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Is Emotion Recognition Impaired in Individuals with Autism Spectrum Disorders?

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Abstract Researchers have argued that individuals with autism spectrum disorders (ASDs) use an effortful "systematizing" process to recognize emotion expressions, whereas typically developing (TD) individuals use a more holistic process. If this is the case, individuals with ASDs should show slower and less efficient emotion recognition, particularly for socially complex emotions. We tested this account by assessing the speed and accuracy of emotion recognition while limiting exposure time and response window. Children and adolescents with ASDs showed quick and accurate recognition for most emotions, including pride, a socially complex emotion, and no differences emerged between ASD and TD groups. Furthermore, both groups trended toward higher accuracy when responding quickly, even though systematizing should promote a speed-accuracy trade-off for individuals with ASDs.

Keywords Autism · Emotion recognition ·
Systematizing · Pride expression

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Introduction

Autism spectrum disorders (ASDs), including high functioning autism (HFA), Asperger's Disorder, and Pervasive Developmental Disorder (PDDNOS), typically involve debilitating interpersonal impairments, thought to result from failures in understanding others' intentions, thoughts, and emotions (Hobson 1993). Consequently, researchers have assumed that individuals with ASDs have difficulty recognizing others' nonverbal expressions of emotion, a process known to occur quickly and accurately in typically developing (TD) individuals (Tracy and Robins 2008). Consistent with this assumption, children and adults with ASDs have shown impaired emotion recognition compared with TD individuals (e.g., Ashwin et al. 2006; Klin Sparrow et al. 1999; Rump et al. 2009; Weeks and Hobson 1987). However, other studies have shown that children and adults with ASDs can accurately recognize emotion expressions, at least those conveying the so-called "basic" emotions (e.g., anger, fear, disgust, happiness), and that there may be no difference in accuracy between ASD and TD groups, at least when individuals are given ample time to respond (e.g., Ozonoff et al. 1990; Piggot et al. 2004; Ponnet et al. 2004; Rump et al. 2009). For more complex expressions, findings are less equivocal; individuals with ASD have been found to be less accurate than TD individuals in the recognition of complex social information, such as embarrassment and trustworthiness, from nonverbal expressions (Adolphs et al. 2001; Heerey et al. 2003).

To reconcile the conflicting findings on basic-emotion recognition, researchers have postulated that individuals with ASDs have the ability to perform simple emotion recognition tasks, but do so through a more effortful and deliberate process than TD individuals—one that involves relatively greater focus on specific parts of the face, such as

the mouth, and that fails to capture the global meaning of the image (e.g., Behrmann et al. 2006; Klin et al. 1999; Neumann et al. 2006).

This cognitive style, which involves a tendency to process perceptual details separately, instead of as related parts of a whole, has been referred to as "weak central coherence" (Frith 2003). Baron-Cohen (2003) has referred to social and linguistic manifestations of this tendency as "systematizing"; a pattern of processing in which individuals focus on the details of a social or communication system to consciously work out the rules that govern it. In the case of emotion recognition, this would mean attending to the details of an expression separately, then effortfully seeking connections among these details to make an inference about the emotion being displayed (Ashwin et al. 2007). Although systematizing may allow individuals with ASDs to accurately identify emotions in certain experimental contexts where ample time is provided, it may prevent recognition in more naturalistic contexts, where expressions are shown only briefly and observers tend to be distracted. Supporting this account, Rump et al. (2009) recently found that children and adults with ASDs show worse emotion recognition, compared to TD individuals, when expressions are displayed only briefly, as dynamic images that unfold over time. Neuroimaging studies also support this account; when recognizing emotions, individuals with ASDs show greater activation in brain regions (e.g., the precuneus) associated with intentional allocation and a focus on irrelevant facial features, whereas TD individuals show greater activation in emotion-focused regions (e.g., the amygdala), associated with holistic and automatic processing (e.g., Critchley et al. 2000; Hall et al. 2003; Santos et al. 2008; Wang et al. 2004).

