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RESEARCH ARTICLE

Autistic adults' perspectives on appropriate empathic responses to others' emotions

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Abstract

Although the ability of autistic adults to recognize others' emotions has been extensively studied, less attention has been given to how they respond to these emotions. We examined two aspects of autistic and non-autistic adults' responsiveness to the emotional expressions of non-autistic actors: their perspectives on the appropriate way of responding to others' emotions and their awareness of others' perceptions of the likely appropriateness of such responses. Autistic ($N = 63$) and non-autistic ($N = 67$) adult samples viewed videos of 74 dyadic social interactions displaying different examples of 12 emotions expressed by one actor in response to the behavior of the other. After each video, participants (a) nominated the emotion expressed by the first actor, (b) offered their perspective on what would constitute an appropriate empathic response by the second actor, and (c) indicated their confidence in that response. Although the autistic group provided fewer appropriate empathic responses—operationalized via a panel's interpretations of normative responses—than the non-autistic group, within-group variability was marked, and the effect was weak and largely confined to basic emotions. Autistic individuals were, however, considerably less confident in their responses. Examination of the relationships between confidence in and the appropriateness of empathic responses provided no indication in either group of reliable discrimination of appropriate from inappropriate empathic responses or finely tuned metacognitive awareness of variations in appropriateness. In sum, autistic adults' perspectives on the appropriate empathic reactions to non-autistic adults' emotions were not unilaterally or markedly different to those of non-autistic adults.

Lay Summary

It is often suggested that autistic individuals may have difficulty responding empathically to other people's emotions. However, little is known about autistic individuals' perspectives on what might be the appropriate way to do so. This study indicates that, despite some minor differences, autistic adults' perspectives on the appropriate way to react to interaction partners' emotions are quite similar to those of their non-autistic peers.

KEYWORDS
autistic adults, confidence, emotion recognition, empathy, self-awareness

INTRODUCTION

Recognizing others' emotions and responding appropriately are important components of social interaction. That autistic individuals may not respond to others' emotions in a manner that might typically be perceived as empathic is foreshadowed by the Autism Spectrum Disorder diagnostic criterion A1-3 (DSM-5; American

Psychiatric Association, 2013) and by the sustained research interest in the putative lack of empathy often attributed to autistic individuals and considered to constrain their ability to interact effectively with others (e.g., Baron-Cohen & Wheelwright, 2004; Rieffe et al., 2021; Rogers et al., 2007; Song et al., 2019). Studies of empathic responses to others' emotions sometimes ask participants to view photographs of people reacting emotionally or observe others displaying their emotions following some event. Researchers might then ask participants to infer the thoughts or feelings of the other person (labeled cognitive empathy) or report their own emotional reactions (affective empathy); or they might simply observe the participants' behavioral reactions. Findings have varied considerably, although some recent studies converge on the conclusion that autistic individuals may display difficulties on measures of cognitive but not affective empathy (e.g., Dziobek et al., 2008; Jones et al., 2010; McKenzie et al., 2022; Song et al., 2019).

Responding empathically to others' emotions—a prosocial dimension of empathy (cf. Depow et al., 2021; Rieffe et al., 2021)—likely involves elements such as recognition of the emotion, consideration of an appropriate empathic response, motivation to behave accordingly and effective execution of the response. Limited research attention has been paid to autistic adults' perspectives on the appropriate way to respond to others' emotions during social interactions. Accordingly, we examined autistic and non-autistic adults' perspectives on appropriate behavioral responses to a range of non-autistic adults' emotions, and their awareness of the appropriateness of those responses.

This study was part of a larger project on "Emotion Recognition, Empathic Reactions and Metacognitions in Autistic Adults" that involved a substantial one-off data collection to address three main components, the third of which is the focus in the current study.[1] The first component (Georgopoulos et al., 2022) involved an examination of speed and accuracy of recognition of facial emotion expressions for three types of stimulus presentation, two response formats and 12 emotions. Across conditions, overall recognition accuracy was slightly lower for autistic individuals although there was substantial within-group variability and inter-group overlap. Autistic individuals also responded more slowly and with lower confidence. The second component involved examination of metacognitive awareness of emotion recognition accuracy. It provided no evidence of lesser metacognitive awareness in autistic than non-autistic adults, although pre-task confidence for the former was significantly lower (Brewer et al., 2022). Autistic individuals discriminated accurate from inaccurate recognition responses as effectively as non-autistic individuals, although again there was substantial within-group variability. Both groups also displayed similar sensitivity to their fluctuations in recognition accuracy. Although the findings of those studies indicated some group differences in inferring the emotional states of others, they are inconsistent with the view that autistic adults are unilaterally characterized by some pervasive deficit in cognitive empathy.

The final (and current) project component examined autistic and non-autistic individuals' perspectives on the appropriate empathic responses to others' emotions and their awareness of the appropriateness of those responses. In the social stimulus type condition of our emotion recognition paradigm, participants viewed video clips of a two-person interaction and described the emotion displayed by person 1 in response to person 2's behavior. Then, after observing the impact of person 2's behavior on person 1, they described what they believed would be an appropriate response from person 2. This approach permitted an examination of whether autistic and non-autistic adults' perspectives on the appropriate response to others' emotions aligned with what might be considered appropriate or normative empathic responses. The data thus offer insights into an aspect of affective empathy that is one of the prerequisites for behaving empathically.

