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Social motivation across multiple measures: Caregiver-report of children with ASD

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Abstract

Social motivation is a foundational construct with regard to the etiology, neurobiology, and phenotype of autism spectrum disorder (ASD). Multiple theories suggest that early-emerging alterations to social motivation underlie a developmental cascade of social and communication deficits across the lifespan. Despite this significance, methods to measure social motivation vary widely, with little data to date as to how different measures might compare. In this study, we explore three existing caregiver-report measures that have been proposed to quantify social motivation among school-age children with ASD (n=18; all male) and without ASD (n=36; 50% female), with the broad goal of characterizing social motivation across measures and specific aims of investigating (1) diagnostic and sex differences in social motivation, (2) correspondence between measures, and (3) relationships between social motivation and broader social outcomes. Across all three measures, individuals with ASD had lower social motivation by caregiver report. However, they did display individual differences in the degree of social motivation reported. There were no differences in social motivation between males and females without ASD on any of the three measures. For the full sample, measures of social motivation correlated with one another as anticipated, and stronger social motivation was associated with stronger social skills and fewer social difficulties. Our data suggest that social motivation among children with ASD may be best conceptualized as an individual difference that is diminished on average relative to peers but which varies among children and adolescents with ASD, rather than as an absolute absence or uniform deficit.

Lay Summary

Several theories suggest that children with ASD experience less social motivation than their peers without ASD, contributing to difficulties in social skills. Based on multiple caregiver-report questionnaires, social motivation was reduced on average for school-age children with ASD but also varied among children with ASD. Stronger social motivation was related to stronger social skills and fewer social problems. Future work should include more girls with ASD, consider social motivation across age groups, and include first-hand perspectives from people with ASD.

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Conflict of Interest

The authors report no affiliations with or involvement in any organization or entity with any financial interest in the outcome of this project. Bernier is currently at Apple.

Keywords

social motivation; sex differences; social skills; affiliation

Introduction

Across several theoretical models, social motivation is a foundational construct with regard to the etiology, neurobiology, and phenotype of autism spectrum disorders (ASD). Multiple theories (Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012; Dawson, Webb, & McPartland, 2005) suggest that early-emerging alterations to social motivation underlie a developmental cascade of social and communication deficits across the lifespan. According to these frameworks, early integration of social stimuli into reward-processing neural systems promotes awareness and attention to social information among typically developing infants (Dawson & Bernier, 2007). This social motivation elicits frequent opportunities for social interaction and learning, facilitating the development of specialized neural systems for social cognition and behavior. Among infants later diagnosed with ASD, inefficient or ineffective integration of social and reward systems yields decreased social interest/attention, and subsequently fewer opportunities for social engagement and processing. Over time, these differences between children with and without ASD are compounded, promoting increasingly divergent developmental pathways with respect to social cognition and behavior (Chevallier et al., 2012; Dawson et al., 2005).

Approaches to measuring social motivation have taken a variety of forms in the literature to date, including measurement of social approach behaviors (e.g., Dubey, Ropar, & Hamilton, 2018; Kim et al., 2015), social attention via eye-tracking (e.g., Chakrabarti, Haffey, Canzano, Taylor, & McSorley, 2017; Traynor, Gough, Duku, Shore, & Hall, 2019), effects of social motivators on reaction time and accuracy (e.g., Demurie, Roeyers, Baeyens, & Sonuga-Barke, 2011; Neuhaus, Bernier, & Beauchaine, 2015), and psychophysiological changes associated with social versus nonsocial stimuli (e.g., Delmonte et al., 2012; Stavropoulos & Carver, 2018; Traynor et al., 2019). Observational and interview methods (e.g., Social Motivation domain of the Broader Phenotype Autism Symptoms Scale, Dawson et al., 2007; Social Motivation Interview, Elias & White, 2019) also offer insight into these processes. Such measures generate a wealth of rich information about social motivation, but often require specialized laboratory-based equipment and/or expensive training to collect and interpret. Consequently, most feasible for many researchers and clinicians are questionnaire measures of social motivation, particularly when working with child and adolescent populations. Caregiver-report tools are especially valuable, as they also carry the benefit of capturing information that cannot be observed within a limited clinic or research visit, and instead integrate information about a child's behavior across settings and circumstances.

Perhaps the most widely used questionnaire measure of social motivation at the present time comes from the Social Responsiveness Scale, currently in its second edition (SRS-2; Constantino, 2012). The SRS-2 was developed to characterize an individual's reciprocal social behavior within naturalistic settings for purposes such as differential diagnosis of

ASD, monitoring of symptom trajectories over time and treatment, and quantification of subclinical social deficits (Constantino & Gruber 2012). Factor analytic research indicates that the items on the SRS-2 are best interpreted as a single factor (Constantino et al., 2004). However, the measure's authors have identified "clusters" of items, affirmed through clinician consensus (Constantino & Gruber, 2012), that may be useful as targets of intervention. Among these clusters is a Social Motivation subscale comprised of 11 items assessing "the extent to which a rated individual is generally motivated to engage in social-interpersonal behavior" (p. 77, Constantino & Gruber, 2012), with items pertaining to social disinterest, avoidance of social interactions, and discomfort with interactions. Children and adolescents with ASD evidence greater difficulties on the social motivation subscale than their peers with either intellectual disability or typical development (Li et al., 2018; Sedgewick, Hill, Yates, Pickering, & Pellicano, 2016).

