Understanding Social Competence in Autism Spectrum Disorders: The Development of a Standardized Measure

by

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ABSTRACT

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). Despite the fact that all individuals with ASD meet the social impairment diagnostic criteria outlined in the DSM-IV-TR, they do not all 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 as well as the implications of these differences on long-term outcomes. It is possible that more detailed investigations of social competence within ASD have been impeded by the lack of standardized measures available to assess the nature and severity of social impairment. The current study aimed to develop and evaluate a parent rating scale capable of assessing individual differences in social competence (i.e., social strengths and weaknesses) among adolescents with ASD. Results from confirmatory factor analyses supported the hypothesized multidimensional factor structure of the scale. 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 and included indices of internal consistency, convergent validity, discriminant validity, criterion-related validity, and known groups validity. Possible applications of this newly developed parent rating scale in both research and clinical settings are discussed.

Keywords: autism spectrum disorders, social competence, Multidimensional Social Competence Scale, psychometric properties, adolescents

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LIST OF ACRONYMS

ABIQ	Abbreviated Battery Intellectual Quotient
ADI-R	Autism Diagnostic Interview – Revised
ADOS	Autism Diagnostic Observation Schedule
ASD	Autism Spectrum Disorder
CFA	Confirmatory factor analysis
CA	Chronological age
CFI	Comparative fit index
DD	Developmentally delayed
DSM-IV TR	Diagnostic and Statistical Manual of Mental Disorders (fourth edition, text revision)
EFA	Exploratory factor analysis
IQ	Intellectual Quotient
MSCS	Multidimensional Social Competence Scale
NNFI	Non-normed fit index
PDD	Pervasive Developmental Disorder (PDD)
PDD-NOS	Pervasive Developmental Disorder – Not Otherwise Specified
RMSEA	Root mean square error of approximation
SB5	Stanford-Binet Intelligence Scale (fifth edition)
SRMR	Standardized root mean square residual
SRS	Social Responsiveness Scale
TD	Typically developing
WS	William's syndrome

Chapter 1

HETEROGENEITY WITHIN AUTISM SPECTRUM DISORDER

Autism and its related disorders are complex, neurodevelopmental disorders characterized by impairment in three central areas – communication, reciprocal social behaviour, and restrictive or repetitive behaviours/interests. Collectively, deficits across these domains of functioning are often referred to as the "triad of impairment." The clinical manifestations of autism are extremely heterogeneous and, thus, the term "Autism Spectrum Disorder" (ASD) is commonly used to convey the range of symptom severity and expression displayed (Willemsen-Swinkels & Buitelaar, 2002).

Heterogeneity within ASD occurs at multiple levels of analysis. At the behavioural level, there is marked variability in the combination of symptoms observed. Indeed, almost any combination is possible within and/or across the core domains. In addition, there is significant inter-individual heterogeneity in the nature and severity of impairments observed within symptom domains. For instance, deficits in communication may manifest as a complete lack of language, significant language delays, or adequate formal language accompanied by notable pragmatic deficits (impairments in the social use of language). Similarly, at a cognitive level, there is tremendous variability in the level of overall functioning attained among individuals with ASD, with intellectual quotients (IQs) ranging from extremely low to superior (Beglinger & Smith, 2001). In general, individuals with ASD who demonstrate cognitive ability within the normal range (i.e., IQ>70) are referred to as "high functioning" while those with intellectual disability are referred to as "low functioning". From a developmental perspective, ASD also demonstrates marked variability in its course and outcome. For instance, investigations of the early course of the disorder (i.e., onset patterns) have suggested that some

children display relatively abnormal development from infancy onwards while others show marked deterioration around two years of age following a period of apparently normal development (Folstein, Haines, & Santangelo, 1998; Maestro et al., 2005).

Given the significant variability in the clinical presentation of ASD, several researchers have suggested that there is likely to be heterogeneity at the level of underlying causal mechanisms (Borden & Ollendick, 1994; Happe, Ronald, & Plomin, 2006). Large individual differences in response to behavioural interventions (e.g., (Birnbrauer & Leach, 1993; McEachin, Smith, & Lovaas, 1993) further imply etiological heterogeneity.

Current Management of Heterogeneity in Autism Spectrum Disorder

Within the broader ASD literature, heterogeneity is commonly viewed as a problem. Indeed, Happe, Ronald, and Plomin (2006) comment that "heterogeneity within the autism spectrum is perhaps the biggest single obstacle to research at all levels" (p. 1220). More specifically, marked heterogeneity within ASD makes it difficult to generalize findings when focusing on particular subsamples. For instance, although individuals with "high functioning" and "low-functioning" ASD share many similarities, it is unclear whether the results from research conducted with one group can validly be applied to the other. Furthermore, when comparing individuals with ASD to other populations (i.e., typically developing or other developmentally delayed), significant heterogeneity within the ASD group may obscure meaningful between-group differences. Similarly, discrepant findings across studies or research groups may reflect sample differences related to population heterogeneity. In other words, inconsistent findings may result when samples are drawn from slightly different portions of the diverse ASD population.

Current attempts to parse the heterogeneity in ASD have focused primarily on the high functioning end of the spectrum resulting in the delineation of three distinct diagnostic categories subsumed under the umbrella of Pervasive Developmental Disorders (PDD). Specifically, the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV-TR) outlines diagnostic criteria for Autistic Disorder, Asperger's Disorder, and Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS)

(APA, 2000). A diagnosis of Autistic Disorder is provided when clinically significant delays or abnormalities are present in the three core symptom domains and when there is evidence of onset occurring before three years of age. Asperger's Disorder is diagnosed when individuals demonstrate poor social functioning and restricted/repetitive patterns of behaviour or interest but do not display the early language or cognitive delays common in Autistic Disorder (APA, 2000). Individuals diagnosed with PDD-NOS demonstrate the same triad of impairment as in autism but fail to meet criteria for Autistic Disorder for one of a number of possible reasons. For instance, they may demonstrate onset after three years of age, display sub-threshold impairment in one or all of the core domains, or present with atypical symptoms (Willemsen-Swinkels & Buitelaar, 2002).

The validity of Asperger's Disorder and PDD-NOS (on their own and as distinct from high functioning Autistic Disorder) is highly controversial. In terms of Asperger's Disorder, it has been argued that overly narrow diagnostic criteria makes this diagnosis highly "improbable" (Mayes, Calhoun, & Crites, 2001; Miller & Ozonoff, 1997). In addition, the current diagnostic criteria for Asperger's Disorder does not recognize any of the symptoms thought to be prototypical of the disorder. Features such as motor delays, clumsiness, all-encompassing special interests, marked verbosity, social motivation, and a tendency to approach others in odd or eccentric ways were emphasized in Hans Asperger's initial descriptions of the disorder but have become less prominent in recent diagnostic conceptualizations (Klin, Pauls, Schultz, & Volkmar, 2005). In fact, the DSM-IV-TR diagnostic criteria for impairment in reciprocal social behaviour and repetitive behaviours in Asperger's Disorder are identical to those used in Autistic Disorder. Thus, current classifications do not reflect any differences in the nature of impairment observed within these two subtypes. Unfortunately, general dissatisfaction with current diagnostic criteria for Asperger's Disorder has led several researchers to apply inconsistent and/or idiosyncratic definitions, further perpetuating difficulties in making cross-study comparisons and accruing a shared body of knowledge (Volkmar & Klin, 2005).

Similarly, the diagnosis of PDD-NOS presents its own set of challenges. While "NOS" diagnoses are commonly viewed as "catchall" categories for all mental disorders, the situation in ASD is particularly disconcerting in light of evidence that PDD-NOS may be the most common ASD diagnosis provided

(Chakrabarti & Fombonne, 2001; Volkmar & Klin, 2005). Given that a label of PDD-NOS is ascribed to anyone who does not "fit nicely" into the categories of Autistic Disorder or Asperger's Disorder, this diagnostic subtype likely represents a considerably heterogeneous group of individuals.

Such a murky clinical picture has resulted in a plethora of studies attempting to clarify diagnostic distinctions (Ehlers et al., 1997; Fine, Bartolucci, Szatmari, & Ginsberg, 1994; Szatmari, Bartolucci, & Bremner, 1989). To date, the vast majority of these efforts have focused on validating existing categories by comparing the performance of individuals with Autistic Disorder, Asperger's Disorder, and/or PDD-NOS (based on a priori diagnostic assignments) on various aspects of functioning. However, this research is frequently plagued by the limitations of circular reasoning. Differences identified in support of diagnostic differences are often the very ones used to define the original groups (e.g., differences in language ability). Even among studies that avoid circular reasoning (such as those focusing on differences in genetic influences, neurobiological factors, response to treatment, or neuropsychological profiles), results have been inconsistent (Klin et al., 2005; Verte et al., 2006). In sum, classification research in ASD appears fixated on validating problematic, and potentially arbitrary, diagnostic categories. Clearly, what is uncovered in terms of factors that differentiate diagnostic groups will be limited by the way in which groups were initially parsed. Given the questionable validity of the DSM-IV diagnoses to begin with, it may be difficult to interpret any differences among them, or lack thereof, as meaningful.

Outside the realm of classification research, the situation is equally challenging. Several studies do not make a distinction among diagnostic subtypes and, instead, combine individuals into "autism" or "ASD" groups for statistical analyses. Although it is common to target either high or low functioning samples, investigators may still be ignoring meaningful heterogeneity within the ASD population. In general, the aggregation of highly variable data may result in a loss of important information and distortions in the results such that no single individual or pattern is adequately represented (von Eye & Bergman, 2003). Indeed, attempts to identify common social, cognitive or biological profiles that characterize individuals with ASD may be hindered when heterogeneity among research participants is ignored (Klinger, Dawson, & Renner, 2003).

The Utility of Person-Oriented Approaches

Given that current diagnostic subtypes within ASD do not appear to parse heterogeneity in meaningful ways, it may be necessary to abandon a strict adherence to existing diagnostic categories. In recent years, "person-oriented" approaches that offer a means of breaking down heterogeneity have received increasing attention within the field of developmental psychopathology. For instance, detailed investigations have already begun to unpack the heterogeneity observed in attention-deficit/hyperactivity disorder (Mill et al., 2006; Nigg, Willcutt, Doyle, & Sonuga-Barke, 2005) and antisocial behaviour (Moffitt, 1993). Such approaches are showing significant promise in their attempts to highlight underlying causal processes and may prove particularly beneficial to the study of ASD.

The application of person-oriented approaches represents a shift from the more traditional emphasis on between-group differences to a focus on within-group individual differences, and thus, are believed to be more consistent with a holistic and interactionist view of the individual (Beauchaine, 2003; Bergman, von Eye, & Magnusson, 2006; von Eye & Bergman, 2003). In other words, the focus of such research is on the individual and not a particular variable. While an extreme application of a person-oriented approach would involve the microscopic investigation of an individual case, the approach also advocates the identification of subgroups composed of individuals who are homogeneous in terms of multiple variables considered simultaneously and throughout development (Bergman et al., 2006). That is, within a diverse population, there may be certain profiles or patterns that are particularly common and may be meaningfully categorized as subtypes. Such subgroups are not meant to represent "literally distinct groups" that map perfectly onto reality, but instead, are intended to "draw attention to differences in the causes and consequences" of their manifestations (Nagin, 1999) (p. 140). It is hypothesized that individuals within subgroups are more likely to share common etiological pathways and demonstrate similarities in treatment response and outcomes (Willemsen-Swinkels & Buitelaar, 2002).

Although the application of subtyping approaches may ultimately inform the development of improved diagnostic categories within ASD for clinical use, the primary value of these methodologies lies in their potential to systematically break down the phenotype of ASD at various levels of analysis. Embracing and deconstructing heterogeneity within complex disorders such as

ASDs represents one avenue with which to attain the level of specificity needed to study underlying causal processes. Thus, the delineation of well-characterized, homogeneous subgroups within ASD is likely to particularly benefit neurobiological and genetic research. Specific patterns of neuro-pathology and associations with susceptibility genes are more likely to emerge when there is less phenotypic variability within samples (Tager-Flusberg & Joseph, 2003; Walker et al., 2004).

Methods of Defining Homogeneous Subgroups

In an attempt to delineate more homogeneous subgroups, subtyping approaches may focus on the identification of broad symptom profiles or the isolation of core domains.

Broad Symptom-Based Approaches

Symptom-based approaches attempt to identify homogeneous subgroups characterized by common patterns of symptoms. These subgroups may be identified via conceptual or empirical means – both of which have been employed in ASD research to varying degrees.

Conceptual methods rely on clinical observation and experience to detect common symptom presentations. For instance, the initial descriptions of autism by Leo Kanner and Asperger's disorder by Hans Asperger proceeded along this route (Kanner, 1943; Frith, 1991). Alternatively, empirical symptom-based methods employ statistical techniques, such as factor and cluster analysis, in their attempts to derive more homogeneous subgroups. In these "bottom-up" approaches, dimensional indices of symptomatology are submitted to exploratory analyses in order to determine whether common symptom profiles emerge in the data.

Within the realm of ASD research, the application of empirical approaches to subgrouping has been advocated by several investigators over the years (e.g., (Bristol et al., 1996; Kraemar, 1996; Kugler, 1998; Szatmari, 1992). Indeed, Klin et al. (2005) proposed that instead of relying on existing diagnostic categories, the ASD behavioural phenotype should be redefined as a dependent variable in order to assess "meaningful and interesting patterns" that may reflect the existence of "true categories" (p. 111).

Beglinger and Smith (2001) provide a fairly comprehensive review of ASD empirical subtyping attempts to date. They concluded that no single subtyping system has reliably emerged that sufficiently accounts for the full range of heterogeneity in ASD. Their review suggested that developmental level (primarily intellectual functioning) accounts for the largest proportion of variance in symptomatology. They further proposed a dimensional classification model in which subtypes could be identified on the basis of functioning within three key dimensions (developmental level, social impairment, and repetitive/stereotyped behaviours); however, this particular model has yet to be further investigated.

