RESEARCH ARTICLE

The Development of the Multidimensional Social Competence Scale: A Standardized Measure of Social Competence in Autism Spectrum Disorders

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Autism and its related disorders are commonly described as lying along a continuum that ranges in severity and are collectively referred to as autism spectrum disorders (ASDs). Although all individuals with ASD meet the social impairment diagnostic criteria outlined in the DSM-IV-TR, they do not present with the same social difficulties. The variability in the expression and severity of social competence is particularly evident among the group of individuals with "high-functioning" ASD who appear to have difficulty applying their average to above average intelligence in a social context. There is a striking paucity of empirical research investigating individual differences in social functioning among individuals with high-functioning ASD. It is possible that more detailed investigations of social competence have been impeded by the lack of standardized measures available to assess the nature and severity of social impairment. The aim of the current study was to develop and evaluate a parent rating scale capable of assessing individual differences in social competence (i.e. strengths and challenges) among adolescents with ASD: the Multidimensional Social Competence Scale (MSCS). Results from confirmatory factor analyses supported the hypothesized multidimensional factor structure of the MSCS. Seven relatively distinct domains of social competence were identified including social motivation, social inferencing, demonstrating empathic concern, social knowledge, verbal conversation skills, nonverbal sending skills, and emotion regulation. Psychometric evidence provided preliminary support for the reliability and validity of the scale. Possible applications of this promising new parent rating scale in both research and clinical settings are discussed. *Autism Res* 2013, ••: ••–••. © 2013 International Society for Autism Research, Wiley Periodicals, Inc.

Keywords: autism spectrum disorders; social competence; multidimensional social competence scale; psychometric properties

The behavioral and clinical manifestations of autism spectrum disorders (ASDs) are extremely heterogeneous. Heterogeneity occurs at multiple levels of analysis. At the behavioral level, there is variability in the nature and severity of symptoms. At a cognitive level, intellectual quotients (IQs) range from extremely low to superior [Beglinger & Smith, 2001]. From a developmental perspective, there is significant variability in the course and outcome of ASD.

Although the social domain has been highlighted as the most defining area of impairment in ASD [Pennington & Ozonoff, 1991; Shanker, 2004; Volkmar & Klin, 2005], heterogeneity in expression and severity of social deficits is marked. Wing and Gould's early work attempted to capture some of this variability by introducing a classification system based on different "qualities of social impairment" [Wing & Gould, 1979]. They described an "aloof" category of individuals (characterized by social withdrawal), a "passive" group (those who tended not to initiate social contact but indifferently accepted the approaches of others), and an "active but odd" group (those who sought social contact in odd or

inappropriate ways). However, since Wing and Gould's early work, there have been few empirical attempts to specify the range of social phenotype within ASD.

Research has likely been hindered by the lack of measurement tools that are able to parse heterogeneity in meaningful ways [Volkmar & Klin, 2000]. The assessment of social competence among individuals with ASD is often accomplished using measures developed for other populations, whether typically developing (TD) or other developmentally delayed (DD) groups. Unfortunately, such measures often have inappropriate content and/or psychometric properties that have not been evaluated for use with ASD [Lecavalier, Aman, Hammer, Stoica, & Mathews, 2004] and therefore are poorly suited to identify individual differences in social competence within this population.

Equally problematic is the practice of measuring social competence in ASD with ASD-specific measures not designed to assess social competence per se. For instance, indices of social competence are often derived from diagnostic tools such as the Autism Diagnostic Interview-Revised (ADI-R) [Rutter, Le Couteur, & Lord, 2003] or

Autism Diagnostic Observation Schedule (ADOS) [Lord et al., 1989]. These measures were designed to make categorical decisions regarding the presence or absence of ASD symptoms and have not been validated for the purpose of detecting social competence differences in a quantitative manner. In addition, items emphasize the variables most strongly related to ASD diagnosis, and thus, potentially meaningful heterogeneity on alternate, although perhaps less salient, dimensions of social competence is ignored. Furthermore, several items on the ADI-R and ADOS confound a lack/limited nature of social behavior with qualitative abnormalities in behavioral expression (i.e. the same score is used if an individual fails to demonstrate a particular behavior or demonstrates it in an odd/inappropriate manner). For example, on the ADI-R, a child who "rarely offers comfort" and one who offers comfort in "odd ways" receive the same score, despite the fact that one child may be displaying greater social interest. As a result, such measures may obscure important differences in social interest that are potentially relevant to the parsing of heterogeneity in social competence in ASD.