The Dimensions of Mastery Questionnaire (DMQ) is a multi-faceted measure assessing mastery motivation across several domains (Morgan, 1997; Morgan, Busch-Rossnagel, Barrett, & Wang, 1997; 2014). Caregiver-report on the DMQ provides two scores relevant to social motivation, termed "Social Persistence with Adults" and "Social Persistence with Children". Each of these scales contains 6 items related to enjoyment of social interactions and play, and efforts to initiate and maintain those interactions. Published findings with these subscales among children with ASD are limited (e.g., Garman et al., 2016), but data presented by the measure's developers indicate lower scores on both subscales of social persistence among children with ASD relative to peers with typical development (Morgan, Wang, Liao, & Xu, 2013).

The Wing Subgroups Questionnaire (WSQ; Castelloe & Dawson, 1993) is based on Wing and Gould's (1979) proposal that individuals' social behavior generally can be subgrouped as: *aloof*, characterized by avoidance of interaction and rare spontaneous social approaches; *passive*, characterized by tolerance of others' approach/interaction but rare spontaneous social approaches; *active-but-odd*, characterized by spontaneous social approaches that are frequent but ineffective or unusual in quality (referred to herein as 'active'); or *appropriate*, characterized by enjoyment and anticipation of social interaction. The WSQ (Castelloe & Dawson, 1993) utilizes caregiver-report ratings of the frequency with which a child displays each of the social styles. Frequency ratings for each social style are collected across thirteen sets of behavioral descriptions and are then combined in order to determine each child's dominant social style. This response method is a particular advantage, as it yields both a categorical outcome (subgroup with the highest frequency ratings) as well as continuous outcomes (frequency ratings for each social style) for an individual. Subgroup classifications based on caregiver-report with the WSQ show strong agreement with clinician-assigned subgroups (Castelloe & Dawson, 1993) and are largely stable over the course of development (Scheeren, Koot, & Begeer, 2020).

Despite the existence of these measures, relatively little information exists on how separate measures of the construct of social motivation relate to one another, particularly among children with ASD. The present study presents and compares three caregiver-report measures that can be viewed as quantifying social motivation among school-age children with and without ASD. In a small but carefully controlled sample of children, we aimed

specifically to (1) investigate possible differences in social motivation based on diagnosis and biological sex, (2) evaluate correspondence among measures of social motivation, and (3) consider associations between social motivation and more general social outcomes.

Method

Procedure

All procedures in this study were conducted in accordance with a protocol approved by the Seattle Children's Institutional Review Board, with informed consent and assent as appropriate. Data for the current analyses were provided by children and caregivers as part of their participation in a study of behavioral and physiological correlates of social motivation and reward.

Participants

A total of 54 families contributed data to the current analyses, within three groups of children aged 8 to 12 years: males with ASD (n=18), males without ASD (n=18), and females without ASD (n=18). All participants had fluent speech, and were free from history of seizure disorder, head injury, major psychiatric disorder, and medication use affecting EEG (relevant to experimental tasks not presented here). In addition, those with ASD met DSM-5 diagnostic criteria for ASD on the basis of ADOS-2 (Lord et al., 2012) and ADI-R administration (Lord, Rutter, & Le Couteur, 1994; Rutter, Le Couteur, & Lord, 2003). Those without ASD (referred to as "typically developing" from herein) had no current or historical concerns for ASD, based on caregiver report and screening questionnaires. Co-morbid mental health concerns were not exclusionary for either group. Within the sample, caregivers reported the following racial backgrounds for their participating child: 1.9% American Indian or Alaska Native; 3.7% Asian; 11.1% more than one race; 81.5% white; and 1.9% not reported. Demographic information is provided in Table 1.

Measures

Caregivers provided information regarding children's social motivation via multiple measures: (1) **Social Responsiveness Scale, 2nd Edition (SRS-2) Social Motivation subscale** (Constantino, 2012), which includes eleven items referring to one's interest and tendency to join in social interactions/settings, identified and affirmed via expert clinician consensus to reflect social motivation (Constantino & Gruber, 2012). (2) **Dimensions of Mastery Questionnaire, 17th Edition (DMQ)** (Morgan, 1997; Morgan et al., 1997), from which the score from the subscale *Social Persistence with Adults* was obtained to reflect social motivation with regard to adults, and the score from the subscale *Social Persistence with Children* to reflect social motivation related to peers. **(3) Wing Subgroups Questionnaire (WSQ)** (Castelloe & Dawson, 1993; Wing and Gould, 1979), which yields categorical information in the form of a dominant *social style* (appropriate, active, passive, aloof), as well as continuous scores reflecting the frequency or degree to which a child displays each of the four social styles.

Additionally, we collected the **Child Behavior Checklist (CBCL) Social Problems subscale** (Achenbach & Rescorla, 2001) as a measure of social difficulties demonstrated

in everyday life, and the **Vineland Adaptive Behavior Scales, 2nd Edition (Vineland-II) Socialization Standard Score** (Sparrow, Cicchetti, & Balla, 2006) reflecting interpersonal, coping, and related skills. Cognitive skills were assessed briefly by administering the Word Definitions and Matrices subtests of the **Differential Ability Scales, Second Edition** (**DAS-II**; Elliott, 2007). A comprehensive description of measures is presented in Supplemental Materials.