Unfortunately, methodological shortcomings may have impeded existing attempts to empirically define broad subgroups within ASD. Statistical subtyping procedures are limited by the variables selected and measures employed. Thus, to some degree, results reflect a priori assumptions about which behavioural dimensions are thought to be most salient (Willemsen-Swinkels & Buitelaar, 2002). Several subtyping attempts have relied on data provided by diagnostic measures such as the Autism Diagnostic Interview – Revised (ADI-R) or the Autism Behavior Checklist (e.g., Sevin et al., 1995; Tanguay, Robertson, & Derrick, 1998). These inventories were initially designed to make categorical diagnostic designations and thus, may not permit the more detailed, multi-dimensional assessment of symptomatology required for valid subtyping. In addition, existing diagnostic measures may not be sufficiently sensitive to less severe manifestations of ASD (such as those manifested among high functioning individuals), and thus, may not capture the full range of heterogeneity within the population. Perhaps most problematic, however, is the fact that current diagnostic measures are based on pre-existing conceptualizations of the most salient symptoms in ASD. Thus, they may overlook other potentially relevant clinical variables (e.g., social motivation; verbosity; attention and sensory issues; or circumscribed interests of a factual nature) that may assist in defining meaningful subtypes.

While broad symptom-based approaches may be useful in guiding our clinical understanding of the underlying nature of ASDs and their boundaries, a greater degree of specificity may be needed to examine the role of distinct etiological mechanisms. Thus, highly targeted approaches that focus on particular aspects of the ASD phenotype hypothesized to relate to specific processes are warranted.

Isolating Specific Symptom Domains

Given the extraordinary intra- and inter- individual variability within ASD, it is possible that no single subtyping system will emerge that adequately accounts for the range of presentations. As Waterhouse and colleagues (1989) stated, there may be "nearly as many categories or subgroups as there are individuals" with ASD (p. 277). Furthermore, even if reliable and common patterns are ultimately identified, broad symptom-based subgroups reflect functioning across multiple diverse areas and, thus, may not be appropriate for more fine-grained investigations into underlying causal processes. In such cases, it would be difficult to determine which particular domain or behaviour reflected in one's profile was most pertinent to the causal process or outcome under investigation.

An alternative, more targeted approach to identifying homogeneous subgroups involves isolating a core domain or behaviour of interest and then identifying common profiles or subgroups with respect to that domain alone. By affording a greater level of specificity, this approach would allow investigators to ask more specific questions of their data and better isolate the role of distinct causal mechanisms. Indeed, it is possible that several different subtyping systems may ultimately prove useful in etiological research (depending on the specific process or outcome under study).

Of direct relevance is Happe et al.'s (2006) recent examination of attempts to identify singular explanations for the diverse symptomatology of ASD. Upon reviewing evidence garnered from behavioural, genetic, and neurocognitive investigations, the authors concluded that there is limited support for the interdependence of core symptom domains (i.e., social behaviour, communication, and rigid/repetitive behaviours). Instead, the authors described heterogeneity in ASD as the "unavoidable consequence of variation along at least three largely independent (although interacting) dimensions of impairment" (p. 1220). It was further argued that the relative independence of core domains implies distinct causal processes for each. For instance, underlying genes may have symptom-specific effects as opposed to resulting in "autism as a whole". Indeed, despite prolific attempts to delineate unitary causal models over the years (e.g., theory of mind, weak central coherence, executive dysfunction), several prominent researchers have suggested that the diverse phenomena observed in ASD are unlikely to be accounted for by the same causal processes (e.g., Courchesne, Yeung-

Courchesne, & Pierce, 1999; Klin et al., 2005; Waterhouse, Wing, & Fein, 1989). Notably, this line of reasoning is more consistent with a developmental psychopathology framework that, in recognizing the complexity and dynamic nature of development, has moved away from single, all-encompassing theories towards acknowledging heterogeneity in underlying pathogenic processes.

An emphasis on causal diversity lends support to the idea of isolating key domains within the ASD phenotype (Happe et al., 2006). Such a strategy may permit researchers to develop more specific "mini-hypotheses" regarding the particular mechanisms accounting for variability in the nature and severity of key aspects of the disorder. In recent years, preliminary attempts at isolating key domains of functioning have emerged in the ASD literature. For instance, Tager-Flusberg (2004) has embarked upon a program of research aimed at breaking down the language phenotype in ASD by focusing on within-group differences. Results suggest the existence of three distinct language subtypes among verbal children with ASD - those with clearly "normal" linguistic skills; those with delayed or "impaired" language who resemble individuals with specific language impairment; and, those demonstrating borderline-normal levels of language abilities (Tager-Flusberg, 2004). Similarly, within the restricted, repetitive behaviours/interests domain, Szatmari and colleagues identified two sub-dimensions within this symptom category - an "insistence on sameness" and "repetitive sensory/motor behaviours" (Szatmari et al., 2006). Such attempts at systematically breaking down the language and repetitive behaviours/interests phenotypes respectively are encouraging and should be extended to other domains of interest – namely, the domain of social functioning.

Chapter 2
DECONSTRUCTING THE SOCIAL PHENOTYPE IN ASD

The social domain has been highlighted by several researchers as the most defining realm of impairment in ASD (Pennington & Ozonoff, 1991; Shanker, 2004; Volkmar & Klin, 2005). Thus, the identification of more homogeneous subgroups based on social functioning may shed light on particularly meaningful sources of heterogeneity within ASD and, ultimately, facilitate the search for underlying mechanisms.

PREVIOUS SOCIAL SUBTYPING ATTEMPTS

Over the years, qualitative differences in the nature of social impairment among individuals with ASD have been highlighted in descriptive and anecdotal accounts (Frith, 2003; Wing & Gould, 1979). Despite the fact that all individuals with ASD meet the DSM-IV diagnostic criteria for "qualitative impairment in social interaction", there is a large range of expression and severity of social deficits apparent within this population. Wing and Gould's early work attempted to account for some of this variability by introducing a general classification system based largely on different "qualities of social impairment" (Wing & Gould, 1979). They described an "aloof" category of individuals characterized by a tendency towards extreme social withdrawal/isolation; a "passive" group consisting of individuals who tended not to initiate social contact but would indifferently accept the approaches of others; and, an "active but odd" group consisting of those who frequently sought social contact but would do so in odd or socially inappropriate ways.

Although Wing & Gould's classification scheme may represent an overly simplistic depiction of social subgroups, it does highlight the variability in social interest observed among individuals with ASD. In particular, their categories appear to be differentiated primarily by varying levels of social motivation – ranging from a lack of interest (aloofness) to passive acceptance to heightened but odd social interest. Variability in social interest has also been emphasized as a potential discriminating factor between Asperger's Disorder and high functioning Autistic Disorder – although not reflected in current diagnostic criteria. Specifically, it has been suggested that individuals with high functioning autism may be more likely to withdraw or show disinterest in others while those with Asperger's disorder may desire social interaction but demonstrate their interest in inappropriate or eccentric ways (Ghaziuddin, 2008; Tantam, 1988; Volkmar & Klin, 2000).

More recently, Tanguay and colleagues (1998) investigated a dimensional classification of ASD symptoms based on differences in social communication behaviour. The authors factor analyzed parent responses on the ADI-R for 63 children diagnosed with autism, Asperger's disorder, or PDD-NOS. The factor analysis was conducted on 28 ADI-R items thought to reflect social communication behaviours. On the basis of their analyses, the authors identified a three factor solution consisting of affective reciprocity, joint attention, and manifestations of theory of mind that best summarized the interview data. Although notable in their attempt to identify more specific dimensions of social deficits, Tanguay and colleagues' (1998) results should be interpreted with some caution. The investigators assessed social communication using the ADI-R – a measure that, as previously mentioned, was designed to make categorical diagnostic decisions and has not been validated as a continuous measure of symptom severity (Rutter, Le Couteur, & Lord, 2003).

Limitations of Existing Social Measures

As with broad symptom-based approaches, social subtyping results are also constrained by the measurement tools used. The limitations of existing measures of social competence in ASD is a significant issue that threatens the utility of past and future social subtyping attempts. As Volkmar and Klin (2000) argue, important differences in the social deficit in ASD "may be blurred in the absence of more sensitive measures and as a result of all-encompassing,

vague definitions" (p. 62). In particular, three key measurement issues need to be addressed in future research – sensitivity to the unique social deficits in ASD; comprehensive coverage of social behaviours in order to permit multi-dimensional conceptualizations; and the potential confounding of absent/ limited social behaviours with deviant/abnormal ones.

The assessment of social competence among individuals with ASD is often accomplished by employing measures initially developed for use with 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 empirically evaluated for use with individuals with ASD (Lecavalier, Aman, Hammer, Stoica, & Mathews, 2004).

Measures that are overly broad in their focus are less likely to capture the social difficulties that are unique or particularly prominent within ASD. For instance, the Social Skills Rating System (SSRS) (Gresham & Elliot, 1990) is a widely used rating scale both within and outside the ASD literature. It was originally designed to assess broad-based social behaviours (such as cooperation, empathy, assertion, self-control, and responsibility) among typically developing children. It does not appear to adequately capture the nuances of reciprocal social behaviour often lacking among individuals with ASD (Williams-White, Koenig, & Scahill, 2007). Even measures designed for use with other DD populations may be problematic as social development in ASD is considered both "quantitatively and qualitatively" different (Klin & Volkmar, 1997). For instance, the Vineland Adaptive Behavior Scales (VABS) (Sparrow, Balla, & Cicchetti, 1984) was designed for use with DD individuals and is frequently used with individuals with ASD. However, the VABS assesses delays in normative social development as opposed to the aspects of abnormal social behaviour which may occur in ASD (e.g., "wooden" facial expressions, inappropriate social approaches, a tendency to monopolize conversations). By neglecting such characteristic social deficits, these inventories lack specificity to ASD, and thus, are poorly suited to discriminate subgroups based on subtle social differences.

A further problem associated with the use of general social measures relates to the inclusion of construct-irrelevant variance. Irrelevant items contribute error or "noise" to the assessment and, as a result, there are fewer relevant items capable of detecting more subtle individual differences (Streiner & Norman, 2003). For instance, the Vineland socialization domain includes

items related to play and leisure which may reflect factors such as social opportunity in addition to social competence ability. The interpretation of construct domains are clearest when they are not confounded by the presence of extraneous factors/variables (Netemeyer, Bearden, & Sharma, 2003).

Equally problematic is the practice of measuring social competence in ASD with ASD-specific measures that were not designed to assess social competence per se. For instance, indices of social competence are often derived from screening or diagnostic tools such as the ADI-R (Rutter et al., 2003) or Autism Diagnostic Observation Schedule (ADOS) (Lord et al., 1989). These measures were initially designed to make categorical decisions regarding the presence or absence of ASD symptoms, and thus, have not been validated for the purpose of detecting social competence differences in a quantitative manner. In addition, items typically emphasize the social variables that are most strongly related to a diagnosis of ASD, and thus, potentially meaningful heterogeneity on alternate, though perhaps less salient, dimensions of social competence is ignored. Relatedly, the use of summary indices provided by these measures do not permit a sufficiently detailed analysis of social competence in ASD. For example, summary scores on the social interaction domain of the ADI-R or ADOS do not provide information regarding the types of social deficits displayed, as different combinations of social deficits can lead to the same overall score.

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 currently used to assess social competence in ASD were informed by a truly multidimensional conceptualization of social competence. The assessment of social competence using a single index reflects an overly narrow conceptualization of the construct and leads to the loss and/or masking of important information (i.e., construct underrepresentation) (Schneider, Ackerman, & Kanfer, 1996). Indeed, it has been suggested that instead of assessing social competence as a unitary construct, a more appropriate strategy would include the determination of "social competence profiles" which emphasize an individual's pattern of social strengths and weaknesses across an array of relevent subdomains (Schneider et al., 1996).

More recently, brief screening instruments, such as the Social Responsiveness Scale (SRS) (Constantino & Gruber, 2005), have been constructed in an

attempt to provide more continuous measures of autism spectrum impairment (including sub-threshold manifestations) in the process of differentiating children with ASD from TD children. The SRS showed initial promise in providing a multidimensional, continuous assessment of social competence in ASD, as sub-domain scores in the areas of awareness, cognition, communication, motivation and mannerisms may be derived from the inventory. However, factor analysis and latent class analysis results have not supported the existence of these independent subdomains of dysfunction and, instead, suggest that a single continuous factor of impairment best characterizes the data provided by the inventory (Constantino et al., 2003; Constantino, Przybeck, Friesen, & Todd, 2000). Furthermore, in addition to focusing on social reciprocity, the SRS assesses aspects of impairment in autism that may not necessarily be social in nature (e.g., sensitivity to sensory stimuli, repetitive interests/behaviours). Again, the incorporation of such items introduces construct-irrelevant variance to the use of this inventory as a measure of social competence.

Finally, several measures confound the lack of a particular social behaviour with a qualitative abnormality in the expression of that behaviour. The same score indicating impairment is often coded on an inventory if an individual fails to demonstrate a particular behaviour or demonstrates it in an odd/inappropriate manner. This issue is particularly relevant with respect to the child's apparent level of social interest or motivation. For example, on the ADOS, high scores (indicating impairment) are given if a child makes frequent inappropriate social initiations or rarely makes any social initiations at all. Similarly, on the ADI-R, a child who "rarely offers comfort" and one who offers comfort in "odd ways" receives the same score, despite the fact that one child may be displaying greater social interest than the other. As a result, such measures can obscure important differences in the level of social interest that are potentially relevant to the parsing of heterogeneity in ASD.

In sum, the limitations of existing measures used to assess social competence in ASD arise from multiple sources. Measures that were designed for use with other populations (e.g., DD, TD) or for different purposes (e.g., diagnosis or screening) are clearly inadequate to provide a sufficiently detailed, multidimensional assessment of social competence in ASD. Additional measures that make use of a guiding theoretical model in operationalizing the relevant dimensions of social competence in ASD are needed.

Chapter 3
Development of the Multidimensional Social Competence Scale

The objective of the current study was to develop and evaluate a new measure of social competence in ASD – the Multidimensional Social Competence Scale (MSCS). By capturing more specific social domains, it is anticipated that the MSCS will be relevant for future subtyping attempts within the ASD population (i.e., facilitating the identification of subgroups characterized by distinct social profiles).