It is important to emphasize that the classification of appropriate or normative responses to others' emotions involves subjective judgments. Factors such as the socialization histories of individuals and broader cultural norms will obviously shape the patterns of behavior that individuals develop to facilitate their interactions with others and, in turn, influence their perspectives on what might be the most appropriate ways to respond. In both cases it is likely that individuals will develop schemas for interpreting and responding to others' emotions and these may differ depending on their prior experiences of, and feedback from, social interactions (Baldwin, 1992; Kuethe, 1962a, 1962b). At the core of these schemas are interpersonal scripts containing both declarative and procedural components for interpreting social situations and planning appropriate responses. Given the presence of social-communicative difficulties implied in a diagnosis of autism, it is plausible that such schemas and scripts may well differ for non-autistic and autistic individuals. This possibility has attracted considerable attention in the context of the "double empathy problem" (e.g., Fletcher-Watson & Bird, 2020; Milton, 2012). Hence, from the outset, it is important to bear in mind that, while we operationalize appropriateness of responses to non-autistic others' emotions in this study, we do not pretend that those operationalizations will necessarily hold across all interaction contexts, including when autistic and non-autistic individuals are interacting with autistic versus non-autistic others.

As well as examining individuals' perspectives on appropriate empathic responses, we also examined autistic and non-autistic individuals' metacognitive awareness of the appropriateness of their empathic responses, thereby informing understanding of autistic and non-

[1]The three components are reported in separate manuscripts because of journal word limits.

autistic adults' appreciation of the impact of their behavior on their interaction partners and of factors shaping the likelihood that they may behave empathically. For example, Cameron et al. (2019) demonstrated that those who believed their empathizing was effective were more likely to respond accordingly. Similarly, Depow et al. (2021) found that people's self-reported empathizing behavior increased as their confidence in empathic responding increased.

To examine metacognitive awareness of the appropriateness of empathic responses, confidence judgments provided by participants after each response were used to compute confidence-appropriateness Gamma (*G*) rank correlation coefficients for individual participants in each group (Goodman & Kruskal, 1954), thereby permitting examination of inter-individual variability and group differences in the discrimination of appropriate from less appropriate empathic responses. We also derived confidence-appropriateness calibration curves—widely used in various domains of decision-making research (e.g., Brewer et al., 2022; Brewer & Wells, 2006; Maras et al., 2020)—which complement *G* coefficients by revealing how sensitively participants monitored the appropriateness of their responses to others' emotions. Thus, as well as reporting higher overall confidence in appropriate than inappropriate responses, participants who are finely tuned to the appropriateness of their empathic responses should be characterized by calibration curves that indicate systematic increases in appropriateness of responses that parallel progressive increases in the confidence expressed in the appropriateness of those responses.

In sum, we examined autistic and non-autistic adults' perspectives on the appropriate way of responding to others' emotions and their awareness of others' perceptions of the likely appropriateness of such responses. Several alternative response patterns were considered plausible. If autistic adults are characterized by a pervasive empathy problem, then fewer appropriate responses to others' emotions than observed in non-autistic individuals might be expected, regardless of emotion type. Moreover, poorer metacognitive awareness of the appropriateness of those responses would be predicted. Conversely, if (as recent studies have suggested) autistic individuals are not characterized by difficulties with affective empathy, they should be able to suggest appropriate empathic responses to others' emotions and display an awareness of the appropriateness of those responses—even if not able to do so effectively.

METHOD

We first provide a brief overview of Method sections of Georgopoulos et al. (2022) and Brewer et al. (2022) that are important for understanding the overall methodology, followed by a detailed account of the elements relevant to this study.

Participants

The autistic sample comprised 63 participants (46 male, 17 female), aged 18–66 years ($M = 31.1$, SD = 13) and diagnosed with autism spectrum disorder based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR [APA, 2000] or DSM-5 [APA, 2013]). Verbal ability was indexed using the Wechsler Abbreviated Scale of Intelligence-Second Edition (WASI-II; Wechsler, 2011) Verbal Comprehension Index (VCI). VCI scores ranged from 85 to 143 ($M = 104.44$, SD = 12.71, 95% CI [101.30, 107.58]). The non-autistic sample included 67 individuals (20 male, 47 female), aged 18–65 years ($M = 23.8$, SD = 8.9); VCI scores ranged from 85 to 136 ($M = 106.57$, SD = 11.44, 95% CI [103.83, 109.31]). There was no group difference in VCI, t (128) = 1.00, $p = 0.318$, $d = 0.18$, d 95% CI [−0.17, 0.52], but the non-autistic group was significantly younger, t (109.26) = 3.73, $p < 0.001$, $d = 0.66$, d 95% CI [0.31, 1.01].

Design

The overall project design was a 2 (Group: autistic, non-autistic) × 2 (Response Format: free-report, multiple-choice) × 3 (Stimulus Type: static, dynamic, social) × 12 (Emotion: afraid, angry, ashamed, disappointed, disgusted, frustrated, happy, hurt, jealous, sad, surprised, worried) mixed design, with stimulus type, response format and emotion as within-subjects' factors. There were multiple stimuli for each emotion. As Georgopoulos et al. (2022) outlined, we targeted as large a sample of autistic adults as would commit to a testing session that might span anywhere from 3 to 5 h. To our knowledge, sample size estimates based on meta-analysis outcomes and approaches within GPower and R-packages do not accommodate designs including a between-subjects factor and three within-subjects' factors. Consequently, in all analyses reported we place a major emphasis on effect sizes and the likely stability of measures.

After participants identified the emotion expressed by the target stimulus on each trial of the social stimulus type condition, they offered their (free-report) perspective on the appropriate empathic response to that person's emotion. These responses were the focus here.