Analytic Plan

For single-outcome continuous measures of social motivation (SRS-2 Social Motivation, DMQ Persistence with Adults, DMQ Persistence with Children), we conducted a series of univariate analyses of covariance to examine effects of diagnostic group and participant sex on social motivation. Within these analyses, participant group (ASD males, TD males, TD females) was entered as a fixed factor, with age as a covariate to account for possible developmental effects on social motivation. To better understand omnibus effects, Helmert contrasts were performed to first consider effects of diagnostic group (ASD vs all TD) and then effects of sex (male vs female) within the TD participants. Note that analyses were conducted with both raw and standardized scores (i.e., T-scores) for the SRS-2 Social Motivation subscale; the pattern of results was unchanged and standardized scores were used for analyses presented here.

Because the WSQ yields categorical as well as continuous outcomes, we computed chi-square tests to consider the distribution of participants across those outcomes, as well as a repeated measures general linear model (GLM) to examine possible effects of diagnosis and group on continuous subscale scores.

In addition to these approaches, we also considered distributional properties in SRS-2, DMQ, and WSQ scores across diagnostic groups (collapsed across sex in the TD group). Two measures were computed in R (R Core Team, 2013), using the “compute.es” (Del Re, 2011) and “RProbSup” (Ruscio, 2019) packages, respectively. First, we computed Cohen’s U_3 (Cohen, 1988; Valentine & Cooper, 2003), an index of the “non-overlap” between ASD and TD distributions on each measure, which ranges from 50% (indicating total overlap between the two groups’ distributions) to an upper limit approaching 100% (indicating near total separation or “non-overlap” between the two groups’ distribution). Second, we computed the probability of superiority (Ruscio, 2008), which estimates the probability that the score from a randomly selected participant from one group (e.g., ASD group) will exceed the score from a randomly selected participant’s score from a second group (e.g., TD group). Higher values (i.e., approaching 1.0) indicate greater separation between the groups.

Finally, we computed Spearman rho correlations to explore associations between various measures of social motivation, as well as associations between social motivation and other measures of broader social functioning.

Results

Aim 1.

Effects of diagnosis and participant sex on social motivation—Table 2 presents descriptive statistics for continuous measures of social motivation, for the full sample as well as by participant group.

As shown in Figure 1, the omnibus ANCOVA for the SRS-2 Social Motivation subscale was significant, $F(3, 50)=7.13$, $p<.001$, $\eta_p^2=.30$, with a significant effect of group, $F(2, 50)=10.28$, $p<.001$, $\eta_p^2=.29$. Helmert contrasts indicated that participants with ASD had greater difficulties with social motivation than did those with TD, $p<.001$. There was not an effect of age in this model, $p=.36$. Among children with TD, there were no sex differences in social motivation, $p=.26$.

With regard to our second measure, the DMQ indicated similar results for caregivers' report of social persistence with adults. The overall model was significant, $F(3, 48)=4.92$, $p<.01$, $\eta_p^2=.24$, as was the effect of group, $F(2, 48)=6.69$, $p<.01$, $\eta_p^2=.22$. There was lower reported social persistence among participants with ASD relative to those with TD, $p<.01$. There was no effect of participant age, $p=.27$, and no effect of sex among participants with TD, $p=.08$.

Consistent with results presented thus far, social persistence with peers was again significant, $F(3, 47)=6.51$, $p=.001$, $\eta_p^2=.29$, with an effect of group, $F(2, 47)=9.76$, $p<.001$, $\eta_p^2=.29$, such that participants with ASD had lower persistence with peers than did those with TD, $p<.001$. There was no effect of age, $p=.99$, and no effect of sex among participants with TD, $p=.89$.

The WSQ, our third measure relevant to social motivation, revealed uneven distribution among Wing subgroups, $\chi^2(4)=29.4$, $p<.001$. All TD participants (100%) were best categorized by the 'socially appropriate' social style. Among participants with ASD, 53% were best categorized by the 'active' social style, 35% by the socially 'appropriate' style, and the remaining 12% by the 'passive' style. None of the participants were categorized as primarily 'aloof.' Bonferroni-corrected residuals revealed that, relative to an even distribution of groups across WSQ social styles, males with ASD were overrepresented in the 'active' style and underrepresented in the 'appropriate' style.

Caregiver ratings on the four subscales of the WSQ (appropriate, active, passive, aloof) were then examined for effects of group and age with a repeated measures GLM, with Greenhouse-Geisser corrected degrees of freedom due to violation of the sphericity assumption, $\chi^2(5)=36.1$, $p<.001$. There was a significant Group x Subscale interaction, $F(4.13, 101.14)=33.46$, $p<.001$, $\eta_p^2=.58$. For all four subscales, the ASD males differed from the TD groups (ps<.05); they were rated lower in 'appropriate' social behavior, and higher in 'active', 'passive', and 'aloof' social styles. There was no significant difference between the male TD and female TD groups on any of the four subscales, ps>.9. See Figure 2.

Figure 3 provides graphical depictions of each groups' scores across the four social behavior subscales within the WSQ. As shown, TD males and females appeared to have a strong dominant social style; that is, they displayed an 'appropriate' social style very frequently, with very low scores on the remaining subscales. By comparison, males with ASD appeared to have a less differentiated social style, with aspects of all four styles displayed to some extent rather than a single style that persisted across all settings. Although informal in nature, these observations suggest complexity and nuance of social behavior and motivation among individuals with ASD.

Aim 2.

Correspondence among measures of social motivation—Next, we aimed to understand how our various measures of social motivation relate to one another within our sample as a whole. Because these correlations may reflect in part diagnostic group differences between participants with ASD and those without ASD, we then computed correlations among measures within each of our three participant subgroups separately; correlations and results for TD participants are described in Supplemental Materials (see Table S1).