In order to ensure the practicality of administration, the MSCS constitutes a summated rating scale. Questionnaire rating scales permit the assessment of specific behaviours across various time periods/settings, are often quick and easy to administer/score in a standardized manner, and can be completed by a range of informants (Lecavalier & Aman, 2005). They are frequently used in the assessment of social competence and can be reliable and valid when careful attention is paid to test construction.

Primary caregivers may be considered preferable informants to individuals with ASD who often display limited insight into their difficulties (Koning & Magill-Evans, 2001; Russell & Sofronoff, 2005; Tantam, 2000). Parents, on the other hand, observe the child interacting with others across a range of naturalistic social settings and are generally familiar with their child's day-to-day social strengths and challenges. Furthermore, there is evidence suggesting that parents and teachers are generally consistent in the problem domains that they identify in their ratings of child social behaviour, although teachers tend to rate these difficulties as slightly less severe than parents (Koning & Magill-Evans, 2001).

Clinical observations offer equally important information about social competence, particularly when used for diagnostic purposes, as they rely on the judgments of professionals who are knowledgeable about social development. However, not all social behaviours are amenable to direct observation in a clinical or research setting and may be best assessed over time and across a range of social situations. For instance, some potentially relevant social behaviours occur with relatively low frequency and, thus, may not be easily elicited in clinical or lab settings (e.g., behaviours demonstrating empathic concern). In addition, given the potential influence of situational effects, it is difficult to determine the extent to which behaviours observed during a single, time-limited assessment are representative of the child's day to day social competence. This is a particular concern if the child is prone to experiencing anxiety in novel or social situations. Thus, for the purposes of ascertaining a comprehensive profile of strengths and weaknesses of the child's day to day social functioning, the ratings of caregivers may be preferable (Constantino & Gruber, 2005).

In developing the MSCS, it was important to target either high or low functioning individuals with ASD. Several researchers have argued that individuals with high and low functioning ASD should be studied separately (i.e., through independent investigations or data analyses) given probable heterogeneity in terms of 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 to be displayed by a nonverbal child with intellectual disability compared to a highly verbal individual with superior intelligence, and it would be challenging for a single measure to adequately assess both groups. Indeed, if the entire spectrum of ASD were assessed, it is possible that subgroups based primarily on level of cognitive functioning or language ability would emerge as has occurred in several previous attempts to identify subgroups within the ASD population (Eaves, Ho, & Eaves, 1994; Waterhouse et al., 1996).

Impairment in reciprocal social interaction is particularly striking in the population of individuals with ASD who have average to above average intelligence as measured by traditional IQ tests. As Szatmari has pointed out, the "discrepancy between their intellectual potential and their actual adaptation in terms of socialization and communication is so very marked" (Szatmari, 2000) (p. 411). This "higher functioning" group (in terms of cognitive

ability) may be considered "purer" cases of social impairment in that any emergent social subtypes are less likely to be confounded by the influence of generalized cognitive deficiency (Prior, 1987). Furthermore, given the higher likelihood of inclusion in regular academic and extra-curricular programs, the social demands and opportunities faced by high functioning individuals may be greater than those encountered by individuals who are low functioning, making the range and extent of their social impairment particularly salient to raters.

It is also possible that the social deficits demonstrated by individuals with high functioning ASD are more likely to overlap with the variability seen in the typically developing population (i.e., they may represent a more "extreme" version of social deficits that occur in more subtle forms among TD individuals). Indeed, it has been suggested that some of the social difficulties associated with ASD may in fact be continuously distributed within the general population (Happe et al., 2006). Thus, the MSCS was developed with the goal of assessing the range of social behaviours commonly observed among individuals within the high functioning ASD population but that may also occur among TD individuals demonstrating milder levels of social impairment. In other words, the measure has been designed to be sensitive to social impairment across a wider range of functioning than is typically the case for existing measures.

In a similar vein, what constitutes socially competent behavior changes througout development and, clearly, the same set of social 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, emergent subgroups may be primarily related to age and/or developmental level instead of representing true heterogeneity in social competence. Thus, there is a need for age-appropriate assessment in which the measure's focus is targeted to a particular developmental period. By focusing primarily on early developmental periods, existing research may be ignoring meaningful diversity in social presentation. Individuals with high functioning ASD (who are more likely to remain undetected until later in childhood) may represent significant variability in the nature and severity of social presentation that would be missed in studies focusing exclusively on early childhood.

Indeed, the study of social competence in adolescence may be particularly promising in its potential to identify distinct social subgroups. At

this time, the social world becomes significantly more complex as social interactions begin to require proficiency in a range of sophisticated social repertoires and skills (e.g., appreciation of social context/ subtle social nuances, initiating and maintaining conversations, offering emotional support to others) (Buhrmester, 1990). Such social skills are often the very ones that higher functioning individuals with ASD struggle with most. Thus, as social and contextual demands increase, social difficulties may become particularly pronounced among higher functioning individuals, possibly making it easier to identify and measure subtle differences in social impairment within this population. In addition, from a person-oriented subtyping perspective, the concept of "developmental crystallization" suggests that divergent symptom profiles may begin to demonstrate greater differentiation and stability over time (Bergman, 1996).

Test Construction

The sequence of steps recommended by Clark and Watson (1995), Netemeyer et al., (2003), Spector (1992), and Streiner and Norman (2003) have guided the process of scale development and validation for the MSCS. These steps represent a combination of theory-driven and empirical (i.e., data-driven) approaches to test construction. Generally, they include defining the construct of interest; designing the scale (e.g., consider format, develop items, determine response scaling); test administration; item analyses (e.g., item trimming, assessing dimensionality and internal consistency); and, scale validation (e.g., assessing construct validity).

Defining the Construct of Interest

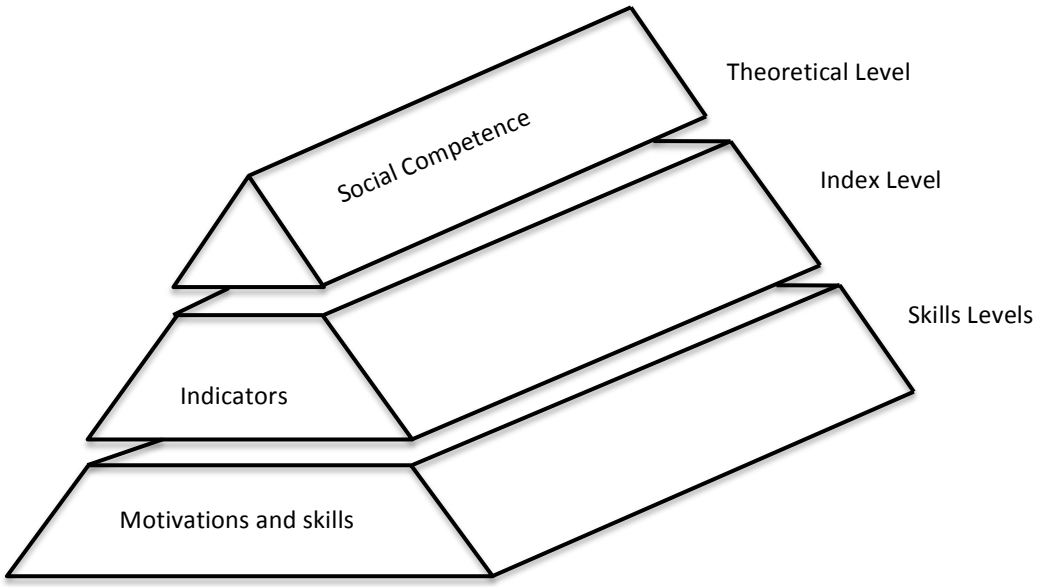
In test construction, latent constructs must be embedded within a theoretical framework in order to facilitate a more "precise conceptualization of the construct, its boundaries and content domains" (Netemeyer et al., 2003) (p. 8). Indeed, the reliability and validity of what is measured by a scale will rely largely upon its initial definition and adequate specification of relevant content domains. Thus, the first step in developing a measure of social competence involves clearly defining the construct of interest.

Unfortunately, there is no widely accepted operational definition of social competence available to guide assessment efforts. In fact, social

competence is routinely conceptualized as occurring at various different levels of analysis – at the level of cognition (e.g., perspective-taking); overt behaviours/skills (e.g., use of eye contact); or, outcome (e.g., social status, peer acceptance). As a result, there has been inconsistent use of the term, an absence of key content domains in many existing inventories, and a general lack of clarity in terms of what is being measured – all of which impede efforts to compare findings across studies (Maag, 1989; Matson & Swiezy, 1994).

Rose-Krasnor's (1997) "prism model" provides a useful framework for conceptualizing social competence and its levels of analysis (see Figure 1). The model broadly defines social competence (at a theoretical level) as overall effectiveness in meeting short and long term social developmental needs/goals. Thus, social competence is viewed as a higher-order, organizing construct with transactional, context-dependent and goal-specific characteristics. An emphasis on the dynamic interplay between characteristics of individuals and their environments has been similarly highlighted by other researchers (Sameroff, Seifer, & Bartko, 1997; Waters & Sroufe, 1983; Wyman, Sandler, Wolchik, & Nelson, 2000).

Figure 1: Rose-Krasnor's prism model of social competence.



The prism 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, or employment success) that are considered to be situation/context-specific (e.g., with peers vs. with family). Although generally indicative of social competence, these indices do not provide detailed information about the social presentation of an individual. Their utility in assessment is primarily as outcome measures or gross screening tools (e.g., identifying individuals who may be socially impaired) (Greenspan, 1981). The *motivation/skills* level consists of the underlying dispositions and abilities that provide the "building blocks" of social interactions (e.g., social motivations and social skills). Social skills include both social-cognitive abilities (e.g., perception and processing of social stimuli) as well as the more overt, observable social behaviours (e.g., eye contact, conversation ability). Any given social motivation or skill may be relevant across contexts or prove particularly valuable within a specific social context. In general, social motivations and skills tend to be more accessible to assessment methods (as compared to the indices) and are commonly measured with performance-based laboratory tasks (e.g., tests of emotion recognition) or observation-based rating scales.

In sum, 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, Yager, & Elfers, 2007; Iarocci, Yager, Rombough, & Mclaughlin, 2008). However, for the purposes of assessment, there is value in identifying and measuring a representative sampling of abilities/behaviours at the social motivation and skills level in order to "tap into" the broader theoretical construct of social competence. Thus, the current measure has focused on assessing a representative range of social motivation/skills in its attempt to operationalize social competence in a multidimensional manner.

A preliminary survey of the theoretical and empirical literature within the areas of clinical, social, and developmental psychology revealed a plethora of social skills potentially relevant to social competence in adolescence. Thus, the prism model was used to provide some focus in identifying key domains. By highlighting the relevant indices for particular developmental stages, the prism model facilitated the search for underlying motivations and skills that

support performance across these indices. In other words, the framework prescribes a top-down approach in which indices that are most salient for a particular developmental stage and environment are used to guide the search for the skills hypothesized to play a role in facilitating those indicators. As an example, during middle childhood (early school years), one's ability to engage in group play with peers may be considered an indicator of social competence. A targeted review of the literature may then reveal specific skills that facilitate one's capacity to participate in group play (e.g., skills related to making social initiation bids, turn-taking, requesting, negotiating, or managing frustration/aggressive impulses).

With respect to adolescence, a review of the literature highlighted two key social indicators as being particularly salient – peer acceptance (the extent to which adolescents are liked or disliked by their peers) and the development of more intimate friendships (mutual, affectionate relationships between two individuals) (Eisenberg & Harris, 1984; Rubin, Bukowski, & Parker, 2006). With respect to the latter, friendships in adolescence begin to involve more emotional closeness, mutual support and sharing of personal thoughts/ feelings, as opposed to being based primarily on play and shared activities. Within the ASD literature, both low peer acceptance and differences in friendship quality (i.e., reduced companionship, support, and security) have been documented among high functioning individuals (Baron-Cohen & Wheelwright, 2003; Bauminger & Kasari, 2000; Bauminger et al., 2008; Chamberlain, Kasari, & Rotheram-Fuller, 2007; Green, Gilchrist, Burton, & Cox, 2000). Thus, by focusing on the underlying motivations and skills that contribute to peer acceptance and close friendship development, it was hoped that a clearer picture of common social profiles in adolescents with ASD would begin to emerge.

Although not exhaustive, the motivations/skills selected for the MSCS were intended to be representative of the variables associated with peer acceptance and close friendship development. The motivations/skills included were 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. Although these skill domains have been isolated for the purposes of conceptual clarity and assessment, they are not considered to be entirely independent, as the skills required in social interactions are highly dynamic (i.e., interact with and build upon one another). Nonetheless, these

constructs have been distinguished in the literature as being relatively distinct and isolatable.

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). In the MSCS, social motivation is assessed with items inquiring about the frequency of social approaches and responses (i.e., the extent to which one seeks out or responds to social contact); displays of shared enjoyment; and, one's apparent interest in people/relationships (e.g., stating a desire to "fit in" with peers, talking about people when they are not around). The quality or appropriateness of social initiations/responses are not assessed within this domain, however, as the primary focus is on the level of social motivation (regardless of how effective or socially skilled one's social interactions are). Instead, the qualitative aspects of specific social behaviours are captured in other domains of the MSCS. For instance, inappropriately approaching strangers (although possibly indicative of high social interest) is captured in the social knowledge domain (i.e., understanding of social norms). By keeping social motivation separate from the quality of social behaviours, it is hoped that the MSCS will ultimately be able to differentiate distinct profiles within the ASD population (e.g., individuals presenting with high social interest but poor social skills from those with low levels of social motivation and skill).

Social Inferencing. The ability to make accurate social inferences when interacting with others involves detecting and interpreting social cues and messages. Thus, it encompasses basic social perception ability and "theory of mind" skills. Social perception has been defined as the ability to encode and interpret social cues (Spence, 2003). Such cues include not only overt behaviors and verbal dialogue, but also the contextual and nonverbal cues that define a situation (e.g., facial expression or tone of voice). The ability to perceive nonverbal social cues is particularly important in situations in which the verbal content of dialogue does not map onto the intended meaning (e.g., as in the use of humour or sarcasm). A failure to accurately perceive social cues may lead to the misinterpretation of a situation and result in an inappropriate social response. Sample items assessing social perception in the MSCS within the social inferencing domain include those inquiring whether the individual notices mood changes in others, can tell when others are trying to end a conversation, and knows when someone is joking with him/her.