A tendency to use a resource-intensive, detail-focused recognition process may also explain the difficulty ASD individuals have in extracting complex social information (e.g., trustworthiness) from nonverbal expressions; the recognition of socially complex messages may necessitate more emotion-focused, holistic judgments, which in TD individuals seem to involve amygdala activation (Adolphs et al. 2001; Pinkham et al. 2008).

If the systematizing account of ASD emotion recognition deficits is correct, we should see impairments in emotion recognition when individuals with ASDs are forced to recognize expressions using a quick and efficient cognitive process that is not conducive to systematizing. In contrast, TD individuals can accurately recognize most emotion expressions even when they view them only briefly and are forced to respond quickly, suggesting that, for most individuals, emotion recognition is an efficient process; and this holds even for the complex "self-conscious" emotions of embarrassment, pride, and shame (Tracy and Robins 2008).

The present research tested whether children and adolescents with ASDs show impaired recognition of all basic-emotion expressions (anger, disgust, fear, happiness, sadness, and surprise) and two more socially complex emotion expressions (contempt and pride), when forced to complete the recognition process in a very brief timeframe.[1] Specifically, we investigated whether these individuals exhibit a general deficit in emotion recognition (i.e., lower accuracy and higher false-alarm rates relative to TD individuals), and whether they recognize emotions through a more deliberate process (i.e., slower response times and below-chance recognition when forced to respond quickly). If between-group differences in accuracy or average response times emerge under speeded conditions, it would support claims that individuals with ASDs use a more deliberative, time-consuming cognitive process, such as systematizing, to recognize emotion expressions. To our knowledge, previous research has not directly addressed this issue, despite calls for studies examining emotion recognition in ASD individuals under more naturalistic conditions, such as imposed limitations in exposure and response times (Grossman et al. 2000; Klin et al. 1999).[2]

Although several recent studies have tested for an effect of ASDs on emotion recognition when facial expressions are shown only briefly (Clark et al. 2008; Rump et al. 2009), none of these studies imposed limitations on response latencies—a necessary precondition for examining response times and recognition (i.e., accuracy) rates when responding occurs quickly. These studies also addressed somewhat different questions from the present research; in the case of Rump et al. (2009), the authors examined the recognition of non-FACS-verified expressions that were dynamic, videotaped displays which unfolded over 500 ms; and in the case of Clark et al. (2008), the authors examined recognition of anger versus happiness only, so accuracy depended upon valence (i.e., positive vs. negative) distinctions rather than discriminations among a range of similarly and non-similarly valenced expressions.

Moreover, this is the first study to examine whether individuals with ASDs can recognize the pride expression, a display that includes facial and bodily components—

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[1] Although contempt has been referred to as a basic emotion, considerable evidence suggests that it is not as reliably recognized, across cultures, as the other six basic emotions (Elfenbein and Ambady 2002); it also is recognized less quickly and efficiently than these other emotions (Tracy and Robins 2008).

[2] In one study that required participants with ASDs to respond to expressions within 10 s, no differences in accuracy were found, but a 10-s time constraint is unlikely to have imposed any impediments to even highly effortful processing. In fact, accuracy in this study was at ceiling for both groups, and mean response times were well within the limit for both groups (1.67 and 1.32 s for ASD and TD groups, respectively; Grossman et al. 2000).

Table 1 Age, Wechsler IQ, and Social Communication Questionnaire (SCQ) scores for the autistic spectrum disorder (ASD) and matched typically developing (TD) samples

Participant characteristics	ASD group ($n = 29$)		TD group ($n = 31$)	
	M (SD)	Range	*M* (SD)	Range
Age (Months)	147 (30.7)	108–208	147 (30.3)	99–207
Verbal IQ	111 (19.6)	69–143	115 (15.7)	89–143
Performance IQ	110 (18.9)	79–135	113 (11.8)	89–141
Full scale IQ	110 (21.5)	72–142	119 (12.5)	98–142
SCQ total	24.4 (6.4)	13–35	3.4 (3.4)	0–14
SCQ social behavior domain	10.5 (3.3)	2–15	1.1 (1.5)	0–6
SCQ repetitive behavior domain	6.2 (2.2)	2–9	1.4 (1.5)	0–7

small smile, head tilt upward, expanded posture, and arms extended out from the body (Tracy and Robins 2004). Given their neurocognitive impairments in self-awareness and theory of mind, as well as previous findings that children with ASDs have difficulty recognizing embarrassment and demonstrate less coherent mental representations of embarrassment and pride (Heerey et al. 2003; Losh and Capps 2006), individuals with ASDs may show selective deficits in the recognition of a self-conscious emotion such as pride.