For the combined sample (Table 3, above diagonal in grey), nearly all of our measures of social motivation were associated with one another. Fewer difficulties with social motivation (via the SRS-2) corresponded to greater social persistence with adults and peers (via the DMQ) with small to moderate associations (r=−.286 and r=−.473, respectively), as well as more 'appropriate' social behavior on the WSQ (r=.−560). The four subscales of the WSQ were moderately correlated with one another such that 'appropriate' social behavior was negatively correlated with 'active', 'passive', and 'aloof' behavior (rs <−.674). In contrast, these three scales demonstrated positive correlations with one another, such that participants with relatively higher levels of one demonstrated higher levels of the others. Of note, the sole nonsignificant correlation (r=.237) among the combined sample was between the two scales within the DMQ, as social persistence with adults was not correlated with social persistent with children. Among our measures, these two scales are the only ones that distinguish between different social contexts or partners (i.e., adults versus peers). Their relative independence from one another suggests the importance of considering context when conceptualizing and evaluating social motivation, as it may vary across these factors.

Within the group of males with ASD only (as shown in Table 3 below the diagonal), caregiver report of greater difficulties with social motivation on the SRS-2 corresponded to poorer persistence with adults, as well as with less 'appropriate' social behavior and more behavior characterized as 'passive' or 'aloof'. Similarly, stronger persistence with adults was associated with more 'appropriate' and less 'passive' or 'aloof' behavior. A number of additional associations did not reach conventional levels of statistical significance (likely due to the reduced statistical power from subdividing the sample by sex and diagnosis), but inspection of correlation values suggested that stronger social motivation on the SRS-2 again corresponded to stronger persistence with peers (r=−.438) and less 'active' social behavior (r=.461), while more 'appropriate' social behavior on the WSQ corresponded to less 'active' (r=−.369), 'passive' (r=−.374), and 'aloof' (r=−.469) social behavior. As with the combined

sample, the two scales of the DMQ were unrelated to one another (r=−.113), suggesting again that social motivation with peers may be distinct from motivation with adults.

Aim 3.

Correlations between social motivation and social outcomes—Table 4 displays correlations between our measures of social motivation and measures of broader social outcomes, both social skills and social difficulties. As above, we present correlations first for the combined sample and then by subgroup, with the results for the TD participants presented in Supplemental Materials (see Table S2).

For the combined sample, social motivation and social outcomes were associated across all measures. Better social skills as assessed with the Vineland-II were moderately associated with fewer social motivation difficulties, stronger social persistence with adults and children, higher ratings on ‘appropriate’ social behavior, and lower ratings on ‘active’, ‘passive’, and ‘aloof’ social styles. Conversely, social problems as assessed with the CBCL were associated with poor social motivation and social persistence, less use of ‘appropriate’ social behavior, and higher ratings of ‘active’, ‘passive’, and ‘aloof’ social behavior. Among males with ASD, we observed significant associations between better social skills and stronger social persistence with adults, higher ratings on ‘appropriate’ social style, and less use of ‘active’ social style. Social difficulties were significantly and rather strongly associated with use of the ‘active’ social style.

Discussion

Our study is among the first to consider the construct of social motivation across multiple instruments in a concurrent manner. Most robust among our findings is a consistent pattern of reduced social motivation by caregiver-report among males with ASD, relative to males and females without ASD. As anticipated, measures of social motivation were positively correlated with one another, and were also correlated with social success for the sample as a whole, such that stronger social motivation was associated with stronger social skill and fewer social difficulties. Together, these findings reinforce both the validity of social motivation as a construct, as well as its importance in understanding individuals’ overall social experience.

Our data also add nuance to our understanding of social motivation in ASD. As evidenced by both continuous and categorical approaches, our participants with ASD varied substantially with regard to social motivation. Although their scores on continuous measures were lower *on average* than TD participants, they were nonetheless characterized by variability and broad range among individuals as shown in Table 2. Similarly, caregiver ratings across Wing social styles indicated that our participants with ASD displayed a variety of social behaviors in daily life, including those consistent with a degree of social motivation. Thus, our data suggest that social motivation among children with ASD may be best conceptualized as an individual difference that is diminished on average relative to peers but varies among children and adolescents with ASD, rather than as an absolute absence or uniform deficit.

These observations carry a number of implications. First, with regard to methodological practices, our data speak to the benefit of assessing social motivation in multiple forms that include categorical and continuous measures. By supplementing the categorical 'subgroup' approach of the Wing Subgroup Questionnaire with analysis of its continuous ratings across the social styles, we can develop a more nuanced perspective that recognizes the variability in social motivation and behavior that characterizes ASD.

As discussed, use of the WSQ in our sample identified approximately half (53%) of our group with ASD who were best described by the 'active' social style, as well as approximately 12% who were best described by the 'passive' social style. Surprisingly, over a third of the group (35%) with ASD were best described by the 'appropriate' social style. These distributions differ from those identified by Wing and Gould (1979) and some subsequent applications of this tool (e.g., Beglinger & Smith, 2005; O'Brien, 1996), particularly with regard to the absence of participants best described by the 'aloof' style. Some of this divergence may be due to differences in the informants who provided subgroup ratings across studies. For example, ratings have been solicited from caregivers (as in our sample), participants' classroom teachers (O'Brien, 1996), and clinicians (Castelloe & Dawson, 1989), and are likely influenced by the social settings and task demands in which a child's behavior is observed, as well as by the reporter's frame of reference.