Theory of mind constitutes a high-level social-cognitive ability that involves inferring the mental states (beliefs, desires, feelings, and intentions) of others (Baron-Cohen, 1989). Theory of mind is itself an umbrella term that encompasses more specific abilities (e.g., first-order false belief comprehension, second-order false belief comprehension, faux pas detection; Adolphs, 2003). Theory of mind representations are used to understand and predict the behaviours and utterances of others (Brownell & Martino, 1998). Manifestations of theory of mind may be evident in numerous day to day social behaviours, some of which are assessed in the MSCS. For instance, an accurate representation of the mental states of others would help one respond to indirect requests; recognize when he/she is being manipulated or taken advantage of; or, deceive/persuade others.

Demonstrating Empathic Concern. Related to the ability to infer the mental states of others is one's capacity to empathize with others. Empathy is commonly conceptualized as involving both a cognitive, theory of mind-type component (i.e., ability to understand another's feelings or experience) as well as an affective component (i.e., experiencing an appropriate emotional response to the affective state of another) (Baron-Cohen & Wheelwright, 2004). Possible demonstrations of empathic concern in day to day life include showing concern for others (e.g., when they are hurt or suffering); offering comfort or support; or, refraining from making hurtful comments.

Social Knowledge. The interpretation of social situations is also guided by one's social knowledge or "social schemas". Social schemas include beliefs about the self and others as well as the procedural rules/norms governing specific social situations and their relevant social contexts (Ingram, Miranda, & Segal, 1998). Socially skilled individuals recognize that there are different expectations for appropriate social behaviour in different settings. Biased or deficient knowledge of a specific social situation may lead to inappropriate responses or a failure to anticipate potential problems. Items in this domain assess the occurrence of inappropriate social behaviours (e.g., approaching strangers, sharing too much personal information); the appreciation of social context (e.g., being polite with authority figures, adjusting the volume of one's voice depending on the situation); the understanding of specific relationships (e.g., what constitutes a friend versus an acquaintance); and, the recognition of potentially dangerous social situations (e.g., internet chat rooms or meeting people they've met over the internet). Individuals who display inappropriate

social behaviours on a regular basis are more likely to "stand out" among their peers and/or to be recognized as odd or socially awkward.

Verbal Conversation Skills. Verbal conversation skills enable individuals to start, maintain, and end reciprocal conversations appropriately. Within this domain, the MSCS assesses one's sense of timing in conversations (e.g., tendency to interrupt, ability to join or end conversations smoothly); conversational topic management (e.g., introduction and maintenance of topics); and conversational turn-taking (e.g., asking questions or elaborating upon others' responses vs. a tendency towards "monologues"). Although many of these skills are not exclusively verbal per se, in that they depend upon the integration of various nonverbal skills and social inferencing skills as well, they are generally easy for an observer to isolate and detect in the context of verbal exchanges and, thus, are classified as verbal communication skills for the purposes of the MSCS.

Nonverbal Sending Skills. Proficiency in the "sending" of nonverbal cues is also needed to communicate effectively with others. One's ability to adjust the quality and quantity of nonverbal responses (e.g., eye contact, facial expression, social distance) plays a significant role in influencing the perceptions and responses of communication partners and, ultimately, impacts the success of a social interaction (Spence, 2003). The MSCS assesses several key elements of nonverbal communication such as appropriate use of body/gestures/personal space; the range, quality and appropriateness of facial expressions; social smiling (e.g., smiling in response to compliments, greetings); quality and use of eye gaze; and, aspects of speech (e.g., prosody, style, volume).

Emotion Regulation. Emotion regulation has been generally defined as the processes involved in monitoring, evaluating, and modulating the intensity and temporal features of internal emotional experiences and emotion-related behaviour in order to attain desired affective states and accomplish specific goals (Lopes, Salovey, Cote, Beers, & Petty, 2005). Successful social interactions also depend upon the effective regulation of emotional experiences (Lopes et al., 2005). The experience and expression of positive emotions can lead to enhanced social engagement and pleasure (by eliciting favorable responses from others) while negative ones can lead to stress, avoidance, and/or disruptive/inappropriate social behaviour (Argyle & Lu, 1990; Furr & Funder, 1998). Indeed, individuals who are not able to regulate their emotions may display negative behaviours (e.g., tantrums or angry outbursts) that lead to

social rejection or isolation. Thus, emotion regulation items in the MSCS primarily assess the regulation of negative emotional states (e.g., use of coping strategies to deal with anger, disappointment, frustration).

Scale Design

Once a construct has been adequately delineated, items systematically sampling each content domain must be generated for the scale. In developing an initial representative item pool for the MSCS, several item stems were collected and adapted from previous measures. The advantage of this approach is that these items have already been tested and proven useful (Streiner & Norman, 2003). For the motivations and skills not adequately captured in existing measures, original items were written on the basis of clinical descriptions of individuals with ASD and/or relevant research findings. In order to support the content validity of the measure, items within each domain were selected to ensure a balanced and adequate sampling of relevant social behaviours. An effort was made to adequately sample both typical manifestations of socially competent behaviours as well as the various skill deficits that are common or particularly salient in ASD (i.e., to ensure the assessment of a range of functioning levels).

In order to ensure an adequate sampling of content areas, it has been suggested that items fall within at least one domain and that each domain should be represented by an adequate number of items (Streiner & Norman, 2003). Ideally, the number of items per domain should reflect the importance or representativeness of that domain and not the ease of writing items reflecting its content. When generating an initial item pool, it was preferable to be over-inclusive rather than under-inclusive (Netemeyer et al., 2003). Problematic items are easily detected and eliminated during test validation but it is difficult to account for important aspects of a construct that are initially overlooked. Thus, the initial version of the MSCS included far more items than were ultimately retained.

In order to facilitate objective measurement, MSCS items were, for the most part, designed to focus on specific and observable behavioural manifestations of the underlying motivations/skills being assessed. For instance, in the majority of items, phrasing emphasized what the target individual has been observed to *say* or *do* during their day to day life. There

are, however, some items that assess more general perceptions of the individual's interaction style (e.g., "enjoys meeting new people").

In terms of readability, Microsoft Word mean readability estimates (Flesh Kincaid Grade Level) for each domain are displayed in Table 1. Grade level estimates were found to range between grades five and seven – which is considered appropriate for a parent questionnaire measure (Streiner & Norman, 2003). No individual items were found to exceed a Grade 9 reading level. In an attempt to minimize the effect of systematic response biases (e.g., acquiescence response sets), some of the items were written to reflect high social competence and others to depict low social competence.

Table 1: Mean readability (Flesh Kincaid Grade Level) estimates for items within original domains.

Domain	Mean Flesh Kincaid Grade Level Estimate
Social Motivation	6.0
Social Inferencing	7.0
Demonstrating Empathic Concern	6.9
Social Knowledge	7.8
Verbal Conversation Skills	7.6
Nonverbal Sending Skills	6.8
Emotion Regulation	5.6

The initial group of items developed consisted of a total of 352 items which were reviewed in order to eliminate any that were redundant, poorly written or did not appear to be specific to any one category domain. This process reduced the pool to 283 items. In order to facilitate the categorization of the remaining items into content domains, the 283 items were administered to a group of 5 graduate student raters who are familiar with social development. The raters were provided with general descriptions of the MSCS domains and were asked to assign each item to one (or more) of the content areas. Only items with 100% agreement on the primary category designation were retained. In the end, a total of 199 items were included in the MSCS (35 social motivation items; 35 social inferencing items; 23 demonstrating empathic concern items; 30 social knowledge items; 24 verbal conversation skills items; 25 nonverbal sending skills items; and, 27 emotion regulation items). A list of the items

retained within each MSCS domain may be found in Appendix A. Reverse coding was applied to 102 of the items to ensure that higher scores on all items reflect lower levels of competence.

In terms of quantifying response options (i.e., item scaling), it has been suggested that a minimum of five to seven response choices are necessary for the underlying construct to be considered "pseudo-continuous" – a requirement for statistical analyses such as factor analysis (Streiner & Norman, 2003). In addition, if too few options are provided, there is uncertainty about boundaries between the response categories and the instrument is deemed less reliable and precise. On the other hand, the reliability and validity of a measure does not necessarily increase when more response options are provided (e.g., a nine point versus a five point scale) and, in fact, the demands of responding in such cases (i.e., making finer distinctions) may become too overwhelming for raters (Streiner & Norman, 2003). Thus, in the MSCS, five response options were provided for each item. Five responses are generally deemed sufficient if a large number of items are included in the measure that will ultimately be summed to create subscale or scale scores (Netemeyer et al., 2003; Streiner & Norman, 2003). The response options provided in the MSCS assess the degree to which a given description is characteristic of the individual's behaviour over the past 6 months (i.e., "not true or almost never true", "rarely true", "sometimes true", "often true", "very true or almost always true").

Administration, Item Analyses, and Scale Validation

The MSCS was administered to parents of early and middle adolescents (aged 11 – 18) for further item analyses and scale validation. Preliminary item analyses (outlined in the Results section) were used to reduce the number of items/domain to 15, leaving a total of 105 items in the MSCS. In particular, items were selected for retention at this stage if they demonstrated sufficient variability in endorsement rates; appeared maximally capable of discriminating between ASD and TD groups; and, demonstrated high levels of internal consistency.

Empirical approaches to scale development typically emphasize the sequential nature of test evaluation (Netemeyer et al., 2003; Spector, 1992; and, Streiner & Norman, 2003). Before composite scores on a scale can be calculated and used in subsequent psychometric evaluations, the dimensionality of a test must be assessed to ensure that calculating composite scores (for each domain

and/or the total test) are justified. In other words, it is important that a scale's dimensionality is established before other psychometric properties (such as reliability or validity) are examined because any composite or average scores used in subsequent analyses will only be meaningful if the items within subscales demonstrate unidimensionality (Schmitt, 1996). Thus, the first step in a sequence of test evaluation is to determine whether the items conform to the theoretical structure of the test. Measures conforming to a unidimensional test theory model consist of items assessing a single latent construct, while multidimensional scales include items tapping more than one dimension or factor (Netemeyer et al., 2003).

With respect to the MSCS, data from the 105 selected items was submitted to confirmatory factor analysis (CFA) in order to evaluate the proposed dimensionality of the scale. In addition to confirming the scale's dimensionality, results from the CFA were used to shorten the scale further and reduce the number of items to 77 (11 items per domain). Subsequent item analyses conducted included assessing internal consistency of the final subscales and a preliminary investigation of the MSCS's construct validity (i.e., convergent validity and criterion-related validity).

Chapter 4
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. In the current project, it was hypothesized that a confirmatory factor analysis 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. The advantage of multidimensional assessment lies in its ability to systematically dissect complex behaviours such as social competence that are routinely assessed using global indices that ignore potentially meaningful heterogeneity. Thus, it was hoped that the data provided by the MSCS would ultimately lead to a more differentiated understanding of social impairment in ASD and facilitate the identification of profiles of strength/weaknesses as well as possible social subtypes.

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.

Chapter 5
METHOD

PARTICIPANTS

Two groups participated in the current research – a sample of adolescents (11-18 years old) with high functioning ASD (and their primary caregivers) and a sample of TD adolescents (and their primary caregivers). Potential participants within both groups were excluded from the study if the primary language spoken in the home was not English.

Different sample sizes were recruited for different components of the current study. As a general rule of thumb, relatively large sample sizes (i.e., at least 200) are considered desirable to perform a confirmatory factor analysis (Boomsma, 1982). Thus, a widespread recruitment initiative was undertaken to enroll parents of adolescents with high functioning ASD to complete the survey (i.e., MSCS) portion of the study via the phone and internet. Potential participants were recruited from a variety of sources. Participants from the Autism and Developmental Disorders Lab's existing database (i.e., families who have participated in previous lab projects or have contacted the lab to express an interest in research participation) were contacted about the study. In addition, information recruitment letters were sent to a number of autism-related service and support programs both locally and across the country (e.g., provincial Autism Societies). When possible, recruitment ads were placed on organization websites (e.g., Autism Community Training Program - BC, Geneva Centre for Autism, Autism Ontario, and Asperger's Society of Ontario).

A smaller subset of participants (those who live locally) were invited to participate in a slightly more extensive version of the study that involved cognitive testing of the adolescents. A smaller sample of participants coming into the lab was deemed sufficient for the between-group analysis of matched samples on the MSCS (i.e., group comparisons to support known groups

validity). Indeed, power calculations suggested that a total sample size of 56 (28 ASD, 28 TD) would provide a Power of 90% to detect a large effect (f=0.4) when conducting a one-way ANOVA on the MSCS scores. The sample of TD adolescents (and their primary caregivers) was recruited through existing lab contacts (e.g., participants from previous studies) as well as from three local private schools.

For all participants within the ASD group, previous clinical diagnoses were confirmed using the ADI-R (Rutter et al., 2003), which is considered to be the gold standard in diagnosis within the field. For participants who completed the cognitive testing, high functioning 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 "high functioning" was applied in which only adolescents who have never been diagnosed with intellectual disability and are currently completing the regular academic curriculum for their grade level (i.e., not completing a modified program) were included in the study. Academic accommodations that do not lower the difficulty level of subject matter or grade-level expectations were permitted (e.g., extra time on tests, use of laptop for written output difficulties).

In total, 229 participants were enrolled in the study (181 ASD, 48 TD). Within the ASD group, 8 did not meet the diagnostic criteria for ASD on the ADI-R and, thus, were excluded from the analyses. An additional 11 participants with ASD did not meet the specified criteria to be considered high functioning, and thus, were excluded. Twenty-seven participants with ASD withdrew part way through or did not complete the study (e.g., the MSCS was not completed). None of the TD participants withdrew prematurely from the study.