Materials

Stimuli were from the EU-Emotion Stimulus Set database (O'Reilly et al., 2012, 2016)[2]; we used the high intensity versions of 12 emotions, displayed in the form of static

[2]Bona fide researchers may access the stimuli via the database manager, H. O'Reilly of the ASC-Inclusion Project: Autism Research Centre, University of Cambridge, UK. Email: heo24@medschl.cam.ac.uk.

images, dynamic video clips (a video of the person making the facial expression), and contextual social scenes (without vocalizations), displayed by a number of (non-autistic) actors of different age, race and sex. The database was chosen because it accommodated all variables within the overall design using consistent stimulus targets, presentation formats and contexts, and provided emotion recognition validation data. The contextual social scenes stimuli were used to generate participants' perspectives on the appropriate responses to other's emotions. Stimuli were presented, and participants' free-report responses entered, on a 15-in. Apple Macbook Pro.

Trials for the three distinct types of stimuli were presented in a block in random order; the order of each block was counterbalanced. The social task stimuli were video clips of an interaction between two people that provided important contextual visual information. For example, one clip showed a person responding with visible disgust after the second actor in the interaction sneezed without shielding or directing their sneeze away from them. After providing their emotion recognition response (accurate response = disgusted), participants described (i.e., a free report response) what they considered would be an appropriate empathic response from the second actor (e.g., "I am very sorry that I sneezed on you. I did not feel that sneeze coming."). Another clip showed one of the two people in the interaction walking along staring at their phone and bumping into the back of the other person who was drinking from a cup; the other person appeared visibly angry. After providing their emotion recognition response (accurate = angry), participants described what they considered would be an appropriate response from the second actor to the target individual after having observed their angry expression. A response deemed appropriate would be one that provided an apology and some type of explanation (e.g., "I am so sorry that I bumped into you like that. I wasn't watching where I was going."). Participants' emotion recognition responses and their perspectives on the appropriate response to the others' emotions were the focus in analyses.

To maximize trial numbers for analyses of responses to the target individual's emotion expression when the emotion had been recognized accurately, we included all available social stimuli ($N = 74$) from the emotion stimulus database for the 12 emotions, resulting in uneven trial numbers (4–7 trials, Mdn = 7) for each of the 12 target emotions.

The following URL provides two examples of social task stimuli:

- Social: https://qualtrics.flinders.edu.au/jfe/form/SV_9oad9qroRmS3yrr.

Emotion

The 12 emotions examined were the six typically classified as "basic" emotions (afraid, angry, disgusted, happy, sad, and surprised) and six other emotions (ashamed, disappointed, frustrated, hurt, jealous, and worried) often referred to as "complex" emotions.

Measures

The two key dependent measures were appropriateness of, and confidence in, responses to emotions. Accuracy of the free-report recognition responses for the social stimuli (reported in Georgopoulos et al., 2022) was also required to examine appropriateness of responses on only those trials when emotion recognition was accurate.

Appropriateness of empathic responses to others' emotions

Scoring appropriateness of empathic responses involved the following steps. Three clinical psychology doctoral students independently provided their perspective on a socially appropriate response for each of the 74 scenarios. Their perspectives were scrutinized by one of the authors to ensure they were providing sufficient detail to guide the subsequent coding. Then, after identifying a common theme in their responses to each stimulus, the three individuals collaborated to write detailed scoring criteria that encompassed the agreed appropriate theme for each scenario.

Participant responses on each trial considered appropriate and inappropriate were assigned scores of 1 and 0, respectively. For some scenarios, a score of 0.5 was assigned when the raters agreed that the response was not inappropriate but lacked depth. For example, one social stimulus clip depicted a person using a fake spider to play a trick on another who was visibly afraid of the spider. An appropriate response to the person (score = 1) who was afraid of the spider included an apology and reassurance that the spider was fake in an attempted prank (e.g., "I am sorry. Don't worry it is only a fake spider") whereas just an apology (e.g., "I am sorry") without further explanation received a score of 0.5. A response that only mentioned the spider being fake or that it was a prank (e.g., "It is a fake spider" or "It was a joke") received a score of 0. (All coding classifications can be viewed at https://osf.io/ndbfs/.) Finally, an overall appropriateness index for each participant's responses was derived as per the following example: if, across 6 trials involving the social presentation of "afraid," a participant received scores of 1, 1, 0, 0.5, 1 and 1, their overall score was 4.5 of a possible 6, translating into an overall appropriateness index of 75.0%.

To assess reliability, two raters (the first of whom was blind to the study aims and not associated with the development of the "appropriateness" coding) were provided with the scoring protocol and a subset of approximately 20% ($n = 1930$) of randomly selected participant

responses to score; Cohen's kappa = 0.87. The first rater then scored the remaining responses ($n = 7960$). To check for rater drift, the second rater also scored another random subset of 800 responses; Cohen's kappa = 0.93.

Emotion recognition accuracy

Coding of and reliability assessment for emotion recognition accuracy for free-report responses are described in Georgopoulos et al. (2022) and those data are used here in the section of the Results examining participants' perspectives on appropriate responses to those emotions that were recognized accurately.

Confidence

Participants' confidence in their perspectives on appropriate empathic responses was assessed after each participant's response using an 11-point scale ranging from 0% to 100%.

Community involvement statement

One of the authors is a practicing clinical psychologist who consults extensively with autistic adults and children; another has conducted social skills workshops for autistic adults. One autistic adult was involved in all stages of coding, the appropriateness protocol development and reliability assessments.

Procedure

The project was approved by the Social and Behavioural Ethics Committee, Flinders University. Participants were tested individually at home or on campus and received a cash honorarium to acknowledge their substantial time commitment over the entire project. The WASI-II administration preceded the emotion recognition tasks. At the beginning of each task (i.e., static, dynamic, and social), the experimenter read aloud the instructions on the laptop screen and checked that participants understood task requirements. Participants completed two practice trials prior to each task and were instructed to respond as quickly and accurately as possible.