Method

Participants

Participants were 29 individuals (3 female) with ASDs (*M* age = 147 months, SD = 31) and 31 (3 female) TD individuals (*M* age = 147, SD = 30; see Table 1 for age ranges), all with Wechsler Full Scale IQ > 70 (WASI; Wechsler 1999). Of the ASD sample, 11 were diagnosed with Autistic Disorder (HFA), 15 with Asperger's, and 2 with PDDNOS,[3] according to criteria set by the DSM-IV-TR (American Psychiatric Association 2000), using the ADOS-G (Lord et al. 2000) and the Social Communication Questionnaire, completed by parents, based on a cutoff score of 15 (SCQ; Berument et al. 1999). We included individuals with varied diagnoses because it is difficult to reliably distinguish among these disorders, and there is no empirical distinction in symptomatology or outcome by the age of 8 years (the age of the youngest participants in this study; e.g., Ozonoff and Griffith 2000).[4] The ASD and TD groups did not differ in Full Scale IQ scores, *M*s = 110 and

119, respectively, $t(56) = 1.46$, $p = .15$.[5] All reported effects held controlling for SCQ and IQ scores; see Table 1 for descriptive data on these measures, separately by ASD and TD group.

Procedure

Participants viewed photos of emotion expressions displayed on a laptop computer with a 15 in. monitor placed 60–75 cm from their face. They responded by pressing one of two keys ("J" or "F"), representing "yes" and "no", and were instructed to keep their index fingers on these keys at all times, allowing for rapid responding. Expressions of anger, contempt, disgust, fear, happiness, pride, sadness, and surprise were shown in eight blocks of 22 photos each. Each block had a different target emotion, and participants determined whether each expression represented the target emotion. Within each block, the correct expression was shown 4 times, and the incorrect expressions 7 times. Both the order of blocks and photos within each block were randomized across participants.

Participants were instructed, "As you view each photo, decide as quickly as you can whether or not the target emotion is being expressed. Make sure to respond quickly. A good way to do this is to use your intuition—just go with your first impression". The question "Is this [target emotion]?" was also displayed in large (32 pt) font above each photo, to prompt participants.

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[3] Results were unaffected when the two participants with a diagnosis of PDDNOS were removed from analyses.

[4] Individuals with diagnoses of autism with known genetic etiologies and psychopathology were excluded.

[5] Although the ASD and TD samples had very similar mean IQ scores, the ranges of scores differed somewhat between groups. Thus, we also conducted all analyses excluding ASD participants with total IQ scores below 98 (as well as one ASD and one TD participant missing IQ scores); the remaining ASD participants ($n = 21$) were thus more closely matched on IQ to the TD participants, given that their full scale IQ scores had the same range (98–142) as well as similar means (*M*s = 116 for the ASD group, and 119 for the TD group). All results reported in text held when the restricted range of ASD participants was used instead, and no new significant effects emerged. The only exception is reported in Footnote 7.

Each photo appeared onscreen for a maximum of 1,500 ms; it disappeared as soon as participants responded, and was replaced by the next photo. If participants did not respond within 1,500 ms, no response was recorded and a message appeared telling them to respond more quickly. Pilot testing demonstrated that a 1,500 ms maximum exposure and response time forced participants to respond quickly but did not lead to task disengagement out of frustration, a particular concern for children with ASDs.