The final sample of participants (with completed MSCSs) consisted of 183 adolescents (135 ASD, 48 TD). There were 143 males (78.1%) and 40 females (21.9%) and the mean age was 14.3 years (SD = 2.26; Range = 11 – 18). Frequencies for the specific ages of participants are provided in Table 2. The ethnic composition of the total sample was as follows: Caucasian, n = 144 (78.6%); Asian, n= 17 (9.3%); Middle Eastern, n = 2 (1.1%); multiracial, n = 18 (9.8%); and other, n = 2 (1.1%). Overall, mothers represented the most frequent respondents in the study, n= 178 (97.3%), followed by fathers, n= 5 (2.7%).

Within the total sample, 132 respondents (87 ASD, 45 TD) also completed the SRS for the purposes of examining the convergent validity of the MSCS.

Table 2: Frequency of participant ages within total sample.

Age	Frequency (%)
11	33 (18%)
12	29 (15.8%)
13	24 (13.1%)
14	32 (17.5%)
15	18 (9.8%)
16	12 (6.6%)
17	25 (13.7%)
18	10 (5.5%)

Within the ASD group, parental report indicated that 50 (37%) had a previous clinical diagnosis of Autistic Disorder, 66 (48.9%) had a diagnosis of Asperger's Disorder, and 19 (14.1%) had a diagnosis of PDD NOS.

Eighty-three adolescent participants (36 ASD, 47 TD) completed the cognitive testing portion of the study in the lab. Of these, 44 (22 ASD, 22 TD) were successfully 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). The mean CA difference between matched participants was 4.95 months and the mean ABIQ difference was 3.95 points. No significant differences were found between the groups in terms of CA or ABIQ. The mean CAs and ABIQs for all matched participants are included in Table 3.

Table 3: Participant characteristics of adolescents within ASD and TD groups 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

MATERIALS

ADI-R. The ADI-R (Rutter et al., 2003) is a parent diagnostic interview that is considered the gold standard in ASD diagnostic assessment. The ADI-R was administered to parents of individuals with ASD by the author (who was trained in administration by a certified trainer at a two-day ADI-R workshop sponsored by the BC government). The ADI-R takes approximately 1-2 hours to complete and consists of 93 items that inquire about early development across three key domains: reciprocal social interaction, communication, and restricted interests. Scores from the interview are entered into the Diagnostic Algorithm to determine whether individuals meet the cut-off for a diagnosis of an ASD. The ADI-R Diagnostic Algorithm is based on parental retrospective report. The ADI-R does not currently provide differential cutoffs or criteria for determining which ASD diagnosis should be provided (e.g., Autistic Disorder, Asperger's disorder, PDD-NOS).

Stanford-Binet Intelligence Scale: Fifth Edition (SB5) – Abbreviated Battery. The SB5 (Roid, 2003) is an individually administered test of cognitive ability for individuals between 2 and 85 years of age. The ABIQ consists of the two routing subtests: Nonverbal Fluid Reasoning (which assesses ability to solve object series/matrices) and Verbal Knowledge (which assesses expressive vocabulary). Recent data suggests that the SB5 ABIQ is adequately representative of the Full Scale IQ in the majority of individuals with ASD (Coolican, Bryson, & Zwaigenbaum, 2008). Completion of the routing subtests generally takes between 15 and 20 minutes.

Family Demographics Questionnaire. A general background questionnaire was developed to collect basic demographics information as well as more specific information regarding the diagnostic and educational history of the adolescent with ASD (see Appendix B). A parallel version of the Family Demographics Questionnaire that does not include diagnostic information was provided for TD participants (see Appendix C). The questionnaires were designed to be completed by the primary caregiver and generally took respondents 5-10 minutes to complete. Of note, given that the ADI-R does not confirm specific DSM-IV diagnoses, parent report on the family demographics questionnaire was used to provide information about previous clinical diagnoses provided.

The questionnaire also includes *indicator* items assessing the adolescent's friendships and peer acceptance. Items deemed to be indicators of friendships

included the following: number of acquaintances (coded on a scale of 0 to 5: 0 = 0 acquaintances, 1 = 1 acquaintance, 2 = 2 acquaintances, 3 = 3 acquaintances, 4 = 4 acquaintances, 5 = 5 or more acquaintances); number of close friendships (coded on a scale of 0 to 5: 0 = 0 friends, 1 = 1 friend, 2 = 2 friends, 3 = 3 friends, 4 = 4 friends, 5 = 5 or more friends); having a best friend (0 = no, 1 = yes); and, frequency of social contact with friends outside of school and extracurricular activities (coded on a scale of 0 to 5: 0 = 3 or more times/week, 1 = 1-2 times/week, 2 = 1-3 times/month, 3 = 3-6 times/year, 4 = 1-2 times/year, 5 = 0 times/year).

The items regarding peer acceptance were only completed for adolescents attending school outside of the home. The following items were selected as indicators of peer acceptance: "is liked by peers at school"; "gets along with his/her classmates"; "is teased or bullied at school"; and, "is ignored by peers at school". Each of these items were rated on a scale of 0 to 4: 0 = never, 1 = rarely, 2 = sometimes, 3 = often, 4 = almost always.

MSCS. The MSCS has been developed for the purpose of assessing social competence in a multidimensional manner. The preliminary version administered to primary caregivers in the current study 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"). Selected items were reverse coded such that higher scores on the MSCS are reflective of lower levels of social competence. Simon Fraser University's WebSurvey software was used to administer a secure electronic version of the MSCS to participants on their computers via the internet. The online survey was constructed so that only one item was presented to the participants at a time. Once a response was entered, the next item would appear. Completion of the scale using WebSurvey took approximately 30 minutes for the majority of participants.

Social Responsiveness Scale (SRS). The SRS (Constantino & Gruber, 2005) is a 65-item parent questionnaire designed to assess the core dimensions of ASD symptomatology - interpersonal behaviour, communication, and the repetitive/stereotypic behaviours. The SRS is used to assess the behaviour of children and adolescents between the ages of 4 and 18 and may be completed in 15 to 20 minutes. Items are rated using a Likert scale response format ranging from 1 to 4 (not true, sometimes true, often true, and almost always true).

The SRS was initially designed to function as a screening tool to assist in differentiating children with ASD from TD children and those with other

psychiatric disorders. It provides both a total score as well as subscale scores within the domains of social awareness, social cognition, communication, motivation, and autistic mannerisms. However, as previously mentioned, results from factor and latent class analyses have not supported the existence of these subscales and suggest that the inventory should be used instead to provide a single continuous measure of severity of impairment in ASD (Constantino et al., 2003). As with the MSCS, higher scores are reflective of lower levels of social responsiveness.

The SRS has been standardized on a sample of over 1,600 children from the general population and separate norms are provided for males and females. Psychometric properties have been evaluated. Total score alpha reliability estimates are above 0.90 for both males and females in clinical and normative samples. Converging evidence supporting the validity of the SRS is available from a variety of studies (e.g., comparisons of SRS results to those obtained using clinical diagnostic interviews; differentiation of ASD from other psychiatric disorders; examination of the structure of the SRS in an epidemiological twin sample) (Constantino & Gruber, 2005).

PROCEDURE

Caregivers who expressed an interest in the current study were contacted by phone so that the project could be adequately explained to them. If they continued to express an interest in participating, they were mailed an introductory package including a cover letter stating the purpose of the study and explaining the voluntary and confidential nature of the research, a consent form, the family demographics questionnaire, the SRS, and a postage-paid return envelope. Once the completed package was received, a phone interview was scheduled with the primary caregiver so that the ADI-R could be completed. Although the ADI-R is traditionally administered face to face, a recent study suggests that telephone interviews are a valid and reliable alternative when cost and geographic concerns limit the feasibility of an in-person administration (Ward-King, Cohen, Penning, & Holden, 2010). Following the ADI-R interview, caregivers were provided with instructions for completing the online survey (MSCS). A link to the online survey web page was subsequently emailed to the caregiver. If necessary, up to two reminder

emails were sent to the caregivers if the MSCS was not completed within two months of the phone interview.

The procedure was slightly different for the participants who were able to come into the lab for a testing session (i.e., a subset of the ASD group and all of the TD participants). Primary caregivers were asked to complete the paper and pencil measures (i.e., family demographics questionnaire, SRS) as well as the web-based MSCS (on one of the lab computers) during the session. For the ASD participants, the ADI-R was also generally administered in person by the author during the session (unless time constraints necessitated a subsequent phone interview). At the same time, the adolescent participants were administered the ABIQ Scale of the SB5 with another experimenter in another room.

Chapter 6
RESULTS

MSCS Item Analyses

Item Trimming. Prior to conducting more complex structural analyses, preliminary item analyses (as outlined by Streiner and Norman, 2003) were conducted in order to reduce the total number of MSCS items to 105. As noted in the Method section, the MSCS was administered to 183 parents – all of whom had complete MSCS data (i.e., no missing values).

To begin with, response distributions of individual items were examined using PASW Statistics 18 in order to identify items with limited variability in responses (e.g., highly skewed responses in which only one or two options are being endorsed). According to Streiner and Norman (2003), items in which one alternative has either a very high or low endorsement rate (i.e., the proportion of people providing that response falls above 0.95 or below 0.05) should be eliminated (as they indicate that most individuals are responding in the same direction or with the same alternative). In light of the possibility that particular items would show differential response distributions across the groups, the response distributions were examined within both the total sample as well as the ASD sample alone. The ASD sample (as opposed to the TD sample) was specifically isolated for closer examination given that the primary goal of the MSCS is to make discriminations among levels of social competence among individuals with ASD.

When response distributions for the total sample were examined, all 199 items were found to have the full range of response options endorsed (i.e., items 1 through 5). None of the items demonstrated extremely high endorsement rates (i.e., > 0.95) for any one response option. Forty-seven items demonstrated very low endorsement rates (i.e., < 0.05) for one response option. In the majority of cases (38 out of 47 items), the option indicating the greatest

impairment was rarely endorsed. When the ASD sample was examined on its own, it was apparent that 37 of these 47 items also demonstrated low endorsement rates for one response option. However, items were not eliminated at this stage solely due to unbalanced distributions. Although certain response options may be rarely endorsed, it may be particularly meaningful when they are. In addition, it is possible that items with low endorsement rates (i.e., skewed items) remain valuable in making discriminations among groups of individuals completing the scale (e.g., ASD vs. TD). Thus, it was important to examine indices of discrimination ability before eliminating any items.

Discrimination ability refers to the extent to which members of distinct groups are likely to have endorsed a particular item and constitutes another index of item utility (Streiner & Norman, 2003). In the current study, items that were identified as minimally discriminating between the ASD and TD groups as well as those deemed incapable of making finer discriminations between high and low scorers within the ASD group alone were considered for possible elimination. Items are often considered to have acceptable discrimination ability if the discrimination index (d) is greater than 0.30 (Streiner & Norman, 2003). The ability of items to discriminate between high and low scorers in the ASD group was determined by selecting the top 1/3 and bottom 1/3 of scorers and subsequently calculating discrimination indices for each item using this sample.

Within the total sample, 76 items were identified as having low discriminating power between the ASD and TD groups. Of these, 31 also demonstrated low discrimination indices when comparing the high and low scorers within the ASD group.

Table 4 lists the 54 items identified for possible elimination through the preliminary item analyses (i.e., items demonstrating unbalanced distributions in both the total and ASD only samples as well as those with low discrimination indices for both the ASD vs. TD and ASD high vs. low scorer comparisons). Thirteen items demonstrated unbalanced distributions in both samples as well as low discrimination indices in both samples and, thus, were eliminated from the item pool. An additional 17 items demonstrating low discrimination indices for both group comparisons were eliminated.

Table 4: Candidate items for elimination identified through preliminary item analyses.

MSCS Item[1]	Skewed Items[2] (Total Sample) (Yes/No)	Skewed Items[2] (ASD Sample) (Yes/No)	Discrimination Index (ASD vs. TD)	Discrimination Index (ASD - top 1/3 vs. bottom 1/3)	Status of item (retained/ eliminated)
Social Motivation					
Prefers to spend time alone	**Y***	**Y***	0.54	0.31	Retained
Shows little interest in people	**Y**	**Y**	0.38	0.47	Retained
Extremely shy	N	N	**<0.30 (0.24)**	**< 0.30 (0.28)**	**Eliminated**
Avoids new or diffi-cult social situations	**Y***	**Y***	0.58	0.47	Retained
Wants to share his/her enjoyment	**Y**	**Y**	**<0.30 (0.12)**	**< 0.30 (0.23)**	**Eliminated**
Expresses an interest in dating or marriage	N	N	**<0.30 (0.16)**	**< 0.30 (0.24)**	**Eliminated**
Shows people things	N	N	**<0.30 (0.14)**	**< 0.30 (0.12)**	**Eliminated**
Interested in gossip	**Y***	**Y***	**<0.30 (0.20)**	**<0.30 (0.08)**	**Eliminated**
Talks or asks about people	N	**Y**	**<0.30 (0.24)**	**< 0.30 (0.24)**	**Eliminated**
Wants people to like him/her	**Y**	**Y**	**<0.30 (-0.01)**	**<0.30 (0.23)**	**Eliminated**
Wants to appear "cool"	N	N	**<0.30 (0.15)**	**< 0.30 (0.29)**	**Eliminated**
Interested in what other people say	**Y**	**Y**	**<0.30 (0.22)**	0.35	Retained
Social Inferencing					
Misinterprets what people say	**Y**	**Y**	0.31	0.54	Retained
Trouble recognizing people	**Y**	N	**< 0.30 (0.19)**	**<0.30 (0.17)**	**Eliminated**
Is suspicious	**Y**	N	**< 0.30 (0.03)**	**<0.30 (0.19)**	**Eliminated**
Can tell when it is best to leave someone alone	**Y**	**Y**	0.49	0.63	Retained
Can tell when someone is lying	**Y***	**Y***	0.51	0.47	Retained
Can tell when people are joking	**Y**	**Y**	**<0.30 (0.19)**	0.32	Retained
Knows what people like to do/ are interested in	**Y**	**Y**	**<0.30 (0.07)**	**< 0.30 (0.14)**	**Eliminated**
Can tell when people are in a "bad mood"	**Y**	**Y**	**<0.30 (0.15)**	0.40	Retained