Brief screening instruments, such as the Social Responsiveness Scale (SRS) [Constantino & Gruber, 2005], have allowed researchers and clinicians to obtain a more continuous measure of autism spectrum impairment (including subthreshold manifestations). Although the SRS provides five subscale scores (social awareness, social cognition, social communication, social motivation, and autistic mannerisms), factor analysis, and latent class analysis results have not supported the existence of any independent subdomains of dysfunction. Instead, the authors suggest that a single continuous factor of impairment in ASD best characterizes the data provided by the inventory [Constantino et al., 2003; Constantino, Przybeck, Friesen, & Todd, 2000]. In addition to focusing on social reciprocity, the SRS assesses aspects of impairment in ASD that may not be social in nature (e.g. sensitivity to sensory stimuli and repetitive interests/behaviors). Although these items are valuable for the purposes of diagnostic screening (or measuring a continuum of autistic traits), the incorporation of such items introduces construct-irrelevant variance to the use of this inventory as a measure of social competence.

Within the wider social-psychological and developmental literature, it is commonly held that social competence is a higher-order construct that encompasses multiple variables—each of which varies in a dimensional manner [Buhrmester, Furman, Wittenberg, & Reis, 1988]. However, few measures used in ASD research were informed by a truly multidimensional conceptualization of social competence. The assessment of social competence using a single index reflects an overly narrow conceptualization and leads to the loss and/or masking of important information [Schneider, Ackerman, & Kanfer,

1996]. A more appropriate strategy would involve determining "social competence profiles" that emphasize patterns of social strengths and weaknesses across relevent subdomains [Schneider et al., 1996].

The primary objectives of the current study were to develop and evaluate the Multidimensional Social Competence Scale (MSCS), a caregiver rating scale designed specifically to assess social competence from a multidimensional perspective in individuals with ASD.

Scale Design

The MSCS was developed using a combination of theory-driven and empirical approaches. In order to ensure practicality of administration, it was designed as a summated rating scale to be completed by primary caregivers. Caregivers observe the child interacting across a range of naturalistic social settings and are generally familiar with their child's day-to-day social strengths and challenges.

In developing the MSCS, it was important to target either high- or low-functioning individuals with ASD. Several researchers have argued that individuals with ASD with an intellectual disability (ID) should be studied separately from those without ID (through independent investigations or data analyses), given probable heterogeneity in etiology, pathophysiology, course, symptomatology, treatment response, and prognosis [Cohen, Paul, & Volkmar, 1987; Fein et al., 1999; Tsai, 1992]. Furthermore, different types of social deficits would be expected from a child without functional language and/or ID compared with a highly verbal individual with average intelligence, and it would be challenging for a single measure to adequately assess both groups. Impairment in reciprocal social interaction is particularly striking in the population of individuals with ASD with average to above average intelligence. In addition, it is possible that the social deficits demonstrated by high-functioning (HF) individuals with ASD are more likely to overlap with the variability seen in the TD population (i.e. more "extreme" versions of subtle social deficits occurring in TD individuals) [Happe, Ronald, & Plomin, 2006; Iarocci, Yager, & Elfers, 2007]. Thus, the MSCS was developed with the goal of assessing social behaviors commonly observed among individuals within the HF ASD population but that may also occur among TD individuals demonstrating milder levels of social impairment.

What constitutes socially competent behavior changes througout development; the same set of skills are not available to the infant and the adolescent [Eisenberg & Harris, 1984; Waters & Sroufe, 1983]. If a given measure assesses a wide range of ages, individual differences may reflect age and/or developmental level instead of true heterogeneity in social competence. During the period of early to late adolescence, the social world becomes significantly more complex as interactions demand a range

of sophisticated social repertoires/skills (e.g. appreciating social context, initiating and maintaining conversations, and offering emotional support to others) [Buhrmester, 1990]. Such skills are often the very ones that individuals with HF ASD struggle with most. Thus, as social and contextual demands increase in adolescence, social difficulties may become particularly pronounced among individuals with HF ASD, possibly making it easier to identify and measure subtle differences in social impairment within this population using a tool such as the MSCS.

In defining social competence for the purposes of scale development, it was apparent that there is no widely accepted operational definition. However, Rose-Krasnor [1997]'s "prism model" provides a useful framework for conceptualizing social competence and its levels of analysis. The model broadly defines social competence at a theoretical level as overall effectiveness in meeting short- and long-term social developmental needs/goals. The model further suggests that social competence can be studied empirically at two distinct levels of analysis—the *index* level and the *motivation/skills* level [Rose-Krasnor, 1997]. The *index* level identifies real-life summary indices of social competence (e.g. attachment security, peer acceptance, and employment success) that are considered to be situation/context-specific (e.g. with peers vs. with family). Although indicative of social competence, these indices do not provide detailed information about an individual's social presentation. The *motivation/skills* level consists of the underlying dispositions and abilities that provide the "building blocks" of social interactions. Social motivation/skills include both social-cognitive abilities (e.g. perception and processing of social stimuli) as well as the more overt, observable social behaviors (e.g. eye contact and conversation ability). This level tends to be more accessible to assessment methods using performance-based laboratory tasks (e.g. tests of emotion recognition) or observation-based rating scales.