Additionally, we suspect that differences in subgroup distributions are due to the nature of our participant group, which was characterized by relatively strong cognitive and verbal skills. Existing literature indicates lower cognitive and language skills among the 'aloof' subgroup relative to the other subgroups (Beglinger & Smith, 2005; O'Brien, 1996; Wing & Gould, 1979); thus, verbally fluent samples such as ours would likely have fewer participants characterized by the 'aloof' social style. Indeed, emerging longitudinal data with verbally fluent adolescents with ASD has documented subgroup distributions that are more comparable to our sample (Scheeren, Koot, & Begeer, 2020).

Clinically, variability in social motivation among children with ASD suggests the need for particular care in diagnostic contexts. Whereas ASD was once described as almost invariably including an absence of such motivation (e.g., characterized "by lack of responsiveness to, or interest in, people"; American Psychiatric Association, 1987, p. 34), we now recognize that the presence of social motivation among an individual does not preclude a diagnosis of ASD. Indeed, as our data underscore, children with ASD can demonstrate a variety of social styles in daily life, and rigid expectation that ASD will be associated with an absence of social motivation across contexts will likely lead to inaccurate diagnostic outcomes. Instead, we must consider both the degree of motivation (e.g., social approach, responsiveness to others, desire for relationships) and the quality of the behaviors expressing that motivation – that is, both social motivation and social skill – when considering a diagnosis of ASD. Such caution may be especially prudent in the context of average intellectual functioning.

With respect to theoretical implications, as we discuss above, the social motivation hypothesis proposes that early-emerging alterations to the integration of social input with reward mechanisms in the brain alters developmental trajectories for social cognition and

behavior (Chevallier et al., 2012; Dawson et al., 2005). Our findings are largely consistent with that hypothesis, as children without ASD had stronger motivation than those with ASD, and social motivation and social skill were positively correlated. While speculative, it may be that the variability in social motivation we observe here during middle childhood stems from very early variability in the strength of integration between social input and reward mechanisms, or in the timing with which those associations form, playing a role in the effectiveness and efficiency with which more sophisticated social cognition can emerge.

Limitations and Future Directions

A primary limitation of the current study is the absence of girls with ASD among our participants, as girls and women with ASD are underrepresented in the literature (Lai, Baron-Cohen, & Buxbaum, 2015), may be incompletely characterized by current diagnostic practices (e.g., Boorse et al., 2019; Dworzynski, Ronald, Bolton, & Happé, 2012), may demonstrate distinct patterns of social information processing (Harrop et al., 2018; Harrop et al., 2019) and may have different social experiences and trajectories in comparison to males with ASD (Lai & Szatmari, 2020). These differences may be especially prominent in a sample such as this one, in which participants had strong verbal and nonverbal cognitive skills (Dworzynski et al., 2012). Moving forward, better understanding of social motivation and its variability among girls with ASD is an important goal, particularly with regard to mental health outcomes, as previous work from our group suggests sex differences in the interactive effects of social motivation and emotional difficulties in broader social outcomes (Neuhaus, Webb, & Bernier, 2019). Exploration of Wing social styles among girls and women with ASD may also be important, especially in their potential to influence diagnostic referrals and outcomes.

In a similar vein, exploration of factors such as age (e.g., early childhood, school-age), verbal skills (e.g., fluency, minimally verbal), social partner/setting (e.g., family, peers at school), and informant (e.g., caregiver-report, self-report) will enrich our field's understanding of social motivation in ASD. The interactions between these factors will likely be especially important; for example, how might social motivation across partners and social settings change over time for children, teens, and adults with ASD? How might such trajectories influence diagnostic status, strategies for support, educational or vocational success, and mental health risks?

Equally important will be the manner in which we assess social motivation. Despite the usefulness and practicality of observational measures and ratings from caregivers or teachers, some element of social motivation is necessarily internal to an individual and so not accessible or apparent to outside observers. Thus, self-report of social motivation through questionnaire (e.g., Chevallier, Grezes, Molesworth, Berthoz, & Happe, 2012; Han, Tomarken, & Gotham, 2019) or interview methods (e.g., Elias & White, 2020) will be essential for a thorough and accurate understanding. Inclusion of self-report may also help to parse social motivation from social skill and social anxiety, as these constructs are likely conflated when assessments rely solely on others' observations (e.g., a caregiver's observation of a child's behavior) and may be best differentiated through self-report (Elias & White, 2020). Moreover, first-hand perspectives from individuals with ASD may also

reveal social motivation that is expressed through behaviors not conventionally interpreted as such by researchers and clinicians (Jaswal & Akhtar, 2018). Ideally, assessment of social motivation would span modalities and reporters, to integrate information gathered via observational, informant-report, and self-report tools.