MSCS Item[1]	Skewed Items[2] (Total Sample) (Yes/No)	Skewed Items[2] (ASD Sample) (Yes/No)	Discrimination Index (ASD vs. TD)	Discrimination Index (ASD - top 1/3 vs. bottom 1/3)	Status of item (retained/ eliminated)
Tells small lies	N	N	**< 0.30 (-0.27)**	**<0.30 (-0.04)**	**Eliminated**
Good at playing fun "tricks"	**Y***	**Y***	**< 0.30 (0.18)**	**<0.30 (0.24)**	**Eliminated**
Demonstrating Empathic Concern					
Rough with animals	**Y**	**Y**	**<0.30 (0.11)**	**<0.30 (0)**	**Eliminated**
Indifferent to people who are upset	**Y**	**Y**	**<0.30 (0.15)**	0.31	Retained
Insults or puts people down	**Y**	**Y**	**<0.30 (0.09)**	**<0.30 (0.28)**	**Eliminated**
Reacts inappropri-ately when others are hurt/ upset	**Y**	N	**<0.30 (0.12)**	**<0.30 (0.23)**	**Eliminated**
Quick to point out mistakes	**Y***	**Y***	0.45	**<0.30 (0.15)**	Retained
Acts "better than others	N	N	**<0.30 (0.15)**	**<0.30 (0.17)**	**Eliminated**
Gives suggestions/ advice in a sensitive way	**Y***	**Y***	0.52	0.63	Retained
Social Knowledge					
Inappropriate with strangers	**Y**	**Y**	**< 0.30 (0.16)**	**< 0.30 (0.14)**	**Eliminated**
Touches people inappropriately	**Y**	**Y**	**<0.30 (0.06)**	**< 0.30 (0.07)**	**Eliminated**
Takes things without permission	**Y**	N	**<0.30 (0.14)**	**< 0.30 (0.21)**	**Eliminated**
Says embarrassing comments or questions	**Y**	**Y**	**<0.30 (0.18)**	0.37	Retained
Understands risky social situations	N	N	**< 0.30 (0.11)**	**< 0.30 (0.19)**	**Eliminated**
Uses polite expressions	**Y**	**Y**	**<0.30 (0.15)**	**< 0.30 (-0.02)**	**Eliminated**
Follows "social rules" around privacy	**Y**	**Y**	**<0.30 (0.11)**	0.32	Retained
Acts appropriately in public situations	**Y**	**Y**	**< 0.30 (0.07)**	0.31	Retained

MSCS Item[1]	Skewed Items[2] (Total Sample) (Yes/No)	Skewed Items[2] (ASD Sample) (Yes/No)	Discrimination Index (ASD vs. TD)	Discrimination Index (ASD - top 1/3 vs. bottom 1/3)	Status of item (retained/ eliminated)
Verbal Conversation Skills					
Long pauses in conversations	**Y**	**Y**	**<0.30 (0.14)**	**< 0.30 (0.17)**	**Eliminated**
Ends conversations suddenly	**Y**	**Y**	**< 0.30 (0.26)**	0.42	Retained
Stays on topic during conversations	**Y**	**Y**	**<0.30 (0.27)**	0.40	Retained
Gives other people a chance to speak	**Y**	**Y**	0.33	0.51	Retained
Brings up interesting conversation topics	**Y***	**Y***	0.50	0.63	Retained
Nonverbal Sending Skills					
Smiles seem forced/ awkward	**Y**	**Y**	**<0.30 (0.2)**	0.35	Retained
Gestures are awkward	N	N	**<0.30 (0.20)**	**< 0.30 (0.21)**	**Eliminated**
Stands or sits too close	**Y**	**Y**	**<0.30 (0.21)**	**< 0.30 (0.26)**	**Eliminated**
Emotional reactions don't match situation	N	N	**<0.30 (0.20)**	**< 0.30 (0.19)**	**Eliminated**
Turns and faces people when talking	**Y**	N	**<0.30 (0.19)**	**< 0.30 (0.28)**	**Eliminated**
His/her facial expressions are easy to read	**Y**	**Y**	**<0.30 (0.23)**	0.37	Retained
Easy to tell how he/she is feeling	**Y**	**Y**	**<0.30 (0.13)**	**< 0.30 (0.26)**	**Eliminated**
Smiles appropriately	**Y**	**Y**	**<0.30 (0.17)**	0.37	Retained
Keeps a comfortable physical distance	**Y**	**Y**	**<0.30 (0.17)**	0.34	Retained
Emotion Regulation					
Acts out of control	N	**Y**	**<0.30 (0.12)**	**< 0.30 (0.21)**	**Eliminated**
Refuses to talk when upset	N	N	**<0.30 (0.25)**	**< 0.30 (0.28)**	**Eliminated**
Stays calm when problems come up	**Y***	**Y***	0.48	0.45	Retained

[1] Summary of item phrasing

[2] Skewed items are defined as those with a low endorsement rate for one response option

* Response option reflecting greater social competence is rarely endorsed

Following these eliminations, 169 items remained in the total item pool. Thus, additional efforts were needed to prioritize 105 items for inclusion in the factor analyses (15 items per domain). Further item selection was then conducted on the basis of examining inter-item correlation matrices and corrected item-total correlations within each domain (Streiner & Norman, 2003). The purpose of examining these correlations was to select the items within each domain that are moderately correlated with one another (a necessary but not sufficient condition for dimensionality).

Given that the scale items were designed to be maximally discriminating between the ASD and TD groups, it was necessary to use mean centered data for the initial correlation and factor analyses of the total sample. In other words, item scores for each participant were standardized according to group means (mean centered around zero) and this transformed data was analyzed for the total sample instead of the raw data.

The inter-item correlation matrices for each domain were visually inspected to identify items with excessively high levels of correlation with other items (i.e., > 0.80) which are suggestive of item redundancy. Five items were removed due to high levels of redundancy with other items. Two of these items were removed from the Social Motivation domain ("likes getting to know new people"; "does not like group activities"); one from the Demonstrating Empathic Concern domain ("makes reassuring comments when people are upset"); one from Nonverbal Sending Skills domain ("makes eye contact when greeting someone"); and one from the Emotion Regulation items ("has a tendency to blow up"). No excessively redundant items were identified within the domains of Social Inferencing, Social Knowledge, or Verbal Conversation Skills.

Corrected item-total correlations (within each domain) were then calculated for the remaining 164 items. These items were rank ordered such that items with the highest corrected item-total correlations were prioritized for inclusion. However, it was also important to ensure that the final group of items allowed for sufficient representation of content areas within domains, and thus, in some instances, items were retained despite not being among the top 15 in terms of corrected item-total correlations. Table 5 includes the ranges and means of the corrected item-total correlations for the final items selected for each domain. A list of the 105 items selected for inclusion in the factor analysis is outlined in Appendix D.

Table 5: Ranges and mean corrected item-total correlation values across domains (based on 105 retained items).

Domain	Minimum of corrected item-total correlation values	Maximum of corrected item-total correlation values	Mean of corrected item-total correlation values (SD)
Social Motivation	0.47	0.71	0.58 (0.07)
Social Inferencing	0.31	0.64	0.53 (0.12)
Demonstrating Empathic Concern	0.44	0.72	0.58 (0.10)
Social Knowledge	0.38	0.58	0.48 (0.06)
Verbal Conversation Skills	0.33	0.67	0.50 (0.10)
Nonverbal Sending Skills	0.31	0.68	0.56 (0.10)
Emotion Regulation	0.48	0.77	0.65 (0.10)

Dimensionality. Once the reduced pool of 105 items was finalized, the dimensionality (or homogeneity) of the items was examined using confirmatory factor analysis (CFA). CFA techniques fall within the broader class of structural equation modeling methods and permit the confirmation of an a priori hypothesis about the relationship of a set of measurement items to their respective factors (Brown, 2006). In other words, a theoretical factor structure is specified and tested for its "fit" with the pattern of observed covariances among items within each factor (Thompson, 2004). A priori estimations include the number of factors, which items load on each factor, and the nature of relationships among factors (i.e., whether or not they are correlated).

Given that it is considered best practice within CFA model testing to assess multiple plausible rival models (Thompson, 2004), a number of alternate factor models of the MSCS were evaluated and compared for their fit. For each model tested, the CFA was conducted using LISREL 8.80 on the sample variance-covariance matrix of the mean centered data. For ease of comparison across models, Table 6 illustrates the fit indices obtained for each of the factor structures evaluated by CFA.

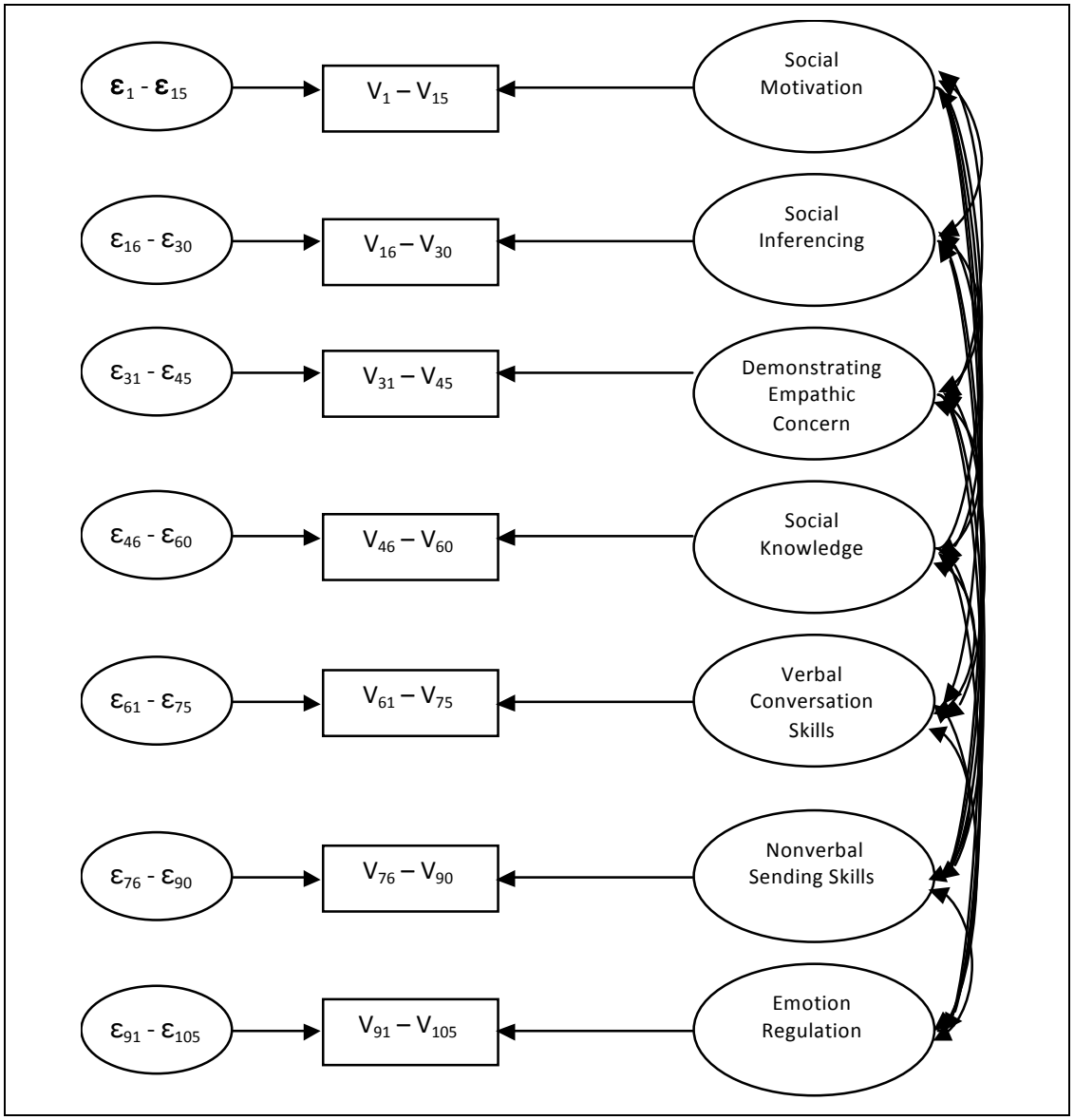
Table 6: Indices of fit for alternative factor models of the MSCS evaluated by CFA.

Factor Model	χ^2	SRMR	RMSEA (90% CI)	NNFI	CFI
7 Factor Model (15 items/domain)	9976.03 (p = 0.0)	0.10	0.062 (0.060 – 0.064)	0.91	0.91
7 Factor Model (11 items/domain)	4948.75 (p = 0.0)	0.086	0.057 (0.054 – 0.060)	0.93	0.93
7 Factor Model (11 items/domain) – ULS Method of Estimation	4898.91 (p = 0.0)	0.078	0.063 (0.060 - 0.066)	1.10	1.00
One Factor Model	7230.64 (p = 0.0)	0.12	0.12 (0.12 – 0.13)	0.85	0.85
Higher Order Model – 1 second order factor	5020.66 (p = 0.0)	0.096	0.058 (0.055 – 0.061)	0.93	0.93
Higher Order Model – 2 second order factors	4970.97 (p = 0.0)	0.090	0.058 (0.055 – 0.061)	0.93	0.93

χ^2: Chi-square; SRMR: Standardized Root Mean Square Residual; RMSEA: Root Mean Square Error of Approximation; NNFI: Non-normed Fit Index; CFI: Comparative Fit Index

To begin with, a seven first order factor model was specified and evaluated. This model is illustrated in Figure 2. Latent variables are represented in the figure using ovals and include the underlying factors and ε (the variance unique to each measured variable). The measured variables (individual items) are represented in the boxes with a "v" and are grouped together for simplicity. For instance, the box with "v_1 - v_{15}" is used to represent all the individual items within that group (v_1 through v_{15}). Pattern coefficients are represented using one-headed arrows and are drawn from factors to the measured variables to reflect the assumption that latent variables underlie the manifestation of factors in the form of scores on the measured variables. Correlations are depicted using two-headed arrows that connect variables in pairs for which correlations are freed to be non-zero. The model includes 105 measured variables (items) and seven factors which are permitted to correlate with one another. Simple structure is indicated with no measured variable being allowed to function as an indicator for more than one factor (i.e., indicators are permitted to load freely on their respective factors but are constrained to zero on the other factors). In addition, all measurement error was presumed to be uncorrelated.