Statistical analyses

Statistical analyses focused on (a) the appropriateness of participants' responses to others' emotions, (b) their confidence in those responses, and (c) participants' awareness of, or insight into, the appropriateness of their suggested empathic responses. Both the mean percent appropriateness index and confidence for each participant's responses were computed across the 4–7 trials for each emotion that required a response, followed by a 2 (Group) × 12 (Emotion) mixed ANOVA. Alpha = 0.05 and effect sizes are reported as generalized eta squared ($\eta_G 2$) and partial eta squared (η_p^2), with guidelines for small, medium and large effects guided by generalized eta squared (η_G^2) values of 0.01, 0.06, and 0.14, respectively (cf. Lakens, 2013).

Participants' metacognitive awareness of the appropriateness of their empathic responses was examined using two approaches. First, confidence judgments provided for each response were used to compute confidence-appropriateness Gamma (G) correlation coefficients for individual participants, informing understanding of inter-individual variability and group differences in the discrimination of appropriate from less appropriate empathic responses. Second, confidence-appropriateness calibration curves illustrated the sensitivity with which participants monitored the appropriateness of their responses to others' emotions.

RESULTS

Appropriateness of responses to others' emotions

The ANOVA revealed a significant effect for emotion, F (8.22, 1051.68) = 105.26, $p < 0.001$, $\eta_G^2 = 0.34$, $\eta_p^2 = 0.45$, with the appropriateness index ranging from 7.07% to 63.68%. The appropriateness index was highest for three basic emotions (sad, happy, and surprised) and lowest for three complex emotions (jealous, hurt, and ashamed). (See Supplemental Materials Table S1 for patterns for all emotions.)

There was a very weak but significant effect for group, F (1, 128) = 5.32, $p = 0.022$, $\eta_G^2 = 0.02$, $\eta_p^2 = 0.04$, reflecting a higher overall appropriateness index for the non-autistic ($M = 43.17$, SE = 1.39, 95% CI [40.43, 45.84]) than the autistic group ($M = 38.10$, SE = 1.77, 95% CI [34.41, 41.41]). A weak Group × Emotion interaction, F (8.22, 1051.68) = 3.12, $p = 0.002$, $\eta_G^2 = 0.02$, $\eta_p^2 = 0.02$, reflected significant group differences on five emotions, four of which were basic emotions (see Supplemental Materials Table S2 for pairwise comparisons).

As noted earlier the two groups differed in age; however, the correlation between age and the appropriateness index was negligible, r (128) = 0.014, $p = 0.872$, and r_s (128) = 0.016, $p = 0.860$.

Confidence

For confidence, the effect of emotion was significant, F (7.78, 996.09) = 13.15, $p < 0.001$, $\eta_G^2 = 0.02$, $\eta_p^2 = 0.09$, with confidence ranging from 73.07% to 81.79%. Two of the three emotions with the highest

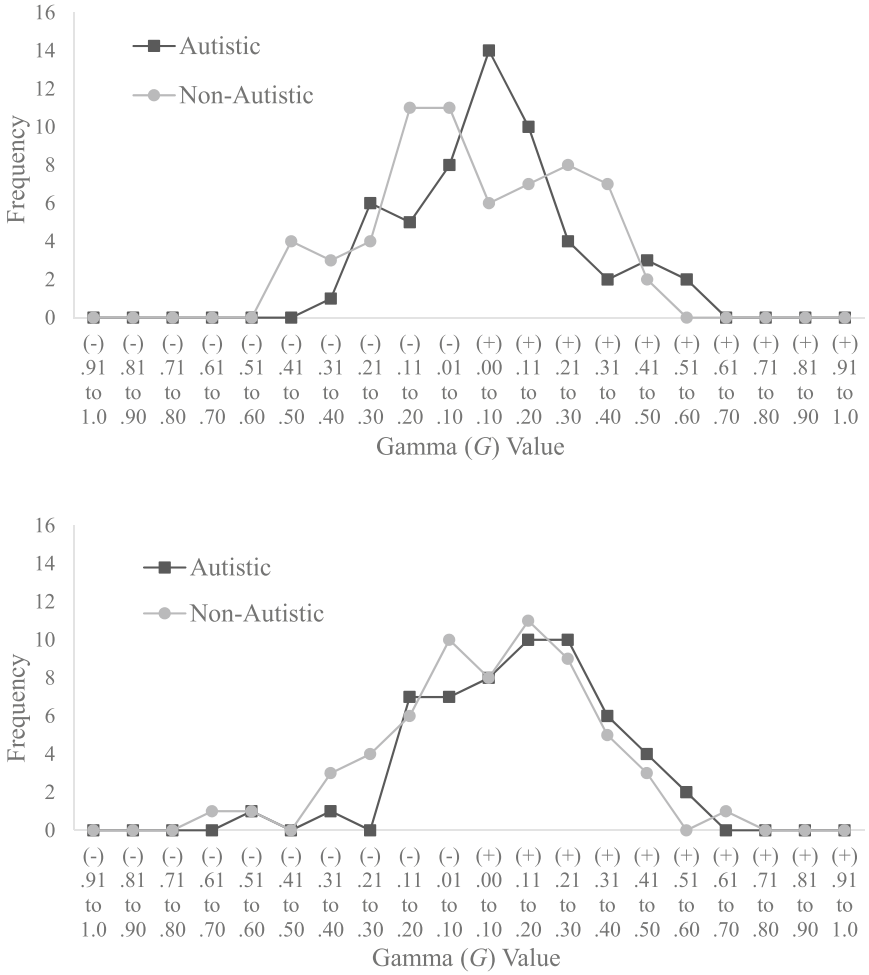

FIGURE 1 Distribution of the emotion responses confidence-appropriateness index Gamma values calculated from all responses with strict (upper panel)* and lax (lower panel) coding (*For the autistic group [strict coding], two G values [of +1 and −1] were omitted; G could not be calculated for five participants due to the participant assigning the same confidence value to each response. For the non-autistic group, two G values [of +1 and −1] were omitted; G could not be calculated for one participant).