As a whole, findings presented here argue for the continued importance of social motivation in conceptualizations of ASD, with stronger recognition of its variability among individuals. Rather than a constant or uniform deficit of ASD, social motivation may be best considered as an individual difference that varies substantially among individuals with ASD and promotes heterogeneity in the developmental trajectory, clinical presentation, subjective experience, and treatment outcomes among individuals with ASD.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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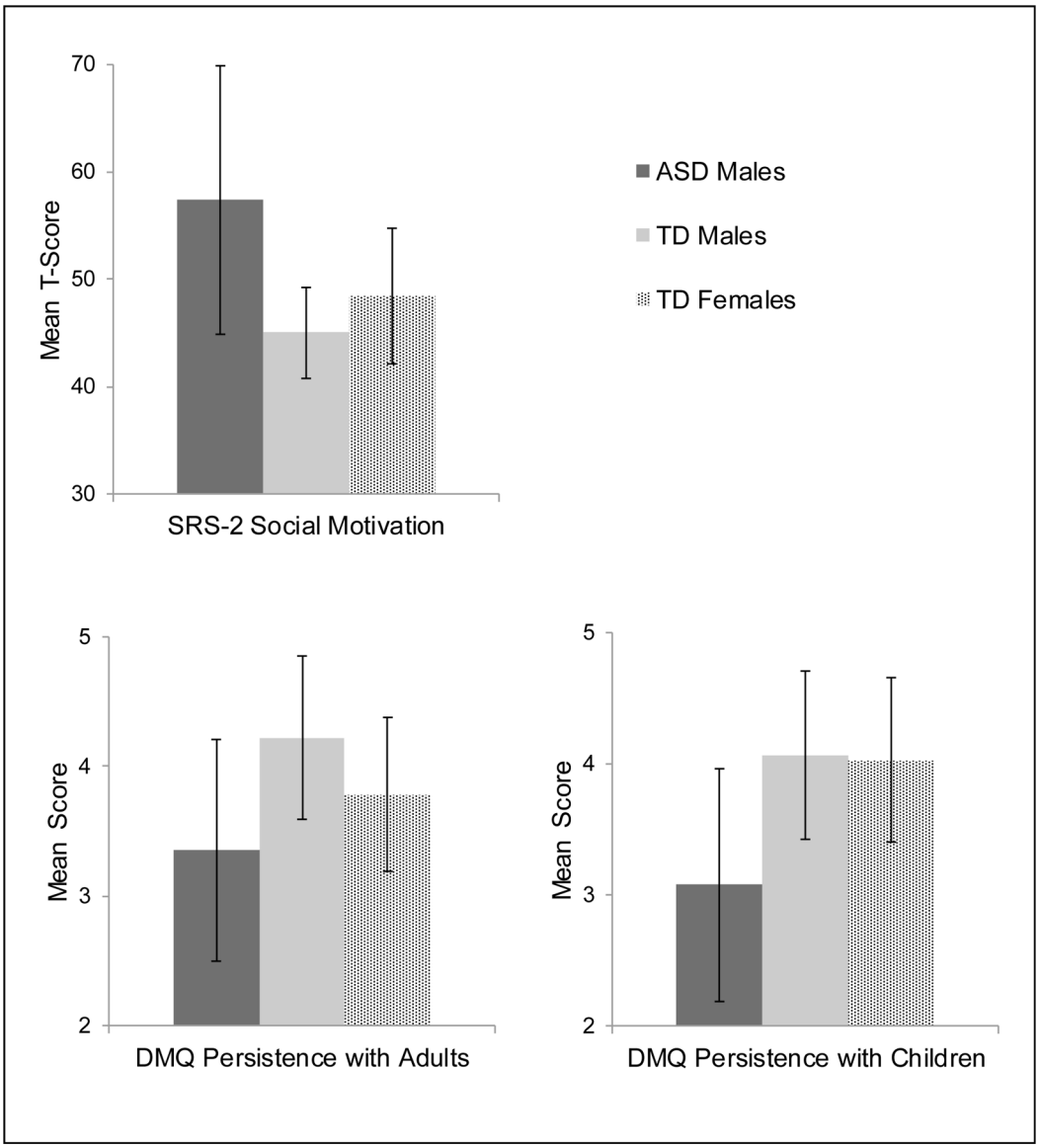

Figure 1: Social Motivation Assessed via SRS-2 and DMQ Subscale Scores by Group
Note: Error bars represent standard deviation.