Stimuli

Each block consisted of 22 photos: 4 showing the target emotion for that block and 7 showing each of the other emotion expressions. Photos of a male and female Caucasian target, depicted from the waist up, were taken from the UC Davis Set of Emotion Expressions (UCDSEE; Tracy et al. 2009; see www.ubc-emotionlab.ca/research#UCdavis), a Facial Action Coding System-verified set of expressions. Accuracy rates were based on the mean hit rate across the four photos (two male, two female) of the target emotion; false alarm rates were examined separately. Additional "filler" expressions were also included to decrease the number of times each photo was repeated. In the case of pride, there are two reliably recognized versions of the expression (Tracy and Robins 2004); both were included, and pride analyses were based on means across the two versions.

Results

Can Individuals with ASDs Recognize Emotions Accurately Under Speeded Conditions?

We first tested whether mean recognition rates for each expression, within the ASD group, were significantly greater than chance (i.e., 50%). All expressions except fear and contempt were recognized significantly better than chance, $p < .05$, based on a binomial test (see Fig. 1). This pattern held in the TD group, all ps $< .05$ except fear and contempt. Consistent with these findings, previous studies have shown that fear and contempt elicit the lowest recognition rates across cultures in TD samples (e.g., Elfenbein and Ambady 2002).

We next compared recognition rates between the ASD and TD groups. Based on t-tests, the overall recognition rate, averaged across emotions, did not differ between ASD (77%) and TD (76%) groups; nor were there significant group differences for any of the eight emotions; all ps $> .10$ (see Fig. 1 for means). There was a small target effect; the male target was recognized slightly better than the female, overall (79 vs. 75%), $t(57) = 2.59$, $p < .05$; but this
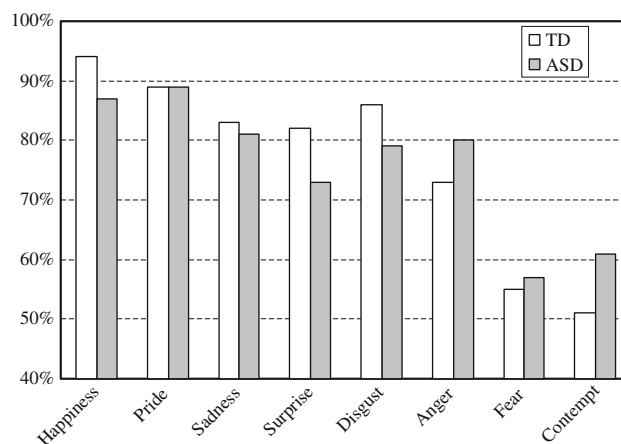

Fig. 1 Mean recognition rates for the Autistic Spectrum Disorder (*ASD*) and Typically Developing (*TD*) groups. *Note*: *N*s = 29 (ASD); 31 (TD); no significant differences between groups emerged. All recognition rates except for contempt and fear were significantly greater than chance (50%), $p < .05$

difference did not vary by emotion or group. Again using t tests, we examined whether the ASD group showed a selective impairment in recognizing the two socially complex expressions (pride and contempt). Pride was recognized no worse and, in fact, even better than the six basic emotions in both the ASD [88 vs. 76%; $t(28) = 22.30$, $p < .05$] and TD [89 vs. 78%; $t(30) = 41.88$, $p < .05$] groups. Furthermore, based on a 2 (emotion type: pride vs. basic) × 2 (sample: ASD vs. TD) analysis of variance (ANOVA), there was no interaction between emotion type and sample, $F(1,58) = .05$, ns, confirming the finding that the ASD group showed no specific deficit in recognizing the socially complex emotion of pride, in particular. Replicating these analyses for contempt, we found that contempt was recognized worse than the basic emotions in both the ASD [61 vs. 76%; $t(28) = 26.20$, $p < .05$] and TD [52 vs. 78%; $t(30) = 37.07$, $p < .05$] groups. Based on another 2 (emotion type: contempt vs. basic) × 2 (sample: ASD vs. TD) ANOVA, again no interaction emerged, $F(1,58) = 2.05$, ns, confirming that the ASD group did not show a specific deficit in recognizing the complex emotion of contempt. Finally, when we re-ran these ANOVAs collapsing across the complex emotions of pride and contempt, once again no emotion type (basic vs. complex) × sample (ASD vs. TD) interaction emerged, $F(1, 58) = 1.57$, ns, suggesting that the ASD group did not show specific deficits in the ability to quickly recognize socially complex emotions.