average confidence ratings were basic emotions; the three emotions with the lowest average confidence ratings were complex emotions. (See Supplemental Materials Table S3 for patterns for all emotions.) A significant medium-sized effect for group, F (1, 128) = 14.23, $p < 0.001$, $\eta_G^2 = 0.09$, $\eta_p^2 = 0.10$, reflected lower confidence for the autistic ($M = 72.16$, SE = 2.39, 95% CI [66.79, 76.42]), than the non-autistic group ($M = 83.24$, SE = 1.74, 95% CI [79.90, 86.67]). A very weak but significant Group × Emotion interaction was detected, F (7.78, 996.09) = 2.77, $p = 0.005$, $\eta_G^2 = 0.003$, $\eta_p^2 = 0.02$, with pronounced group differences on all emotions, except frustrated (Supplemental Materials Table S4).[3]

Within-individual confidence-appropriateness relationships

Confidence-appropriateness index G correlations were calculated for each participant. Figure 1 indicates similar G coefficient distributions for both groups under strict (upper panel) and lax (lower panel) coding for appropriateness.[4] Appropriateness was coded using both strict and lax criteria to check that G patterns did not simply reflect the specific criterion used. There was considerable inter-individual variability in each group, but the overall coefficients were similar and small for both. Under strict coding, for example, G ranged from −0.33 to 0.61 ($M = 0.07$, SD = 0.22, Mdn = 0.07) and −0.50 to 0.46 ($M = 0.01$, SD = 0.25, Mdn = −0.00) for the autistic and non-autistic groups, respectively. Supplemental Table S7 shows the range, mean and median coefficients, and inferential group comparisons, for all conditions. Although the coefficients appear slightly larger for the autistic group, no difference was significant. And, although the inter-individual variability suggests that some individuals were aware when their responses were appropriate, many of the values suggesting a sizeable positive (or negative) correlation did not differ significantly from zero.

[3]As the data violated some assumptions of parametric ANOVA, appropriateness index and confidence data were also analyzed with non-parametric tests. Patterns were consistent across both tests; non-parametric analysis results appear in Supplementary Materials Tables S5 and S6.

[4]Under the strict coding of appropriateness, only scores of 1 were coded as correct.

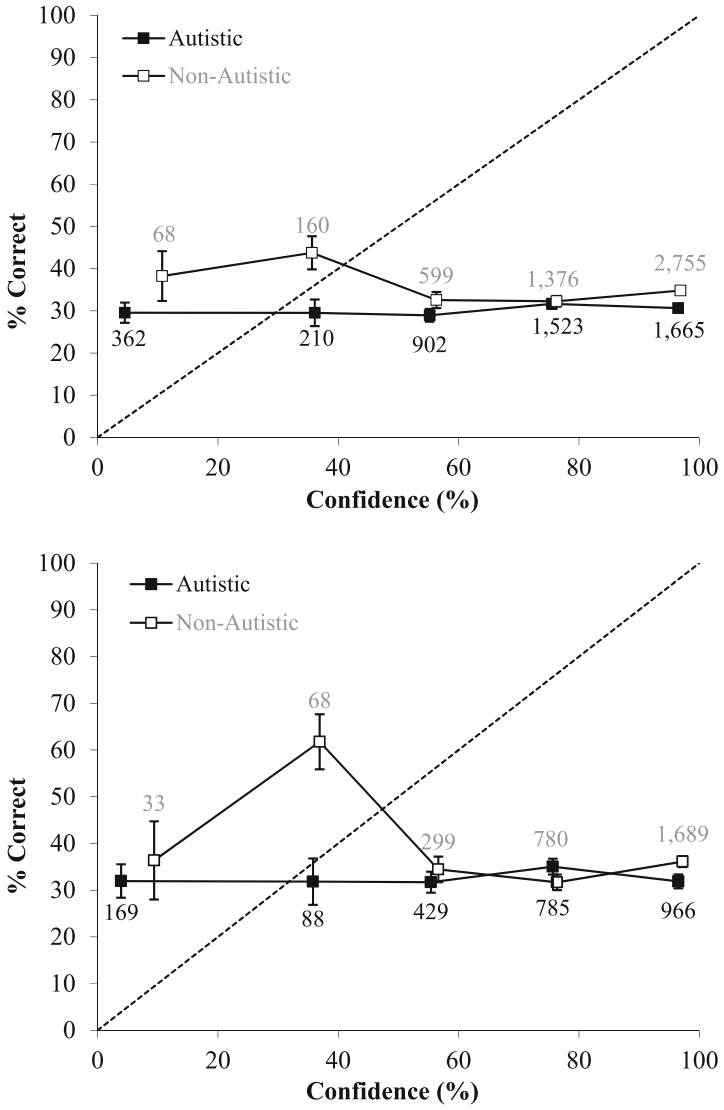

FIGURE 2 Confidence-appropriateness index calibration curves for autistic and non-autistic groups for responses to others' emotions for all emotions. Upper panel includes all responses; lower panel includes only responses when emotion recognition was accurate. Number of data points in each confidence category are shown. Dotted line represents perfect calibration. Error bars represent standard error.