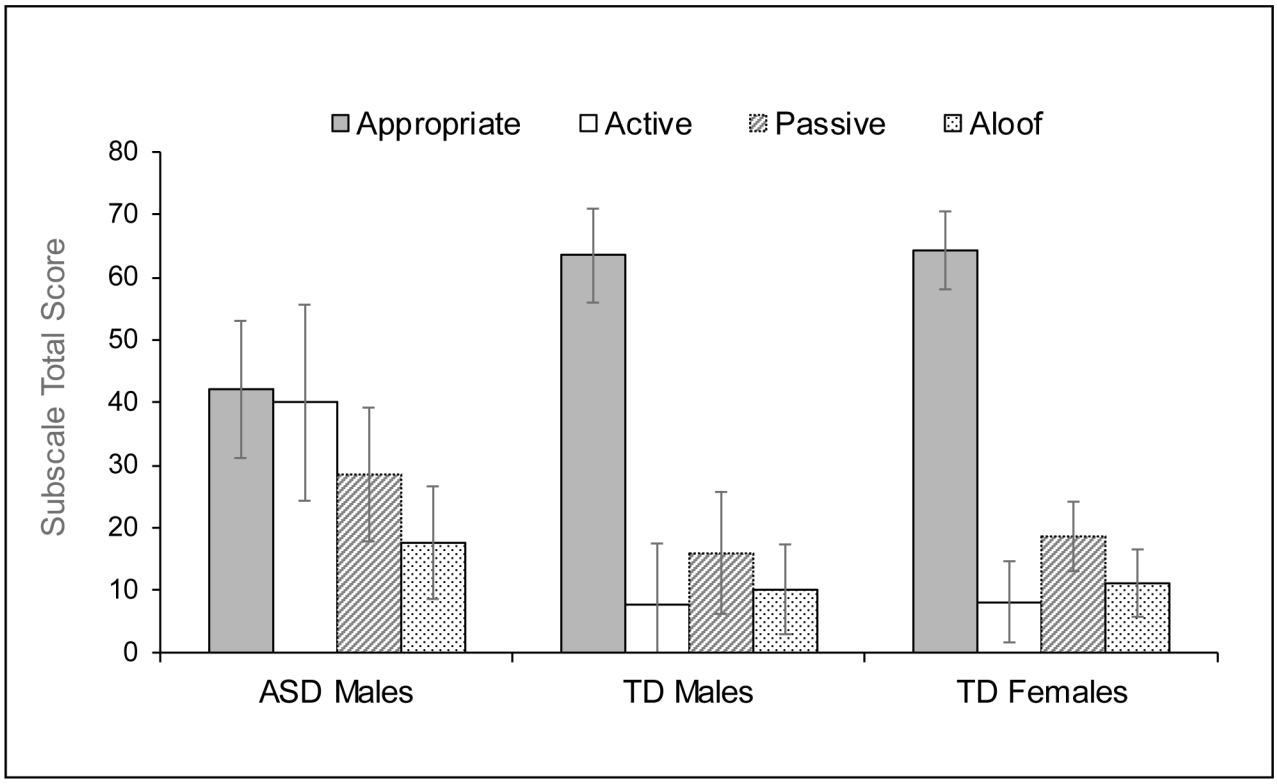

Figure 2: Subscale Ratings on the Wing Subtypes Questionnaire by Group
Note: Error bars represent standard deviation.

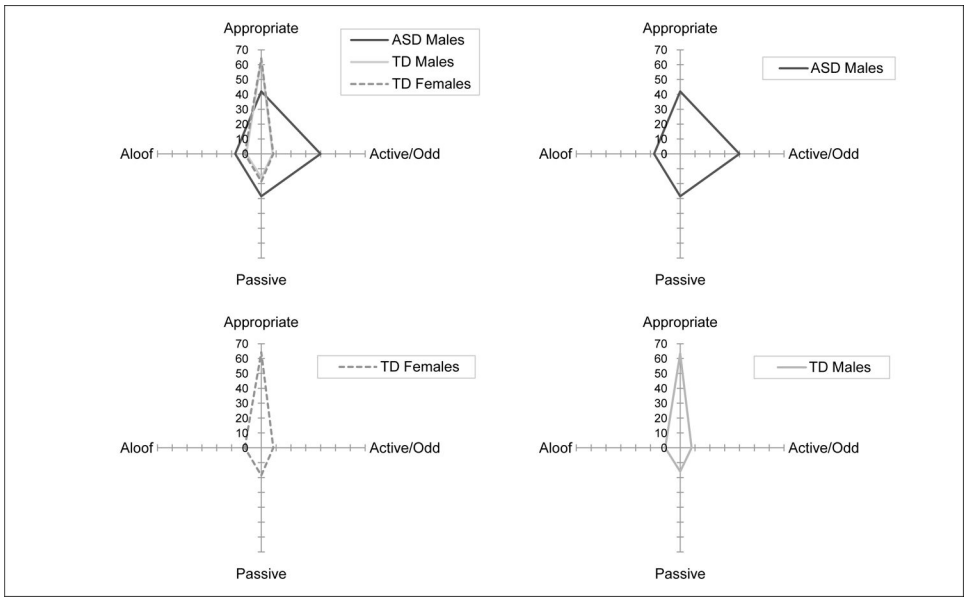

Figure 3: Radar Plot of Subscale Ratings on the Wing Subtypes Questionnaire by Group

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Table 1:

Descriptive demographic information by group and sex

	Combined	ASD Males	TD Males	TD Females
Age (years)	10.18 (1.31) Range: 8–12.9	10.23 (1.46) Range: 8–12.9	10.30 (1.15) Range: 8.3–12.9	10.02 (1.38) Range: 8.3–12.7
Verbal Skills *	57.15 (11.28) Range: 34–90	51.06 (9.64) Range: 34–71	61.56 (13.70) Range: 44–90	58.83 (7.31) Range: 45–75
Nonverbal Skills *	57.28 (10.56) Range: 24–80	57.83 (11.12) Range: 41–79	57.39 (9.57) Range: 36–80	56.61 (11.46) Range: 24–74
Adaptive Behavior Composite **	93.69 (13.2) Range: 65–122	79.89 (7.38) Range: 65–98	99.0 (9.59) Range: 87–122	102.17 (9.48) Range: 87–116
ADOS-2 Comparison Score	--	7.83 (1.51) Range: 5–10	--	--

Notes:

* Values represent mean, SD, and range for T-scores (mean=50, SD=10) on the Word Definitions and Matrices subtests, respectively, of the Differential Ability Scales, 2nd Edition (Elliott, 2007).

** As assessed via the Vineland Adaptive Behavior Scales, 2nd Edition (mean=100, SD=15; Sparrow, Cicchetti, & Balla, 2006).