Do Individuals with ASDs Show the Same False-Alarm Rates as TD Individuals?

We next examined false-alarm rates; that is, the proportion of participants who responded "yes" to expressions that

did not represent the target emotion. It is possible that high accuracy levels found within the ASD sample were due not to accurate discrimination, but rather to a tendency to respond by pressing the "yes" key to most expressions that appeared. That is, because false-alarm rates and hit rates were independent (e.g., both could be 100% for a given expression), high hit rates may be misleading. However, mean false-alarm rates (for each expression, averaged across all possible misidentifications) within the ASD group were considerably lower than recognition (i.e., hit) rates (overall M false alarm rate $= 22\%$), and, within both the ASD and TD groups, false alarm rates were relatively similar across emotions: 25 and 15% (anger), 38 and 29% (contempt), 20 and 15% (disgust), 16 and 17% (fear), 28 and 24% (happiness), 12 and 10% (pride), 23 and 22% (sadness), and 18 and 12% (surprise), for the ASD and TD samples, respectively. Based on t tests, none of these rates differed significantly between ASD and TD groups, and none were greater than chance (i.e., 50%). Thus, participants did not tend to mislabel other expressions as the target emotion, and the absence of impaired emotion recognition in the ASD sample was not due to a relatively greater false-alarm rate among these individuals.

Can Individuals with ASDs Recognize Emotions Quickly?

Although the ASD and TD groups did not differ in recognition or false-alarm rates, this could be due to the amount of time allotted to the task; it is possible that even within the brief timeframe of 1,500 ms, individuals with ASDs can effectively systematize (i.e., use deliberative and effortful cognitive processes) to accurately identify each expression. If this is the case, we should see a difference in the amount of time actually used by each group; that is, individuals with ASDs should take longer to accurately identify an expression than TD individuals. However, based on t tests, no differences in mean response times emerged between the TD and ASD group, when examining response times for accurately recognized expressions only, all ts < 1.80, ns (see Fig. 2).[6] A comparison of mean response times across all accurately recognized expressions also showed no overall group difference, $t(58) = 1.29$, ns. We also tested for a group (ASD vs. TD) by emotion type (basic vs. complex) interaction, using ANOVA, and found no main effects for either group, $F(1, 43) = 2.18$,
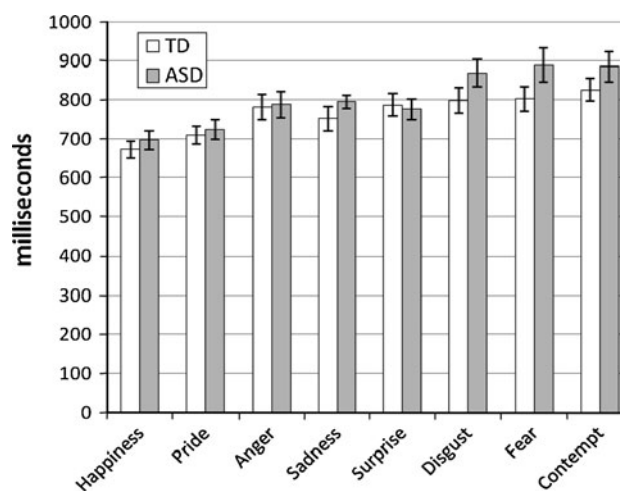
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[6] Before computing response times, we removed all responses that occurred within 300 ms, or were greater or less than 2.5 standard deviations from the mean (Bargh and Chartrand 2000).

Fig. 2 Mean response times for accurate responders in the ASD and TD groups. *Note*: No significant differences between groups emerged, all ps > .10

or emotion type, $F(1, 43) = .89$, nor an interaction, $F(1, 43) = .06$, all ns. There was also no target effect on response times, Ms = 780 vs. 750 ms for the female and male, respectively, $t(57) = 1.32$, ns.