Confidence-appropriateness index calibration

Confidence-appropriateness index calibration curves for each group for responses to others' emotions for all responses were derived by (a) collapsing the confidence data into five categories (i.e., 0%–20%, 30%–40%, 50%–60%, 70%–80%, and 90%–100%) to ensure stable estimates in each, (b) plotting the proportion of appropriate responses to others' emotions in each category against the weighted mean confidence for that category.[5]

The resultant curves (see Figure 2, upper panel) provide no evidence that confidence in, and the appropriateness of, responses to others' emotions were calibrated for either group. Responses offered with progressively higher levels of confidence were no more likely to be appropriate than less confident responses. Moreover, both curves reflected pronounced overconfidence when participants used the upper half of the confidence scale where most responses were located. Note also that non-autistic individuals contributed more observations than autistic individuals at the 90%–100% confidence level. (The same overall patterns prevailed for basic vs. complex emotions.)

Responses to others' emotions when recognized appropriately

As a failure to respond appropriately to others' emotions is unsurprising if interpretation of the emotion is awry, we also examined responses when emotion recognition was accurate. First, we examined responses for individuals whose recognition performance might be considered "good." To secure an adequate number of participants who recognized an emotion at a reasonably high level,

[5]Curves are based on strict coding of appropriateness. The only difference when using the lax scoring was that the curves for both groups indicated marginally higher appropriateness indices at each confidence level.

TABLE 1 Mean (and SD) appropriateness index and inferential statistics for responses to others' emotions for autistic and non-autistic groups when recognition accuracy was 75% or higher.

Emotion	Group	*n*	*M* (SD)	*t* (df)	*p*	Hedge's *g*
Afraid[a]	Autistic	37	41.22 (24.61)	1.29 (85)	0.202	0.28
	Non-autistic	50	47.50 (20.91)			
Angry[a]	Autistic	36	33.93 (17.86)	2.18 (81)	0.032[b]	0.48
	Non-autistic	47	42.55 (17.87)			
Ashamed	Autistic	26	8.24 (12.24)	1.49 (55)	0.142	0.39
	Non-autistic	31	4.15 (8.41)			
Disappointed	Autistic	5	30.00 (12.78)	0.13 (6)	0.901	0.08
	Non-autistic	3	28.57 (18.90)			
Disgusted[a]	Autistic	44	38.26 (21.52)	0.81 (77.76)	0.422	0.17
	Non-autistic	52	35.10 (15.86)			
Frustrated	Autistic	57	45.18 (22.13)	0.32 (120)	0.747	0.06
	Non-autistic	65	46.35 (17.91)			
Happy[a]	Autistic	31	61.29 (24.52)	1.71 (55.20)	0.093	0.43
	Non-autistic	33	70.56 (18.19)			
Hurt	Autistic	15	35.71 (25.04)	1.59 (40)	0.120	0.50
	Non-autistic	27	25.66 (16.00)			
Jealous	Autistic	21	36.31 (31.60)	0.36 (46)	0.721	0.10
	Non-autistic	27	39.82 (34.85)			
Sad[a]	Autistic	16	62.05 (23.72)	1.24 (42)	0.223	0.38
	Non-autistic	28	69.39 (15.66)			
Surprised[a]	Autistic	7	57.14 (14.29)	0.00 (8)	1.000	0.00
	Non-autistic	3	57.14 (14.29)			
Worried	Autistic	16	30.63 (25.16)	2.02 (34)	0.051[b]	0.662
	Non-autistic	20	45.50 (19.05)			

[a]Denotes basic emotion.
[b]Non-significant in non-parametric test.

"good" was denoted by the individual achieving recognition accuracy on an emotion of 75% or higher. "Good" performance was classified separately for each emotion because individuals' performance varied across emotions, as did the number of individuals who performed at that level. For 10 of the 12 emotions, 15–65 individuals met the 75% recognition accuracy criterion. Two emotions (surprised and disappointed) provided too few participants in each group (between 3 and 7) who reached the criterion.

Table 1 shows the mean (and SD) appropriateness index for responses to emotions by the two groups when recognition accuracy was "good," together with a *t*-test contrast, for each emotion. We emphasize three features of these statistics. First, for many emotions, the appropriateness index was relatively low, especially for complex emotions. Second, the variability within each group was substantial. Third, given the relatively low numbers in each group who met the "good" recognition criterion, the appropriateness index patterns need to be interpreted cautiously. Most of the group differences were nonsignificant. The effect size indices provide tentative pointers to where significant group differences might have been detected with much larger samples, but we again caution that most effects were weak.

For three emotions—angry, worried and happy (two of which are basic emotions)—non-autistic adults were more likely to offer appropriate responses, with the effect sizes suggesting a medium (worried) or a weak effect (angry, happy). For two emotions—afraid and sad (basic emotions)—the effect sizes were even weaker but suggest, with much larger samples, a significant effect, again favoring the non-autistic group, might be detected. For the remaining five emotions, there was no indication that non-autistic individuals were more likely to offer appropriate responses. There was no hint of a group difference for three of those emotions (disgusted, frustrated, and jealous). For the other two—hurt (medium effect) and ashamed (weak effect)—the appropriateness index was higher for autistic than non-autistic individuals, although both groups performed close to the floor for ashamed.

We also examined responses for which the associated individual recognition response was accurate: that is, examining appropriate responses by trial rather than participant. Table 2 shows appropriateness indices when emotion recognition was accurate using a lax criterion

TABLE 2 Appropriateness index for responses to others' emotions for autistic and non-autistic groups, when emotion recognition was accurate (lax coding, Georgopoulos et al., 2022).