Figure 2: Seven factor model for the MSCS.



CFA was conducted on the seven factor model using a maximum likelihood method of estimation. Several indices of fit were available and consulted in evaluating the fit of the specified factor structure including the chi-square (χ^2), standardized root mean square residual (SRMR), root mean square error of approximation (RMSEA) and its 90% confidence interval (90% CI), the non-normed fit index (NNFI), and the comparative fit index (CFI). Guided by suggestions outlined in Hu and Bentler (1999) and Browne and Cudeck (1993),

reasonably good fit between the target model and the observed data was defined as instances when the chi-square is not significant; SRMR values are close to .08 or below; RMSEA values are close to .06 or below (with values less than .08 suggesting adequate model fit); and, NNFI and CFI values are close to .95 or greater (although values in the range of .90 to .95 may be indicative of acceptable model fit). Multiple indices were consulted because they each provide different types of information about model fit. More specifically, the chi-square and SRMR are considered absolute fit indices, the RMSEA evaluates fit adjusting for model parsimony, and NNFI and CFI are comparative fit indices that evaluate the model in comparison to a null or "independence" model (in which the covariances among all indicators are fixed to zero) (Brown, 2006).

In terms of the initial seven factor model, the χ^2 value suggested poor overall fit, χ^2 (5334) = 9976.03, p = 0.0. However, the χ^2 is rarely relied upon heavily in the evaluation of model fit due to significant limitations (e.g., underlying distributions are rarely χ^2 distributed in small N, non-normal data; it tends to be inflated by sample size or in models containing many observed variables) (Brown, 2006). Notably, the other indices were generally consistent in suggesting acceptable fit of the seven factor model: SRMR = 0.10, RMSEA = 0.062 (90% CI = 0.059 – 0.064), NNFI = 0.91 and CFI = 0.91.

All freely estimated unstandardized parameters in the seven factor model were statistically significant (ps < 0.05), indicating that all items load significantly on their respective factors. The completely standardized parameter estimates (factor loadings) and the proportion of variance of the observed variable that is accounted for by the factor (R^2s) for this solution are provided in Table 7. The magnitude of factor loading estimates ranged from 0.22 to 0.83. Thus, indicators appeared to vary in the extent to which they related to their specified latent factors (range of R^2s = 0.05 - 0.69). A moderate degree of correlation among factors was obtained (range of rs = 0.22 - 0.74) (provided in Table 8).

Table 7: Parameter estimates for the 7 factor CFA model of the MSCS (based on 105 items).

MSCS Item*	Factor Loading	R^2
Social Motivation		
Prefers to spend time alone	0.55	0.30
Enjoys meeting new people	0.62	0.39
Initiates social "chit-chat"	0.55	0.31

MSCS Item*	Factor Loading	R^2
Asks people questions about themselves/lives	0.54	0.29
Avoids talking to people	0.70	0.49
Introduces him/herself to people	0.63	0.39
Trouble with activities that are social but seem "pointless"	0.50	0.25
Not interested in having many friends	0.51	0.26
Seeks out people to spend time with	0.56	0.32
Needs to be told/prompted to talk/interact with people	0.79	0.63
Shows little interest in people	0.76	0.58
Chooses to be involved in social activities/groups	0.54	0.29
Initiates get-togethers with other kids	0.59	0.35
Stays in the "background" in group social situations	0.67	0.45
Needs to be prompted to respond when others greet/say goodbye	0.72	0.51
Social Inferencing		
Recognizes unfriendly actions	0.65	0.42
Misreads social cues	0.65	0.42
Good at persuading people to change their mind	0.40	0.16
Can tell when people are joking	0.67	0.45
Easily persuaded or manipulated by others	0.48	0.23
Aware of his/her social status with peers	0.36	0.13
Can see things from another person's perspective	0.64	0.41
Understands sarcasm	0.68	0.46
Recognizes when people are taking advantage of him/her	0.71	0.50
Trouble judging who is trustworthy	0.58	0.34
Picks up on subtle hints and indirect requests	0.63	0.40
Trouble predicting what others will do	0.57	0.32
Misses the subtleties of social interaction	0.60	0.36
Is naïve	0.50	0.25
Can tell when someone is lying	0.68	0.46
Demonstrating Empathic Concern		
Blurts out hurtful or rude comments	0.37	0.13
Apologizes after hurting someone	0.66	0.43
Expresses concern for others	0.80	0.63
Appears upset when sees people suffering	0.54	0.29
Tries to cheer people up	0.77	0.59
Indifferent to people who are upset	0.66	0.44

MSCS Item*	Factor Loading	R^2
Offers to share things with people	0.54	0.29
Offers comfort to people	0.83	0.69
Is sensitive to feelings/concerns of others	0.80	0.64
Seems concerned about people and their problems	0.66	0.44
Gives suggestions/advice in a sensitive way	0.54	0.29
Congratulates people	0.74	0.55
Does not offer to help people	0.57	0.33
Seems emotionally detached	0.47	0.22
Compliments people	0.65	0.42
Social Knowledge		
Makes odd sounds/noises in public	0.37	0.14
Uses common slang words/phrases	0.47	0.22
Has reasonable expectations of friends	0.54	0.29
Tells “white lies” to avoid hurting people’s feelings	0.48	0.23
Knows about the latest trends	0.59	0.35
Acts appropriately in public situations	0.57	0.32
Understands what makes a true friend	0.64	0.41
Does “private” behaviours in public	0.44	0.20
Changes his/her behaviour to suit the situation	0.67	0.45
Understands the importance of good hygiene	0.50	0.25
Dress age-appropriately for social situations	0.56	0.32
Understands the “social hierarchy” (e.g., at school)	0.52	0.27
Adjusts the volume of his/her voice for situation	0.57	0.32
Follows “social rules” around privacy	0.51	0.26
Hides his/her “true feelings” so doesn’t hurt others	0.55	0.30
Verbal Conversation Skills		
Ends conversations suddenly	0.31	0.09
Talks “over” people in conversations	0.70	0.49
Good at taking turns in conversations	0.63	0.40
“Talks around” things	0.45	0.20
Shifts conversations to his/her favourite topic/interest	0.62	0.38
Talks about the same things over and over	0.72	0.51
Gives other people a chance to speak	0.64	0.41
Trouble making conversation	0.22	0.05
Dominates conversations	0.75	0.56

MSCS Item*	Factor Loading	R^2
Trouble joining conversations appropriately	0.66	0.44
Provides excessive detail when talking about a topic	0.62	0.39
Goes off track during conversations	0.55	0.30
Talks “at” people	0.55	0.31
Talks too much	0.59	0.35
Brings up interesting conversation topics	0.33	0.11
Nonverbal Sending Skills		
Changes tone of voice appropriately	0.73	0.53
Smiles seem forced/ awkward	0.58	0.34
Facial expressions seem “flat”	0.71	0.50
Stares at people	0.27	0.07
Uses appropriate gestures when communicating	0.51	0.26
Speaks with a varied tone of voice	0.74	0.55
Speaks with a flat, monotonous tone of voice	0.71	0.51
Points at things when appropriate	0.50	0.25
Looks people in the eye	0.50	0.25
His/her facial expressions are easy to read	0.63	0.40
Smiles appropriately	0.59	0.35
Sounds the same regardless of how he/she is feeling	0.74	0.55
Uses eye contact to get someone’s attention	0.55	0.30
Shows a range of facial expressions	0.70	0.49
Speaks in an unusual sounding way	0.43	0.18
Emotion Regulation		
Is patient	0.63	0.40
Can disagree without fighting/arguing	0.56	0.31
Gets extremely anxious	0.51	0.26
Has “meltdowns”	0.74	0.54
Stays calms when problems come up	0.50	0.25
Is easily overwhelmed	0.67	0.46
His/her emotional responses tend to be extreme	0.76	0.58
Gets upset if things not done his/her way	0.72	0.52
Difficult to reason with when upset	0.80	0.64
His/her moods change suddenly	0.79	0.63
Recovers quickly after setbacks/disappointments	0.51	0.26
Gets frustrated easily	0.78	0.61

MSCS Item*	Factor Loading	R^2
Acts out when angry/upset	0.72	0.52
Responds appropriately when provoked	0.55	0.31
His/her emotions tend to be "all or nothing"	0.72	0.51

* Summary of item phrasing

Table 8: Factor correlations for the 7 factor CFA Model (based on 105 items).

	MOTIV	SOCINF	EMPATH	KNOW	VERB	NONVERB	EMOTREG
MOTIV	1.00						
SOCINF	0.46	1.00					
EMPATH	0.65	0.48	1.00				
KNOW	0.57	0.74	0.61	1.00			
VERB	0.25	0.46	0.28	0.59	1.00		
NONVERB	0.60	0.49	0.57	0.55	0.33	1.00	
EMOTREG	0.22	0.41	0.27	0.47	0.44	0.28	1.00

MOTIV: Social Motivation; SOCINF: Social Inferencing; EMPATH: Demonstrating Empathic Concern; KNOW: Social Knowledge; VERB: Verbal Conversation Skills; NONVERB: Nonverbal Sending Skills; EMOTREG: Emotion Regulation

With respect to the goal of further shortening the MSCS to 77 items (11 items/domain), parameter estimates were examined in order to eliminate items that did not appear to load highly on their specified factors. Fourteen items were identified with factor loadings below 0.50 and were eliminated (two from the Social Inferencing domain, two from the Demonstrating Empathic Concern domain, four from the Social Knowledge domain, four from the Verbal Conversation Skills domain, and two from the Nonverbal Sending Skills domain). An additional fourteen items were eliminated primarily on the basis of apparent redundancy (i.e., similar content to others already included within each domain). A list of the final 77 items of the MSCS is included in Appendix E.

The final 77 items of the MSCS were then re-submitted to CFA. Again, CFA was conducted using the maximum likelihood method of estimation. Modest improvements in the fit of the model (over the initial model with 105 items) were obtained. Although the χ^2 value continued to suggest poor overall fit, χ^2 (2828) = 4948.75, p = 0.0, the other indices consulted were suggestive of satisfactory model 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). The completely standardized parameter

estimates (factor loadings) and R^2s for this solution are provided in Table 9. Factor loading estimates ranged from 0.50 to 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 generally appeared to be moderately correlated with one another, although there was notable variability in the extent to which they were found to relate to one another (range of rs = 0.15 - 0.75) (provided in Table 10).

Table 9: Parameter estimates for the 7 factor CFA model of the MSCS (based on 77 items).

MSCS Item*	Factor Loading	R^2
Social Motivation		
Prefers to spend time alone	0.51	0.26
Enjoys meeting new people	0.65	0.42
Initiates social "chit-chat"	0.58	0.34
Asks people questions about themselves/lives	0.56	0.31
Avoids talking to people	0.71	0.50
Introduces him/herself to people	0.65	0.39
Seeks out people to spend time with	0.55	0.31
Needs to be told/prompted to talk/interact with people	0.77	0.59
Shows little interest in people	0.74	0.54
Initiates get-togethers with other kids	0.59	0.35
Stays in the "background" in group social situations	0.68	0.46
Social Inferencing		
Recognizes unfriendly actions	0.61	0.37
Misreads social cues	0.67	0.46
Can tell when people are joking	0.68	0.46
Can see things from another person's perspective	0.66	0.43
Understands sarcasm	0.68	0.46
Recognizes when people are taking advantage of him/her	0.66	0.44
Trouble judging who is trustworthy	0.55	0.30
Picks up on subtle hints and indirect requests	0.65	0.43
Trouble predicting what others will do	0.59	0.35
Misses the subtleties of social interaction	0.62	0.39
Is naïve	0.50	0.25
Demonstrating Empathic Concern		
Apologizes after hurting someone	0.66	0.43
Expresses concern for others	0.80	0.64

MSCS Item*	Factor Loading	R^2
Appears upset when sees people suffering	0.55	0.30
Tries to cheer people up	0.77	0.59
Indifferent to people who are upset	0.68	0.46
Offers comfort to people	0.83	0.70
Is sensitive to feelings/concerns of others	0.81	0.66
Seems concerned about people and their problems	0.67	0.44
Congratulates people	0.74	0.55
Does not offer to help people	0.56	0.32
Compliments people	0.64	0.41
Social Knowledge		
Has reasonable expectations of friends	0.57	0.32
Knows about the latest trends	0.56	0.31
Acts appropriately in public situations	0.56	0.31
Understands what makes a true friend	0.65	0.42
Changes his/her behaviour to suit the situation	0.69	0.48
Understands the importance of good hygiene	0.50	0.24
Dress age-appropriately for social situations	0.57	0.33
Understands the “social hierarchy” (e.g., at school)	0.53	0.28
Adjusts the volume of his/her voice for situation	0.57	0.32
Follows “social rules” around privacy	0.50	0.25
Hides his/her “true feelings” so doesn’t hurt others	0.54	0.29
Verbal Conversation Skills		
Talks “over” people in conversations	0.71	0.50
Good at taking turns in conversations	0.60	0.37
Shifts conversations to his/her favourite topic/interest	0.65	0.42
Talks about the same things over and over	0.72	0.52
Gives other people a chance to speak	0.61	0.37
Dominates conversations	0.77	0.60
Trouble joining conversations appropriately	0.65	0.43
Provides excessive detail when talking about a topic	0.62	0.38
Goes off track during conversations	0.55	0.30
Talks “at” people	0.55	0.30
Talks too much	0.63	0.40
Nonverbal Sending Skills		
Smiles seem forced/ awkward	0.61	0.37
Facial expressions seem “flat”	0.72	0.52

MSCS Item*	Factor Loading	R^2
Uses appropriate gestures when communicating	0.53	0.28
Speaks with a flat, monotonous tone of voice	0.67	0.44
Points at things when appropriate	0.50	0.25
Looks people in the eye	0.51	0.26
His/her facial expressions are easy to read	0.66	0.44
Smiles appropriately	0.59	0.35
Sounds the same regardless of how he/she is feeling	0.72	0.52
Uses eye contact to get someone's attention	0.57	0.32
Shows a range of facial expressions	0.72	0.52
Emotion Regulation		
Is patient	0.65	0.43
Can disagree without fighting/arguing	0.58	0.33
Gets extremely anxious	0.51	0.26
Has "meltdowns"	0.72	0.52
Stays calms when problems come up	0.51	0.26
His/her emotional responses tend to be extreme	0.75	0.56
Gets upset if things not done his/her way	0.72	0.52
Recovers quickly after setbacks/disappointments	0.50	0.25
Gets frustrated easily	0.79	0.63
Acts out when angry/upset	0.71	0.51
His/her emotions tend to be "all or nothing"	0.72	0.52

* Summary of item phrasing

Table 10: Factor correlations for 7 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

MOTIV: Social Motivation; SOCINF: Social Inferencing; EMPATH: Demonstrating Empathic Concern; KNOW: Social Knowledge; VERB: Verbal Conversation Skills; NONVERB: Nonverbal Sending Skills; EMOTREG: Emotion Regulation

Given that some of the MSCS items included in the final sample had skewed distributions, the 77 items were also submitted to CFA using the unweighted least squares method of estimation. It has been suggested that when distributions are skewed, the unweighted least squares procedure for obtaining parameter estimates in confirmatory analyses may be preferable (Floyd & Widaman, 1995). The results using this method were found to be consistent in terms of the pattern and magnitude of parameter estimates obtained. Slight improvements in model fit were obtained for the absolute fit indices (χ^2 (2828) = 4898.91, p = 0.0; SRMR = 0.078) and comparative fit indices (NNFI = 1.10 , and CFI = 1.0); however, the RMSEA indicated slightly less satisfactory fit (RMSEA = 0.063, 90% CI = 0.060 – 0.066). Thus, given that the fit using the unweighted leas squares method was not overwhelmingly superior (and there was consistency in the parameter estimates obtained), remaining alternative models were assessed using the more commonly used maximum likelihood method of estimation.