It remains possible, however, that deficits in accuracy would emerge when individuals with ASDs respond even more quickly than the 1,500 ms timeframe. Thus, for each expression we identified the subgroup of ASD and TD participants who responded within 800 ms, and used t tests to compare their accuracy rates for that expression (overall M response time for accurate responders, across all expressions $= 782$ ms). No differences in accuracy emerged between the ASD and TD groups for these fast responders (Ms = 83 vs. 81% across all emotions; and 91 vs. 81% for anger; 64 vs. 60% for fear; 69 vs. 63% for contempt; 82 vs. 89% for disgust; 93 vs. 93% for happiness; 93 vs. 89% for pride; 91 vs. 81% for sadness; and 80 vs. 80% for surprise; respectively for ASD and TD groups, all ps > .10); moreover, all recognition rates within the 800 ms cut-off were significantly greater than chance, $p < .05$, except for fear and contempt.

Furthermore, in both groups, correlations between accuracy and response time tended to be negative; for the ASD and TD samples, respectively, rs = −.41 ($p < .05$) and −.31 (ns) for anger, −.36 and −.20 (both ns) for contempt, −.38 and −.54 (both ps < .05) for disgust, −.26 and −.20 (both ns) for fear, −.50 ($p < .05$) and .24 (ns) for happiness, −.38 ($p < .05$) and −.29 (ns) for pride, −.14 (ns) and −.45 ($p < .05$) for sadness, and .03 and .07 (both ns) for surprise. Except for happiness, none of these correlations differed significantly between groups, ps > .10. For happiness, higher accuracy was associated with quicker responding only within the ASD group, $z = 2.91$,

$p < .05.$[7] Overall then, this pattern suggests that quick responding enhanced, rather than inhibited, accurate recognition among both ASD and TD participants. If participants with ASD used a more deliberate, time-intensive process to recognize expressions, we would expect higher accuracy to come at the cost of slower responding, resulting in positive correlations between accuracy and response time. Yet, for all expressions except surprise, correlations between response time and accuracy trended in the negative direction within the ASD sample, and half of these correlations were significant. It is also noteworthy that the two socially complex emotions, pride and contempt, were among those expressions that showed a negative correlational trend between accuracy and response time, in both groups.

Discussion

Contrary to widespread claims, the present study failed to find evidence that individuals with ASDs show impaired emotion recognition. Compared with TD controls, individuals with ASDs were: (a) equally accurate even when exposure and response times were brief; (b) equally fast when instructed to respond as quickly as possible; and (c) equally fast and accurate at recognizing the complex social emotions of pride and contempt. In addition, individuals with ASDs, like TD individuals, tended to show higher accuracy when they responded more quickly.

These findings have several important implications. First, they challenge the prevailing view that ASDs involve the use of a more time-consuming and cognitively taxing systematizing process to recognize emotion expressions. We saw no evidence of slower recognition among individuals with ASDs, suggesting that if they use a more deliberate process than TD individuals, they have by late childhood become proficient enough to use it very quickly; this is consistent with results from Rump et al. (2009), who also failed to find impaired recognition among individuals with ASDs in the same age range as the present research.[8] Furthermore, regardless of the process used, the present findings suggest that individuals with ASDs can accurately recognize emotion expressions under the conditions in which these expressions are typically displayed in everyday life—briefly, and when only minimal time is available

for interpretation. This suggests that the deficits in social perception previously documented in individuals with ASDs are unlikely to result from basic impairments in the recognition of emotion expressions.

Second, these findings raise questions about ASD impairments in the recognition of complex social information from nonverbal behavior. Pride recognition rates were high within the ASD sample, despite the fact that the pride expression is somewhat unique in its inclusion of body, head, and facial movements, and that the experience and understanding of pride emerges later in development than that of basic emotions (Lagattuta and Thompson 2007; Tracy et al. 2005). Interestingly, previous findings on ASD impairments in self-conscious emotion recognition suggest that the deficit is less pronounced for shame, another self-conscious emotion, than embarrassment (Heerey et al. 2003). Combined with the present results, these findings may indicate that recognition of pride and shame expressions require a lower level of social processing than other complex social expressions, perhaps because these two expressions originated as part of an ancient dominance/submission system (Fessler 1999; Tracy and Matsumoto 2008), whereas other socially complex expressions show less evidence of evolutionary origins.