	Autistic		Non-autistic	
Emotion	**Number of responses**	**Appropriateness index (%)**	**Number of responses**	**Appropriateness index (%)**
Basic				
Afraid	294	45.07	332	46.54
Angry	364	35.16	390	43.46
Disgusted	297	41.08	329	39.06
Happy	287	55.05	312	68.11
Sad	239	60.46	301	72.09
Surprised	212	54.72	241	64.73
All basic emotions	1693	47.31	1905	54.49
Complex				
Ashamed	297	7.24	351	5.41
Disappointed	150	36.67	161	37.27
Frustrated	209	44.74	244	45.08
Hurt	294	25.85	358	23.60
Jealous	124	37.50	144	40.97
Worried	184	38.59	199	51.76
All complex emotions	1258	28.90	1457	29.89
Overall	2951	39.46	3362	43.83

(cf. Georgopoulos et al., 2022); using a strict criterion did not change the overall picture. The appropriateness index was higher among non-autistic participants for four of the six basic emotions (angry, happy, sad, and surprised) and only one of the six complex emotions (worried). These emotions corresponded to those highlighted by the participant-level analysis, except for "surprised" (for which few participants reached the 75% accuracy criterion).[6] Thus, whether we focused on accurate recognition trials or relatively accurate individuals, when emotion recognition was good there was a weak trend for non-autistic individuals to be more likely to provide an appropriate response than autistic individuals for basic, but not complex, emotions.

Confidence-appropriateness index calibration

The unusual nature of the data (i.e., different individuals contributing to "good" performance on different emotions) does not prevent an examination of confidence-appropriateness index calibration at the group level where all relevant trials for each group are sorted by confidence category. The calibration curves when recognition was accurate (Figure 2, lower panel) closely resemble those for all appropriateness responses (but for one non-autistic plot point based on few observations). Again, there was no indication that responses associated with progressively higher levels of confidence for either group were more likely to be appropriate. Both curves were relatively flat and reflected pronounced overconfidence when participants used the upper half of the confidence scale where the bulk of responses were located.

[6]Note that the difference in the appropriateness index between autistic and non-autistic "good recognizers" that appeared to favor the former on the emotions "hurt" and "ashamed" was extremely small when only accurate recognition responses were examined.

Exploratory analyses

Because the distribution of males and females differed between groups, we examined male–female differences in appropriateness of, confidence in, and metacognitive awareness of empathic responses (see Supplementary Materials, pp. 8–13). The only discernible pattern was the suggestion of a very small superiority of female over male autistic individuals on the appropriateness index.

DISCUSSION

We examined autistic adults' perspectives on appropriate empathic responses to non-autistic adults' facial emotions. There were five main findings. First, although the percentage of appropriate responses was lower for autistic than non-autistic adults, the difference was small and largely confined to basic emotions; moreover, for both groups the appropriateness indices were relatively low. Second, confidence in these responses was lower for autistic individuals. Third, the patterns for (a) individuals whose recognition of facial emotions was generally

accurate, and (b) trials where emotions were recognized accurately, were inconsistent with the view that autistic individuals are unilaterally less likely to suggest an appropriate empathic response than non-autistic individuals. The marked variability in performance in both groups, coupled with relatively weak group differences, resulted in substantial overlap between groups. Thus, a lack of appropriate social responsiveness by autistic individuals was not ubiquitous, which is inconsistent with the existence of a core affective empathy "problem" in autistic adults. Fourth, although the data patterns for responses following accurate recognition responses of many basic emotions suggested possible differences favoring non-autistic individuals, such effects were relatively modest.

Fifth, although Brewer et al.'s (2022) findings highlighted awareness of the accuracy of emotion recognition responses among both autistic and non-autistic individuals, this did not apply to awareness of the appropriateness of empathic responses. The within-individual confidence-appropriateness index coefficients provided no indication that either group reliably discriminated appropriate from inappropriate empathic responses. And the confidence-appropriateness index calibration curves for the two groups for all responses—and for accurately recognized emotions—provided no evidence of finely tuned metacognitive awareness. Both groups were often highly confident in the appropriateness of inappropriate responses to others' emotions and unconfident in appropriate responses. Interestingly, non-autistic individuals provided many more extremely high confidence responses.

Limitations and future directions

Our findings prompt several important questions. First, why are the overall appropriateness scores relatively low across emotions, even in the presence of accurate emotion recognition? Perhaps it is an inevitable reflection of the subjectiveness of the normative appropriateness index and the way in which the judges' schemas have been translated into the appropriateness coding index. Perhaps people in general simply lack such skills. Or perhaps aspects of our paradigm curtail individuals' ability to demonstrate their empathic awareness. In daily interactions, for example, individuals have the opportunity to process feedback from their interaction partner—whether it be subtle or explicit—and promptly adapt or elaborate their response.

Second, why might autistic–nonautistic differences be largely confined to basic emotions—assuming the relatively weak effects suggested by our data prove to be reliable? One possibility is that the range of plausible appropriate responses for the complex emotions is much wider, with many perhaps not described by participants with sufficient clarity to be captured by our coding protocols. Another possibility is that scripts for interpreting and responding to basic emotions—scripts that are likely to be well rehearsed among non-autistic individuals—are just eschewed by many autistic individuals.

Third, although within-group variability was large, the between-group differences were not. The implications of this for possible differences in everyday social functioning and competencies are unclear. We do not know how large a departure from normative interpretations of appropriate empathic responses observed in the lab context is necessary to be reflected in a meaningful impediment to identifying appropriate empathic responses during everyday social interactions. And, although it may seem trite to say so, the impact of such departures in daily life will clearly depend on the perceivers who are making the normative judgments of appropriateness. Moreover, everyday interactions are typically replete with a variety of potentially important contextual cues—such as those offered by subtleties of gesture, voice tone, the preceding and likely subsequent context, the nature of the relationship between the interaction partners and so on—many of which are difficult to capture, or unlikely to be captured, in the lab setting (Stellar & Duong, 2023). Whether the opportunity to exploit such cues in real-life interactions might narrow or enlarge the group differences we observed here remains to be seen.