Table 2:

Social motivation across measures by participant group

	Combined	ASD Males	TD Males	TD Females	Cohen's U_3 (ASD v TD)	Prob. of Sup. (ASD v TD)
SRS-S Social Motivation	50.28 (9.83) Range: 38–93	57.39 (12.51) Range: 42–93	45.0 (4.24) Range: 38–52	48.44 (6.32) Range: 38–62	89.55%	0.82 CI: 0.65–0.91
DMQ Social Persistence						
With Adults	3.79 (.78) Range: 1.7–5.0	3.35 (.86) Range: 1.67–4.67	4.22 (.63) Range: 3.0–5.0	3.78 (.59) Range: 2.83–4.5	81.77%	0.72 CI: .56–85
With Children	3.74 (.84) Range: 1.5–5.0	3.07 (.89) Range: 1.5–4.5	4.07 (.64) Range: 2.83–5.0	4.03 (.63) Range: 2.67–4.67	91.03%	0.81 CI: 0.66–0.92
WSQ						
Appropriate	56.87 (13.18) Range: 30–75	42.06 (10.96) Range:30–68	63.44 (7.5) Range: 45–73	64.28 (6.23) Range: 56–75	99.53%	0.93 CI: 0.76–0.99
Active	18.18 (18.66) Range: 0–59	39.94 (15.66) Range: 8–59	7.69 (9.75) Range: 0–36	8.11 (6.49) Range: 0–20	99.84%	0.95 CI: 0.86-.99
Passive	20.85 (10.27) Range: 1–47	28.47 (10.69) Range: 13–47	15.93 (9.74) Range: 1–44	18.56 (5.55) Range: 4–28	89.46%	0.79 CI: 0.62–0.90
Aloof	12.85 (7.88) Range: 0–39	17.58 (9.00) Range: 9–39	10.11 (7.17) Range: 0–30	11.12 (5.38) Range: 4–21	82.92%	0.78 CI: 0.64–0.88

Notes: SRS-2 – Social Responsiveness Scale, 2nd Edition (Constantino, 2012). DMQ – Dimensions of Mastery Questionnaire, 17th Edition (Morgan, Busch-Rossnagel, Barrett, & Wang, 1997). WSQ – Wing Subgroups Questionnaire (Castelloe & Dawson, 1993). CI – 95% confidence interval.

Table 3:

Correlations among measures of social motivation for combined sample (above diagonal in grey) and ASD males only (below diagonal).

	SRS-2 Social Motivation	DMQ Social Persistence with Adults	DMQ Social Persistence with Children	WSQ Appropriate	WSQ Active	WSQ Passive	WSQ Aloof
SRS-2 Social Motivation	.	−.286* CI: −.52 – .01	−.473*** CI: −.66 – −.23	−.560*** CI: −.72 – −.34	.470*** CI: .23 – .66	.545*** CI: .32 – .71	.400** CI: .15 – .61
DMQ Social Persistence with Adults	−.612** CI: −.84 – −.19	.	.237 CI: −.04 – .48	.468* CI: .22 – .66	−.491*** CI: −.68 – −.25	−.532*** CI: −.70 – −.30	−.396** CI: −.61 – −.14
DMQ Social Persistence with Children	−.438 CI: −.77 – .07	−.113 CI: −.58 – .41	.	.515*** CI: .28 – .69	−.459* CI: −.65 – −.21	−.289* CI: −.52 – −.02	−.457* CI: −.65 – −.21
WSQ Appropriate	−.515* CI: −.80 – −.05	.624* CI: .19 – .86	.227 CI: −.30 – .65	.	−.792*** CI: −.88 – −.67	−.674*** CI: −.80 – −.49	−.766*** CI: −.86 – −.63
WSQ Active	.461 CI: −.03 – .77	−.378 CI: −.74 – .15	.047 CI: −.46 – .53	−.369 CI: −.72 – .14	.	.603*** CI: .40 – .75	.649*** CI: .46 – .78
WSQ Passive	.679** CI: .29 – .87	−.712** CI: −.89 – −.34	−.204 CI: −.64 – .33	−.374 CI: −.73 – .13	.210 CI: −.30 – .63	.	.644*** CI: .45 – .78
WSQ Aloof	.517* CI: .05 – .80	−.557* CI: −.83 – −.08	−.126 CI: −.59 – .39	−.469 CI: −.78 – .02	.278 CI: −.23 – .67	.637** CI: .23 – .86	.

Notes:

* $p<.05$.

** $p<.01$.

*** $p<.001$.

SRS-2 – Social Responsiveness Scale, 2nd Edition (Constantino, 2012). DMQ – Dimensions of Mastery Questionnaire, 17th Edition (Morgan, Busch-Rossnagel, Barrett, & Wang, 1997). WSQ – Wing Subgroups Questionnaire (Castelloe & Dawson, 1993). CI – 95% confidence interval.

Table 4:

Correlations between social motivation and social outcomes for combined sample and by group

	Combined sample		ASD Males	
	Vineland-II Socialization	**CBCL Social Problems**	**Vineland-II Socialization**	**CBCL Social Problems**
SRS-2 Social Motivation	−.456**	.394**	−.200	.269
DMQ Social Persistence with Adults	.410**	−.379**	.566*	−.404
DMQ Social Persistence with Children	.418**	−.350*	−.092	.171
WSQ Appropriate	.628***	−.615***	.714**	−.369
WSQ Active	−.689***	.694***	−.501*	.719**
WSQ Passive	−.453**	.446**	−.258	.189
WSQ Aloof	−.369**	.456**	−.462	.434

Notes:

* $p<.05$.

** $p<.01$.

*** $p<.001$.

SRS-2 – Social Responsiveness Scale, 2nd Edition (Constantino, 2012). DMQ – Dimensions of Mastery Questionnaire, 17th Edition (Morgan, Busch-Rossnagel, Barrett, & Wang, 1997). WSQ – Wing Subgroups Questionnaire (Castelloe & Dawson, 1993). Vineland-II – Vineland Adaptive Behavior Scales, 2nd Edition (Sparrow, Cicchetti, & Balla, 2006). CBCL – Child Behavior Checklist (Achenbach & Rescorla, 2001).