Social competence cannot be reduced to any single index or skill but requires the active, skillful coordination of multiple lower-order processes as well as contextual factors in order to adequately meet the social demands of a particular situation [Iarocci et al., 2007; Iarocci, Yager, Rombough, & McLaughlin, 2008]. However, for the purposes of assessment, we focused on identifying and measuring a representative sampling of abilities/behaviors at the social motivation/skills level in order to "tap into" the broader construct of social competence in a multidimensional manner.

A survey of the theoretical and empirical literature within the areas of clinical, social, and developmental psychology revealed several potentially relevant motivations/skills that could be meaningfully categorized as falling within seven key content domains: social motivation, social inferencing, demonstrating empathic concern, social knowledge, verbal conversation skills, nonverbal sending skills, and emotion regulation. Items reflecting each of these domains were developed for the MSCS.

Description of Domains

Social motivation. The term social motivation is used to reflect one's level of comfort, interest, and enjoyment in interacting with others [Newcomb, Bukowski, & Pattee, 1993]. This domain assesses interest in others as well as a tendency to make social approaches/overtures (e.g. prefers to spend time alone; initiates get togethers with other kids; stays in the background in group social situations).

Social inferencing. This domain assesses one's ability to detect and interpret social cues as well as "theory of mind" skills (i.e. ability to infer mental states). Sample items include those inquiring whether the individual recognizes when he/she is being manipulated, picks up subtle hints/indirect requests, or understands when people are being sarcastic.

Demonstrating empathic concern. Items in this domain assess an individual's ability to recognize when others are hurt/upset and to respond in an empathic manner. Sample items include expressing concern when others are hurt/distressed, trying to cheer people up, and apologizing after hurting someone.

Social knowledge. This domain assesses one's knowledge of the norms/rules governing specific social situations/contexts. Specific items relate to the appreciation of social context (e.g. being more polite with authority figures and acting appropriately in public places) as well as understanding relationships (e.g. what constitutes a friend and having reasonable expectations of friends).

Verbal conversation skills. The conversation skills needed to start, maintain, and end reciprocal conversations are assessed in this domain. Items relate to one's sense of timing (e.g. joining conversations without interrupting), conversational topic management (e.g. shifting conversations to topics of interest), and turn-taking ability (e.g. dominating conversations and talking "at" people).

Nonverbal sending skills. Items within this domain focus on one's proficiency in the "sending" of nonverbal social communication cues such as gestures/pointing, eye contact, facial expressions/social smiling, and tone of voice.

Emotion regulation. Individuals with challenges modulating negative emotions are more likely to display acting-out behaviors that can lead to social rejection or isolation. Therefore, items in this domain primarily assess one's ability to modulate negative emotional states (e.g.

acting out when angry/upset, tendency to have "melt-downs," and easily frustrated).

Goals of the Study

There were two main objectives of the current project. The primary goal was to determine whether social competence in ASD could be measured in a multidimensional fashion such that distinct domains of functioning could be isolated. It was hypothesized that a confirmatory factor analysis (CFA) of the MSCS would reveal the following seven first-order factors: social motivation, social inferencing, demonstrating empathic concern, social knowledge, verbal conversation skills, nonverbal sending skills, and emotion regulation. After establishing the dimensionality of the MSCS, a secondary objective of the current study was to evaluate the psychometric properties of the MSCS with the aim of providing preliminary support for the reliability and validity of the tool in its assessment of social competence in adolescents with ASD.

Method
Participants

The current study included a sample of HF adolescents (11–18 years old) with ASD (and their primary caregivers) and a sample of TD adolescents (and their primary caregivers). A subset of adolescents from both groups completed cognitive testing for the purposes of between-group comparisons. For all participants with ASD, previous clinical diagnoses were confirmed using the ADI-R [Rutter et al., 2003]. For participants who completed the cognitive testing, HF ASD was defined as a diagnosis of ASD in conjunction with an IQ falling at or above the "low average range" (i.e. at or above 80). For those completing only the survey portion of the study, a proxy for HF was applied in which only those who had never been diagnosed with ID and were completing the regular academic curriculum for their grade level were included.

In total, 229 participants were enrolled in the study (181 ASD and 48 TD). Within the ASD group, eight did not meet the diagnostic criteria for ASD on the ADI-R and were excluded. An additional 11 participants with ASD did not meet criteria to be considered HF. Twenty-seven caregivers did not complete the MSCS within the allotted time frame or withdrew from the study because of personal reasons (e.g. illness). The final sample of participants consisted of 183 adolescents (135 ASD and 48 TD). Mothers represented the most frequent respondents in the study, $n = 178$ (97.3%), followed by fathers, $n = 5$ (2.7%). Within the ASD group, caregiver report indicated prior clinical diagnoses of autistic disorder (37%), Asperger's disorder (48.9%), and pervasive developmental disorder—not otherwise specified (14.1%).