Several directions for future research would improve our understanding of the conditions under which individuals with ASDs can and cannot accurately decode emotion expressions. It is possible that the absence of group differences that emerged from the present research are partly due to the age range of our sample; although Rump et al. (2009) noted a similar absence of differences between ASD and TD individuals at this age, they found relatively worse performance in younger (i.e., $M = 6$ years) and older (i.e., $M = 27$ years) ASD samples, compared to age-equivalent TD individuals. Thus, future studies are needed to replicate the present methodology with individuals in early childhood and in adulthood, to determine whether individuals with ASDs might, in fact, use a different cognitive process or skill set to recognize emotions quickly—but one that changes over the course of development. Such studies should also ensure that controls are well matched to ASD participants on all potentially relevant cognitive factors.

Another important future direction is to replicate this study in a sample that is more gender balanced; given evidence of gender differences in ASDs, and the possibility that systematizing is a particularly "male" strategy (Baron-Cohen 2003), we cannot be sure that the present findings would generalize to a sample with more female participants. The present results also may be due, in part, to the high-functioning nature of our ASD sample; a lower-functioning sample would, presumably, be more likely to show relative impairments. In addition, future studies might consider including more participants with varied

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[7] When ASD participants with IQ scores below 98 were excluded, the correlation between accuracy and response time for happiness changed from $-.50$ to $.11$ (ns) and, as a result, no longer differed from the correlation of $.24$ found in the TD group.

[8] Age was not significantly correlated with recognition rates, false-alarm rates, or response times in the ASD group, TD group, or total sample.

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diagnoses to help inform debates about whether distinctions among these diagnoses are meaningful (e.g., Ozonoff and Griffith 2000).

Future studies might also use different tasks, such as ones that require pre-conscious responding. In a similar vein, the dichotomous response ("yes/no") required by the task used here may have increased its ease; although accuracy was not near ceiling in either group ($Ms = 77$ and 76%), future studies might address this issue by providing multiple response options (e.g., asking participants to choose among various emotion responses). However, it may be difficult to move beyond the dichotomous response option framework and still accurately measure response times, because the need to choose from more than two response keys would likely slow down responding for reasons not due to the emotion recognition process.

One important question for future research is whether individuals with ASDs can recognize the shame expression quickly and efficiently, as TD individuals have been shown to do (Tracy and Robins 2008). Future studies should also examine whether individuals with ASDs might, somewhat paradoxically, show accurate recognition of embarrassment or trustworthiness when forced to respond quickly; previous research consistent with this possibility has found that children with ASDs perform comparably to TD individuals in judging displays of mental states such as trustworthiness, but only when they view targets' eyes in isolation, rather than the whole face (Back et al. 2007). It also remains to be seen whether accuracy for basic and self-conscious emotions would falter under the addition of cognitive load, generally considered a critical test of efficiency. TD individuals can accurately recognize most expressions under cognitive load (Tracy and Robins 2008), and the negative correlations between response time and accuracy found here suggest that similarly efficient recognition might be found in ASD samples. However, if ASDs involve the use of a more cognitively taxing process, then the addition of a cognitive load, or a further reduced response timeframe, may be the final straw that is needed to reveal it; the recent finding that individuals with ASDs show impairments, relative to TD controls, in making valence distinctions (i.e., recognizing happy vs. angry expressions) when expressions are displayed for only 30 ms is consistent with this possibility (Clark et al. 2008).

In conclusion, the present research suggests that ASDs do not prevent individuals from quickly and accurately recognizing and distinguishing among emotion expressions, and thus that the social deficits seen in these individuals may emerge at a higher level of cognitive processing. These findings are consistent with the growing recognition that individuals with ASDs demonstrate fewer social perception deficits than has previously been assumed (Bauminger et al. 2008).

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