Future research with large samples would also allow a more robust examination of the possible impact of sex differences on the between-group differences in appropriateness of empathic responses. Our exploratory analysis of sex differences suggested the possibility of a relatively small superiority of female over male autistic individuals. Whether this difference will prove reliable and translate into meaningful consequences for real-life interactions is unknown.

Fourth, we can only speculate about reasons for the lower confidence expressed by autistic individuals, a finding that parallels the significantly lower pre-task emotion recognition confidence for autistic than non-autistic adults reported by Brewer et al. (2022). Perhaps autistic individuals have learned from popular characterizations of the condition—or from frequent negative feedback (or stigmatizing) about their social behavior (cf. Schriber et al., 2014)—to be more measured in their self-appraisals. Regardless of the key contributing factors, Schriber et al.'s (2014) research into the personality characteristics of autistic individuals indicates a general awareness of difficulties that may characterize their social interactions, an awareness that may well undermine confidence in the likely appropriateness of their social behavior. Whether low confidence might inhibit expressions of empathy in day-to-day interactions would be an interesting avenue for research.

Fifth, the relationship between knowing what might constitute an appropriate response and convincingly executing the corresponding behavior is also unclear. An

individual may recognize and appreciate another person's emotional state, be able to nominate an appropriate empathic response, but not be sufficiently adept to respond effectively.

The finding that neither autistic nor non-autistic individuals were well attuned to the appropriateness of their suggested empathic responses highlights a sixth issue. Perhaps judgments of the appropriateness of empathic responses in daily life are rather idiosyncratic or involve a substantial degree of guesswork, much like our metacognitive data suggest. Alternatively, perhaps providing metacognitive judgments about the appropriateness of "hypothetical" responses (i.e., merely nominating an appropriate response) to others' emotions is not something with which people are well-practiced. Rather, it may be that in real-life interactions the likely appropriateness of our behavior is signaled by the nonverbal and verbal reactions that an interaction partner displays following the expression of an empathic response.

Three other issues merit comment. First, at the outset we outlined some of the ways in which researchers have operationalized empathy: for example, recognizing others' feelings, reporting one's own emotional reactions when confronted with others' emotions, and the (often-neglected) pro-social dimensions of empathy (cf. Depow et al., 2021) such as recognizing what might be an appropriate empathic response and then executing it. In sum, definitions and operationalizations of empathy vary widely (cf. Stellar & Duong, 2023) and, as Depow et al. (2021) argued, the precise relationships and interactions between these dimensions—although separable in principle—are mostly unclear. Although our study taps into two of these dimensions and the relationships between them—specifically, recognizing others' feelings (captured by our emotion recognition data) and identifying an appropriate empathic response (captured by participants' perspectives on how to respond to others)—it does not tap into participants' own emotional reactions or their execution of empathic responses. Nor does it address the relationships between all of these dimensions of empathy.

Second, the dominant research paradigm in this general area—and the one employed in our study—has involved autistic and non-autistic individuals' responses to the emotions of non-autistic targets. The likelihood that autistic individuals' empathic responses may differ when interacting with other autistic individuals (and vice-versa for non-autistic individuals) has garnered attention in considerations of the "double empathy problem" (e.g., Fletcher-Watson & Bird, 2020; Milton, 2012). A growing body of research suggests (a) an improved social experience when autistic individuals relate to other autistic individuals (e.g., Crompton, Hallett, et al., 2020), (b) non-autistic individuals find it difficult to interpret the behavior of autistic individuals (e.g., Edey et al., 2016; Sheppard et al., 2016), and (c) communication breakdowns between autistic and non-autistic individuals but not between same group (i.e., autistic–autistic or nonautistic–nonautistic) individuals (Crompton, Ropar, et al., 2020). Thus, understanding emotion processing and empathic responding in autistic (and non-autistic) individuals in both interaction contexts will be required for a comprehensive appreciation of any difficulties that individuals may experience.

The third issue concerns the possible relationship between alexithymia and the identification of appropriate empathic responses, an association that has received considerable attention in recent literature on emotion processing in autism (e.g., Cook et al., 2013; Fletcher-Watson & Bird, 2020). Practical constraints on the number of measures included in our study meant that our study cannot speak to this issue, but we note two points, the first previously highlighted in Brewer et al.'s (2022) study of metacognitive awareness in autistic adults. Huggins et al. (2021) used a behavioral measure of emotional self-awareness rather than one of the commonly used self-report alexithymia instruments that have consistently suggested poorer emotional self-awareness in autistic than non-autistic individuals. Individuals with high autistics traits underestimated their emotional self-awareness whereas those with low autistic traits did the opposite. Huggins et al. suggested that autistic individuals' poorer emotional self-awareness as measured by self-report scales may merely reflect a lack of confidence in their abilities in this domain. Second, and consistent with this characterization of autistic individuals, our data revealed lower confidence levels for autistic than non-autistic individuals, with the confidence-appropriateness index calibration data showing that non-autistic individuals were much more likely to express extremely high confidence in the appropriateness of their empathic responses whereas autistic individuals were more likely to use the lowest end of the confidence scale.

CONCLUSION

Our findings challenge the notion that autistic adults experience some pervasive difficulty in identifying appropriate empathic responses to others' emotions. Although the likelihood of identifying such responses was slightly lower for autistic adults, neither group excelled and there was substantial inter-individual variability and overlap between groups. Moreover, group differences were mostly only apparent for some of the basic emotions and, even then, the evidence was not decisive. Although autistic individuals were generally less confident in the appropriateness of their responses, the metacognitive awareness data revealed that neither group was attuned to variations in the appropriateness of those responses. Whether autistic (and non-autistic) individuals are able to translate their appraisal of what might constitute appropriate empathic responses into corresponding behavioral responses is a key issue for future research.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Open Science Framework at https://osf.io/ndbfs/.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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