Table 1. Participant Characteristics of Adolescents Individually Matched on Gender, CA, and ABIQ

Group	n	Mean CA (years) (± SD)	Mean ABIQ (± SD)	Male : female
ASD	22	14.17 (2.25)	101.05 (10.53)	19:3
TD	22	14.12 (2.27)	100.18 (10.60)	19:3

ABIQ, Abbreviated Battery IQ Scale; ASD, autism spectrum disorder; CA, chronological age; SD, standard deviation; TD, typically developing.

Within the total sample, 132 respondents (87 ASD and 45 TD) completed the SRS for the purposes of examining convergent validity. Eighty-three adolescent participants (36 ASD and 47 TD) completed the cognitive testing portion of the study. Of these, 44 (22 ASD and 22 TD) were individually matched on gender, chronological age (CA; within 12 months), and the Stanford–Binet Intelligence Scale—Fifth Edition (SB5) Abbreviated Battery IQ Scale (ABIQ) (within a score difference of 6 points). No significant group differences were found for CA or ABIQ (see Table 1).

Materials

ADI-R. The ADI-R [Rutter et al., 2003] was administered to the caregivers of individuals with ASD by the author who was trained in administration by a certified trainer at a two-day ADI-R workshop at the local children's hospital.

SB5—Abbreviated Battery. The SB5 (Roid, 2003) ABIQ Scale was administered to each child. Recent data suggest that the SB5 ABIQ is adequately representative of the full-scale IQ in the majority of individuals with ASD [Coolican, Bryson, & Zwaigenbaum, 2008].

Family demographics questionnaire. A general background questionnaire was used to collect demographics information as well as information regarding the adolescent's diagnostic and educational history. The questionnaire also included items designed to assess the adolescent's friendships and peer acceptance (i.e. number of close friendships, frequency of social contact, and acceptance by classmates).

MSCS. The preliminary version administered to primary caregivers included 199 items to be rated on a Likert scale ranging from 1 ("not true or almost never true") to 5 ("very true or almost always true"). Items were coded such that higher scores reflected higher levels of social competence. Simon Fraser University's WebSurvey software was used to administer a secure electronic version of the MSCS to participants via the Internet.

Completion of the scale using WebSurvey took approximately 30 min for the majority of participants.

SRS. The SRS [Constantino & Gruber, 2005] is a 65-item parent questionnaire designed to assess core dimensions of ASD symptomatology in youth (aged 4–18 years). The SRS has been standardized on a sample of over 1600 individuals, and there is evidence supporting its reliability and validity [Constantino & Gruber, 2005].

Procedure

This study was reviewed and approved by Simon Fraser University's Office of Research Ethics. Paper copies of the family demographics questionnaire and the SRS were sent via the mail to caregivers. For the majority of participants (recruited from across Canada), the ADI-R was administered over the phone. Although the ADI-R is traditionally administered face to face, telephone interviews are a valid and reliable alternative when cost and geographic challenges limit the feasibility of an in-person administration [Ward-King, Cohen, Penning, & Holden, 2010]. Following the interview, a link to the online survey web page was emailed to the caregivers. For local participants, the ABIQ Scale of the SB5 was administered to adolescents by an experimenter in the lab.

Results
MSCS Item Analyses

Item trimming. Preliminary item analyses were used to reduce the total number of MSCS items to 105. Items selected for retention demonstrated variability in endorsement rates (i.e. did not have highly unbalanced or skewed item response distributions) and moderate to high levels of internal consistency. In addition, items were retained that appeared maximally capable of discriminating between the ASD and TD groups. Discrimination indices were calculated by comparing the number of participants in each group (ASD vs. TD) who positively endorsed each item. Specifically, indices were calculated by subtracting the proportion of participants in the ASD group who positively endorsed an item from the proportion of participants in the TD group who positively endorsed the item. Possible index values range from –1.0 to 1.0, with values greater than 0.30 thought to represent acceptable discriminating power [Streiner & Norman, 2003].

