisarya, N. Gurunathan, S. Wheelwright, The systemizing quotient: An investigation of adults with Asperger syndrome or high-functioning autism, and normal sex differences. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* **358**, 361–374 (2003).
15. A. Wakabayashi *et al*., Empathizing and systemizing in adults with and without autism spectrum conditions: Cross-cultural stability. *J. Autism Dev. Disord.* **37**, 1823–1832 (2007).
16. A. Wakabayashi *et al*., Development of short forms of the empathy quotient (EQ-Short) and the systemizing quotient (SQ-Short). *Pers. Individ. Dif.* **41**, 929–940 (2006).
17. S. Baron-Cohen, E. Ashwin, C. Ashwin, T. Tavassoli, B. Chakrabarti, Talent in autism: Hyper-systemizing, hyper-attention to detail and sensory hypersensitivity. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* **364**, 1377–1383 (2009).
18. A. Senju, V. Southgate, S. White, U. Frith, Mindblind eyes: An absence of spontaneous theory of mind in Asperger syndrome. *Science* **325**, 883–885 (2009).
19. S. Williams White, K. Keonig, L. Scahill, Social skills development in children with autism spectrum disorders: A review of the intervention research. *J. Autism Dev. Disord.* **37**, 1858–1868 (2007).
20. A. Gollwitzer, Data for autism spectrum traits predict higher social psychological skill. Open Science Framework. https://osf.io/4pd2m/?view_only=db1650b2e86240ddb7a6158a96f6abf5. Deposited 8 August 2019.
21. A. L. Murray, T. Booth, K. McKenzie, R. Kuenssberg, What range of trait levels can the autism-spectrum quotient (AQ) measure reliably? An item response theory analysis. *Psychol. Assess.* **28**, 673–683 (2016).