Dimensionality. Given that seven content domains (and their respective items) were identified in the process of scale development, CFA was deemed an appropriate strategy to examine such a priori hypotheses about the dimensionality of the scale. Mean-centered data were used for factor analyses because scale items were designed

Table 2. Indices of Fit for Alternative Factor Models of MSCS Evaluated by CFA

Factor model	χ^2 (df)	SRMR	RMSEA (90% CI)	NNFI	CFI
Seven-factor model (105 items)	9976.03 (5334) ($P = 0.0$)	0.10	0.062[a] (0.060–0.064)	0.91[a]	0.91[a]
Seven-factor model (77 items)	4948.75 (2828) ($P = 0.0$)	0.086[a]	0.057[a] (0.054–0.060)	0.93[a]	0.93[a]
One-factor model	7230.64 (2849) ($P = 0.0$)	0.12	0.12 (0.12–0.13)	0.85	0.85
Higher-order model	4970.97 (2841) ($P = 0.0$)	0.090	0.058[a] (0.055–0.061)	0.93[a]	0.93[a]

[a]Index suggests adequate model fit.
CFA, confirmatory factor analysis; CFI, comparative fit index; MSCS, Multidimensional Social Competence Scale; NNFI, nonnormed fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual.

to be maximally discriminating between the ASD and TD groups (i.e. item scores for the ASD and TD samples were standardized separately around each group mean). CFA analyses were conducted on the sample variance–covariance matrix of the mean-centered data using a maximum likelihood method of estimation. The fit indices obtained for the alternative factor models that were evaluated are included in Table 2.

The initial seven first-order factor model included 105 measured variables (items) and seven factors that were permitted to correlate with one another. Although the χ^2 value suggested poor overall fit, χ^2 (5334) = 9976.03, $P = 0.0$, the other indices were generally consistent in suggesting acceptable fit of the seven factor model: standardized root mean square residual (SRMR) = 0.10, root mean square error of approximation (RMSEA) = 0.062 (90% confidence interval (CI) = 0.059–0.064), nonnormed fit index (NNFI) = 0.91, and comparative fit index (CFI) = 0.91. All freely estimated unstandardized parameters in the seven-factor model were statistically significant (Ps < 0.05). The magnitude of factor loading estimates ranged from 0.22 to 0.83 (range of R^2s = 0.05–0.69).

In order to further shorten the MSCS, parameter estimates were examined in order to eliminate items that did not load highly on their specified factors. Items with factor loadings below 0.50 were eliminated. The final 77 items of the MSCS were then resubmitted to CFA. Modest improvements in model fit were obtained. Again, the majority of indices were suggestive of satisfactory fit: SRMR = 0.086, RMSEA = 0.057 (90% CI = 0.054–0.060), NNFI = 0.93, and CFI = 0.93. All freely estimated unstandardized parameters were statistically significant (Ps < 0.01). Factor loading estimates ranged from 0.50 to

Table 3. Factor Correlations for Seven-Factor CFA Model (Based on 77 Items)

	MOTIV	SOCINF	EMPATH	KNOW	VERB	NONVERB	EMOTREG
MOTIV	1.00						
SOCINF	0.51	1.00					
EMPATH	0.63	0.49	1.00				
KNOW	0.55	0.75	0.55	1.00			
VERB	0.15	0.40	0.19	0.55	1.00		
NONVERB	0.64	0.50	0.53	0.51	0.23	1.00	
EMOTREG	0.21	0.46	0.23	0.52	0.44	0.25	1.00

EMOTREG, emotion regulation; EMPATH, demonstrating empathic concern; KNOW, social knowledge; MOTIV, social motivation; NONVERB, nonverbal sending skills; SOCINF, social inferencing; VERB, verbal conversation skills.

0.83 and revealed that items were moderately to highly related to their purported latent factors (range of $R^2 = 0.25–0.70$). Factors were moderately correlated with one another, although there was some variability in the extent to which they were found to relate to one another (range of rs = 0.15–0.75; see Table 3).

A rival model that was evaluated posited one underlying factor ("social competence") accounting for the covariance among items. All indices were indicative of poor fit for this model: χ^2 (2849) = 7230.64, $P = 0.0$, SRMR = 0.12, RMSEA = 0.12 (90% CI = 0.12–0.13), NNFI = 0.85, and CFI = 0.85.

Alternatively, it was hypothesized that a higher-order factor model including second-order factors accounting for the covariances among the seven first-order factors would best explain the data. Given the differential patterns of correlation among the first order factors, a model including more than one higher-order factor was considered. In order to further examine this possibility, an exploratory factor analysis (EFA) was performed on the domain scores. The EFA was performed using PASW Statistics 18 (IBM, New York, USA) using maximum likelihood method of extraction with Promax rotation. Based on the inspection of the scree plot, a solution with two higher-order factors was examined for interpretability. The two-factor solution accounted for 66.31% of the variance (see Table 4 for factor loadings). Factor I consisted of three domains including social motivation, demonstrating empathic concern, and nonverbal sending skills. These domains appear to assess the extent to which individuals demonstrate an awareness of and connection with others, and will be referred to collectively as "social responsiveness." Factor II consisted of social inferencing, social knowledge, verbal conversation skills, and emotion regulation. This factor appears to assess the more cognitive, emotional, and skills-based aspects of social competence and will be referred to as "social understanding/emotion regulation."

The resulting higher-order model with two second-order factors was submitted to CFA. The fit indices obtained were comparable with the original seven-factor

Table 4. Factor Loadings for the Domain Scores of the MSCS Based on EFA Results

	Factors and loadings	
Domain	Factor I	Factor II
Social motivation	0.93	−0.18
Demonstrating empathic concern	0.70	0.02
Nonverbal sending skills	0.66	0.05
Verbal conversation skills	−0.18	0.73
Emotion regulation	−0.07	0.67
Social knowledge	0.26	0.66
Social inferencing	0.28	0.52

EFA, exploratory factor analysis; MSCS, Multidimensional Social Competence Scale.

model in terms of the RMSEA (0.058, 90% CI = 0.055–0.061), NNFI (0.93), and CFI (0.93), with slightly weaker indices of absolute fit (χ^2 (2841) = 4970.97, $P = 0.0$; SRMR = 0.090). Each of the first-order factors were found to load moderately to strongly on the second-order factors (range of loadings = 0.55 to 0.95), and there appeared to be a high level of correlation between the two higher order factors (r = 0.71).

In sum, the higher-order solution did not result in a significant decrease in model fit over the first-order factor model. Improvements in goodness of fit are not typically expected with a higher-order solution, given that it attempts to reproduce the factor correlations with fewer freely estimated parameters [Brown, 2006]. In addition, this model provides a more parsimonious account of the correlations among the first-order factors and thus, appears to provide the best fit to the MSCS data.

Scoring the MSCS. In light of CFA results, users are justified in computing the following summated scores for the MSCS: domain scores (social motivation, social inferencing, demonstrating empathic concern, social knowledge, verbal conversation skills, nonverbal sending skills, and emotion regulation); subscale scores (social responsiveness and social understanding/emotion regulation); and an overall "social competence" total score.

Table 5. Coefficients Alpha for MSCS Summated Scores

MSCS Score	Coefficients alpha
Social motivation	0.87
Social inferencing	0.87
Demonstrating empathic concern	0.90
Social knowledge	0.84
Verbal conversation skills	0.88
Nonverbal sending skills	0.87
Emotion regulation skills	0.89
Social responsiveness	0.94
Social understanding/emotion regulation	0.93
MSCS total score	0.95

MSCS, Multidimensional Social Competence Scale.

Table 6. Correlations between the SRS Total Score and MSCS Scores within the ASD Group

MSCS score	Correlation with SRS total score
Social motivation	−0.48
Social inferencing	−0.55
Demonstrating empathic concern	−0.40
Social knowledge	−0.57
Verbal conversation skills	−0.46
Nonverbal sending skills	−0.68
Emotion regulation skills	−0.43
Social responsiveness	−0.64
Social understanding/emotion regulation	−0.67
MSCS total score	−0.78

ASD, autism spectrum disorder; MSCS, Multidimensional Social Competence Scale; SRS, Social Responsiveness Scale.

Internal consistency. The final 77 items were found to be internally consistent. Corrected item-whole correlations for items were all greater than or equal to 0.34. Coefficient alpha reliabilities for domain, subscale, and total scores were all above 0.84 (see Table 5).

Preliminary Validation Analyses

Convergent validity. Within the total sample, the correlation between the MSCS total score and the SRS was significant and very large (r = –0.89, *n* = 132, *P* < 0.001), suggesting strong convergent validity between the measures. Within the ASD group alone, the correlation between the MSCS total score and the SRS was also significant and large (r = –0.78, *n* = 87, *P* < 0.001). When the correlations were examined between the SRS total scores and the MSCS domain/subscale scores within the ASD sample, the correlations were generally medium in value, and there was some variability among the coefficients obtained (rs ranged from –0.40 to –0.68; see Table 6).

Discriminant validity. A small correlation (r = 0.20) that was not statistically significant (*n* = 83; *P* > 0.05) was obtained between the MSCS total score and the SB5 ABIQ, suggesting that social competence assessed by the MSCS and cognitive ability are relatively distinct. In addition, a trivial and statistically nonsignificant correlation was obtained between the MSCS total score and CA (r = 0.07; *n* = 183; *P* > 0.05), suggesting that there does not appear to be a systematic relationship with age (whereby all older individuals appear more socially competent).

Criterion-related validity. Concurrent validity was examined by correlating MSCS scores with data obtained on indicators of social competence (i.e. peer acceptance and friendships) (Table 7). These correlations were computed for the total sample as well as for the ASD and TD groups separately. Within the total sample, a large significant correlation was obtained between number of close friends and the MSCS total score (r = 0.69; *P* < 0.01), with

higher levels of perceived competence (i.e. higher MSCS scores) being associated with more friends. In addition, a significant medium correlation of 0.38 (*P* < 0.01) was obtained between the MSCS total score and frequency of social contact with friends, suggesting that adolescents engaging in more frequent social contacts demonstrate higher levels of parent-rated social competence. A significant large correlation was also obtained between getting along with classmates and the MSCS total score (r = 0.56; *P* < 0.05), with adolescents described as getting along with classmates demonstrating higher ratings of social competence. Within the ASD sample, significant small to medium correlations were also obtained between the MSCS total score and the indicators of friendship and peer acceptance (see Table 7). Within the TD sample, a significant medium correlation was obtained between the MSCS total score and getting along with classmates (r = 0.35, *P* < 0.05). Trends in the data were suggestive of a similar relationship between the MSCS total score and indicators of friendship in the TD group; however, these correlations were not statistically significant (likely because of the considerably smaller sample size for this analysis).

Known-groups validity. Mean scores on the MSCS were compared for the individually matched ASD and TD groups using *t*-tests. Significant group differences were found for all MSCS domains, subscale, and total scores with higher levels of social competence reported for TD individuals compared with individuals with ASD (Table 8).

Discussion

Overall, results supported the multidimensional factor structure of the MSCS. Results also suggested that certain domains of social competence may be more strongly

Table 7. Correlations between the MSCS Total Score and Indicators of Friendship and Peer Acceptance within Total Sample, ASD Group, and TD Group

Indicator	Correlation with MSCS (total sample)	Correlation with MSCS (ASD)	Correlation with MSCS (TD)
Friendship			
Number of close friends	0.69*	0.45*	0.25
	(n = 167)	(n = 128)	(n = 39)
Frequency of social contact	0.38*	0.19*	0.30
	(n = 169)	(n = 130)	(n = 39)
Peer acceptance			
Getting along with classmates	0.56*	0.35*	0.35*
	(n = 148)	(n = 109)	(n = 39)

*P < 0.05.
ASD, autism spectrum disorder; MSCS, Multidimensional Social Competence Scale; TD, typically developing.

Table 8. Mean MSCS Scores for ASD and TD Groups

	ASD mean score (SD)	TD mean score (SD)	t-value	Effect size (Cohen's d)
Social motivation	29.02	42.10	9.92*	1.77
	(8.33)	(6.28)		
Social inferencing	28.35	45.00	14.45*	2.56
	(7.21)	(5.72)		
Demonstrating empathic concern	32.56	45.38	9.05*	1.64
	(9.04)	(6.38)		
Social knowledge	33.65	48.13	12.06*	2.31
	(7.97)	(3.92)		
Verbal conversation skills	28.87	45.69	13.11*	2.38
	(8.21)	(5.68)		
Nonverbal sending skills	34.23	47.10	10.05*	1.86
	(8.29)	(5.24)		
Emotion regulation	29.55	43.92	10.67*	1.88
	(8.41)	(6.76)		
Social responsiveness	95.82	134.58	11.62*	2.08
	(21.07)	(15.89)		
Social understanding/emotion regulation	120.41	182.73	16.28*	2.94
	(24.31)	(17.61)		
Total score	216.23	317.31	16.33*	2.91
	(38.94)	(30.06)		

*P < 0.01.
ASD, autism spectrum disorder; MSCS, Multidimensional Social Competence Scale; SD, standard deviation; TD, typically developing.

related than others. In particular, results from an EFA indicated that MSCS domains could be meaningfully grouped together to form two subscales (social responsiveness and social understanding/emotion regulation).

It is possible that the social responsiveness subscale is tapping into the extent to which individuals are oriented toward and responsive to others. Individuals who are rated by their parents as more interested in spending time with others may also be more likely to be emotionally tuned in and connected with others at a nonverbal level. Nonverbal sending skills may represent an important mode of communicating one's interest and/or empathic concern for others and thus be related to one's general level of social responsiveness. Perhaps individuals who are interested in and/or concerned about others are more likely to attend to and engage others socially through nonverbal means (e.g. eye contact, gestures, and tone of voice). Conversely, individuals who are less attuned to or responsive to others may not consistently attend to nonverbal cues in critical early developmental periods to develop these skills to the same degree. From a developmental perspective, infants must first select and orient to social cues (such as faces and eyes) before they can learn to use nonverbal cues strategically to engage others. Individual differences in the social orienting of attention emerge early in development and impact the development of adaptive social functioning across the lifespan [Mundy & Sigman, 2006; Rombough, Barrie, & Iarocci,

2012]. Well-developed nonverbal sending skills may represent a possible downstream manifestation (or marker) of higher levels of social responsiveness.

The component domains of the social understanding/ emotion regulation subscale appear to reflect more of the cognitive and behavioral skills needed to respond appropriately in social situations. Caregivers rated individuals with strengths in these areas as adept at interpreting social cues, understanding social norms, applying their social understanding in conversations with others, and regulating their emotions during their interactions. Interestingly, this collection of skills (e.g. conversation skills, reading social cues, awareness of social rules, and self-control) is commonly targeted in social skills training interventions with some success [Rao, Beidel, & Murray, 2008; Williams-White, Keonig, & Scahill, 2007].

The core factors associated with social competence are likely to be multidimensional and may not be adequately captured by existing measures. The psychometric properties of the MSCS are encouraging and provide preliminary support for the MSCS as a reliable and valid parent rating measure of social competence in adolescents with HF ASD. The final subset of items was found to be internally consistent. A high overall level of correlation was obtained between the MSCS and SRS (in both the total and ASD sample alone). This is not surprising given that the total scores of both scales are assessing overall social competence in a fairly specific population (i.e. HF ASD). However, the differential pattern of correlations obtained between the SRS and MSCS domain scores provides preliminary evidence of relative distinctions between the SRS and MSCS scales (e.g. domains of social competence, such as demonstrating empathic concern and emotion regulation skills) and further supports the notion that social competence is a multidimensional construct.

Thus, if a single overall score for social competence (e.g. for screening) is needed, the MSCS may not be the ideal choice (e.g. it takes longer to administer than scales such as the SRS). However, there would be advantages to using the MSCS in certain research/clinical contexts wherein a more differentiated view of social competence is advantageous. Here, the multidimensionality of the MSCS (i.e. the inclusion of seven domains relevant to social competence in ASD) would allow researchers/clinicians to identify and develop more specific hypotheses regarding profiles of social strengths/challenges that would not be possible with an overall score of social competence.

In addition, the MSCS shows promise with regard to capturing social functioning in the adolescent's everyday life. For example, parent ratings of poor social competence on the MSCS were correlated with parent reports of their child's difficulties with friendships and peer acceptance.

Although the MSCS effectively differentiated individuals with ASD from TD individuals, it was not intended for use as a diagnostic or screening tool. The MSCS was primarily designed as an assessment tool capable of generating profiles of social competence among individuals with ASD. Nonetheless, the finding of significant group differences across all MSCS scores supports its utility as a measure of social competence that is specific to ASD. Furthermore, the lack of significant correlations obtained between the MSCS and age/cognitive functioning suggests that differences in parent ratings on the MSCS cannot be accounted for by age or level of intelligence.

The findings suggest that the MSCS merits further research and development. A significant methodological limitation of the current study is that the sample size was small for the CFAs that were performed. Although the loadings obtained were high enough to suggest reliability in the interpretations [Guadagnoli & Velicer, 1988], future research (using larger samples) is clearly needed to replicate the higher-order factor structure of the scale. Additional data collection may also facilitate the development of norms (e.g. scale scores) and cutoff points (to empirically designate "high" vs. "low" scores). Furthermore, additional informants (e.g. teachers and clinicians), different methods of administration (e.g. observation and behavioral assessment), as well as the collection of IQ data for the entire sample would allow for a more thorough evaluation of the measure and the suitability of the measure with a lower functioning sample.

The MSCS will have several applications in both research and clinical settings as it is unique in a number of ways. Its content was developed based on a theoretical framework of social competence and an extensive literature review. It is specifically targeted to adolescents with HF ASD and provides comprehensive coverage of the deficits commonly observed within this subpopulation. As compared with existing measures, the MSCS may better capture the multidimensional assessment of social competence. By focusing exclusively on parent ratings of current social functioning in individuals already diagnosed with ASD, items were retained that may have minimal diagnostic relevance but are of great importance in understanding one's social presentation and/or planning interventions. Ultimately, this specificity will lead to a more comprehensive assessment of social competence in this diverse clinical population.

Researchers have argued for the importance of documenting "specific deficits in this subgroup (HF ASD) which may be different from those identified in other disorders inside or outside of the autism spectrum" [Rao et al., 2008, p. 359]. The MSCS holds promise as a tool that is capable of capturing heterogeneity in social competence within the autism spectrum and facilitating the identification of distinct profiles of social competence in subtyping analyses. Such profiles of social competence may prove useful in behavioral and genetics research, in which a well specified behavioral phenotype or

endophenotype is a more useful way of grouping participants than a clinical diagnosis [Iarocci et al., 2007].

Within a clinical context, the MSCS may prove useful by characterizing individual profiles of social strengths and challenges to help clinicians to better tailor interventions to client needs and improve their effectiveness [Rao et al., 2008]. Thus, the MSCS would allow both researchers and clinicians to more precisely group youth with ASD based on profiles of social strengths/challenges and, in so doing, develop more specific research hypotheses or targets for intervention.

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