One rival model that was evaluated posited a single underlying factor ("social competence") accounting for the covariance among items. The fit indices obtained were generally indicative of poor model fit: 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.

Another alternative factor structure evaluated consisted of a higher-order factor model of the MSCS and is illustrated in Figure 3. The model includes the final 77 measured variables (items), seven first-order factors, and a single second-order factor (social competence) that accounts for the covariances among the first order factors. The indices of model fit obtained for the higher order model was comparable to the fit of the 7 factor model in terms of the RMSEA (0.058, 90% CI = 0.055 – 0.061), NNFI (0.93), and CFI (0.93) while the indices of absolute fit were slightly weaker (χ^2 (2842) = 5020.66, p = 0.0; SRMR = 0.096). However, improvements in goodness of fit are not expected with a higher order solution relative to a first-order solution due to the fact that the higher order model is attempting to reproduce the factor correlations with fewer freely estimated parameters (Brown, 2006). Instead, the acceptability of higher order models is typically evaluated with respect to the magnitude of the higher-order parameters (e.g., size of higher-order factor loadings) and the extent to which the factor model lends itself to a more parsimonious interpretation of the data (Brown, 2006). The factor loadings of the first-order factors on the second-order factor (social competence) were moderate to high and ranged from 0.49 to 0.89 (provided in Table 11).

Figure 3: Higher order factor model of the MSCS: One second order factor.

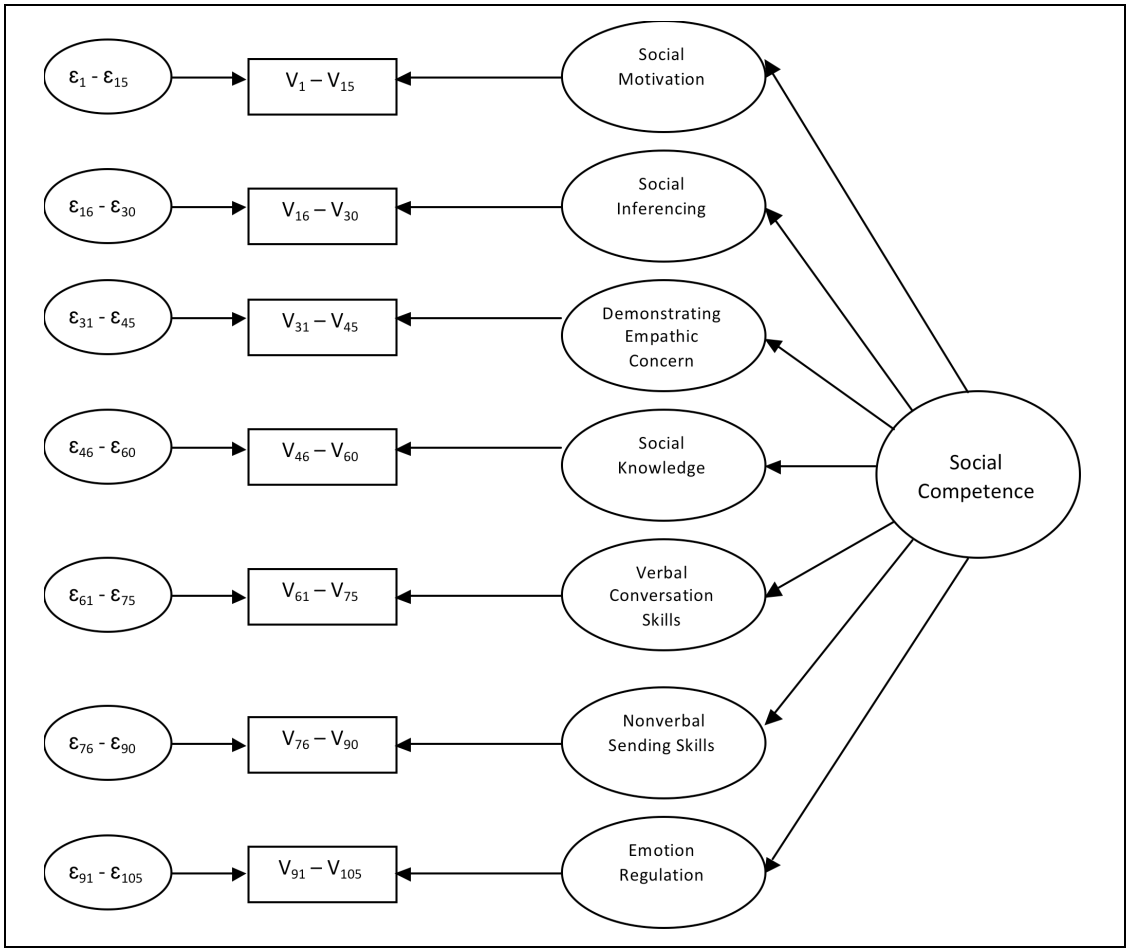


Table 11: Factor loadings for 7 first order factors in the single second order factor CFA model of the MSCS (based on 77 items).

Factor	Factor Loading
Social Motivation	0.68
Social Inferencing	0.81
Demonstrating Empathic Concern	0.66
Social Knowledge	0.89
Verbal Conversation Skills	0.49
Nonverbal Sending Skills	0.65
Emotion Regulation	0.51

Given the range of first order factor loadings on the higher-order "social competence" factor (as well as differential patterns of correlation among the first order factors), it appears that the domains are not equally representative of the concept of social competence. Thus, it is possible that a model including more than one higher order factor best describes the MSCS data. In order to further examine this possibility, an exploratory factor analysis (EFA) was performed on the domain scores (i.e., the sum of the 11 items within each domain). The EFA was performed using PASW Statistics 18 using maximum likelihood method of extraction with Promax rotation. Based on the inspection of the scree plot, a solution with 2 higher order factors was examined for interpretability. The two-factor solution accounted for 66.31% of the variance. Factor I consisted of three domains including Social Motivation, Demonstrating Empathic Concern, and Nonverbal Sending Skills. Factor II consisted of the remaining four domains including Social Inferencing, Social Knowledge, Verbal Conversation Skills, and Emotion Regulation. Factor loadings are presented in Table 12. The domains loading on Factor I appear to primarily assess the extent to which individuals demonstrate an awareness of and connection with others, and thus, will be referred to collectively as "Social Responsiveness". Factor II appears to assess the more cognitive and skills based aspects of social competence and will be referred to collectively as "Social Understanding/Emotion Regulation".

Table 12: Factor loadings for the domain scores of the MSCS based on EFA results.

Domain	Factors and Loadings	
	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

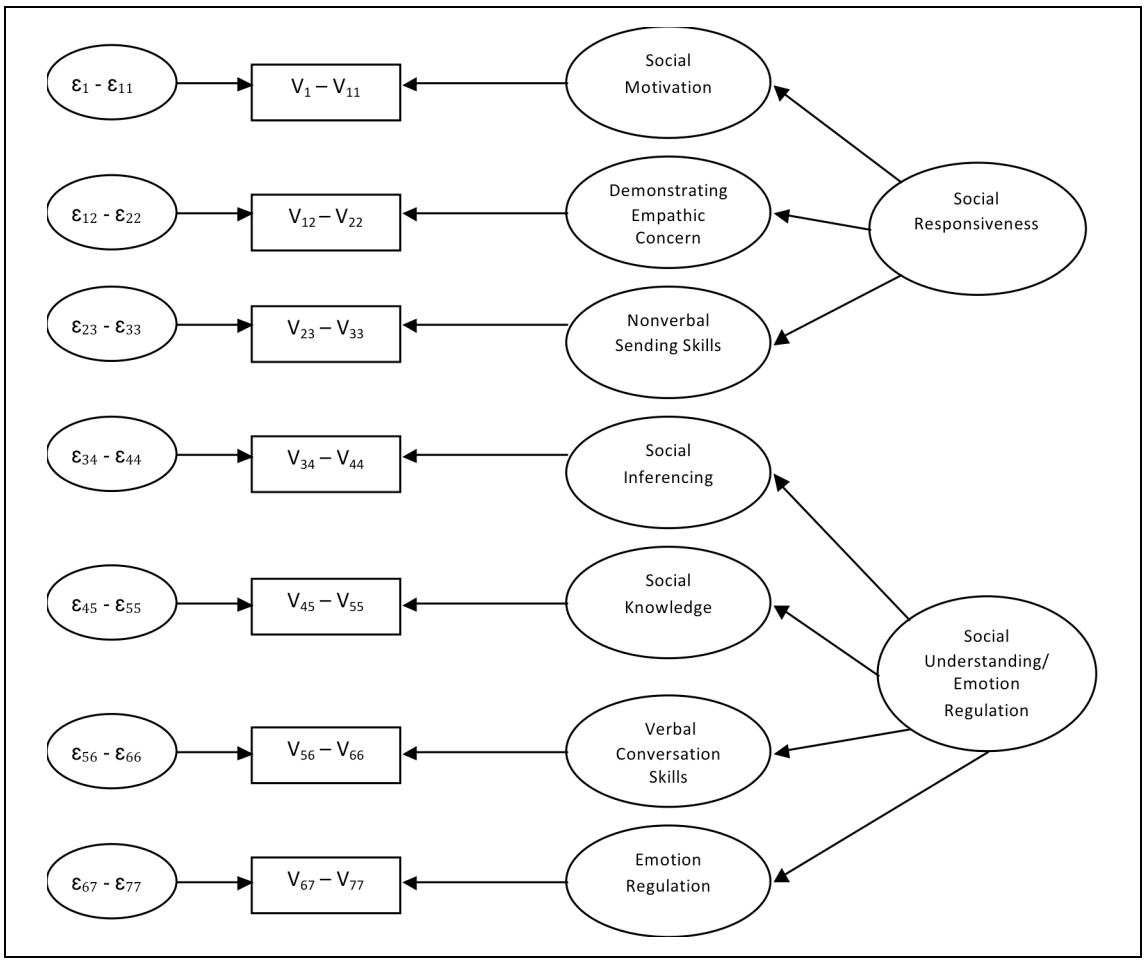
The resulting higher order model with two second-order factors (illustrated in Figure 4) was then submitted to a CFA. As with the previous higher order model evaluated, the indices of model fit obtained for this second order model was also comparable to the fit of the 7 factor model in terms of the RMSEA (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 loads moderately to strongly on the second-order factors (range of loadings = 0.55 to 0.95) (provided in Table 13). There appears to be a high level of correlation between the two higher order factors (r = 0.71).

Table 13: Factor loadings for the domain scores of the MSCS based on CFA results.

Domain	Factors and Loadings	
	Factor I	Factor II
Social Motivation	0.83	–
Demonstrating Empathic Concern	0.75	–
Nonverbal Sending Skills	0.75	–
Verbal Conversation Skills	–	0.55
Emotion Regulation	–	0.55
Social Knowledge	–	0.95
Social Inferencing	–	0.80

Figure 4: Higher order factor model of the MSCS: Two second order factors.



In sum, the higher order solution with two second-order factors does not result in a significant decrease in model fit over the seven factor model. In addition, this model provides a more parsimonious account of the correlations among the first order factors than the higher order model with a single second order factor. Thus, it can be concluded that the higher order model with two second-order factors provides the best fit to the MSCS data.

Scoring the MSCS. In light of results from the CFA, 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) and subscale scores (Social Responsiveness and Social Understanding/Emotion Regulation).

Weighting of items (based on factor loadings) is often recommended when computing summated scores on rating scales (particularly when there is a wide range of item factor loadings comprising scale scores). In the case of the MSCS, this possibility was examined with respect to domain scores by calculating domain scores that were the sum of items weighted by their respective factor loadings. Correlations between these summated weighted domain scores with summated scores based on an unweighted total were then obtained in order to determine whether the results based on the weighted totals were discrepant enough to justify this additional scoring step (Streiner & Norman, 2003). Correlation results indicated that the weighted sum was very highly correlated with the unweighted sum for all seven domains (all rs greater than or equal to 0.98). Thus, for the sake of simplicity in scoring, it does not appear that weighting is necessary for the domain summated scores. The same procedure was undertaken for the subscales (correlating weighted and unweighted subscale scores), and again, results indicated very high levels of correlation (rs greater than 0.98), suggesting there is no need to use weighted scores when calculating summated subscale scores.

Although the results of the CFA suggested that a higher order model with two second-order factors best accounts for the MSCS data, there may be instances in which individuals using the MSCS are interested in computing an overall "social competence" total score. Indeed, the MSCS was designed in order to capture the various dimensions tapping into the general construct of social competence. The rationale for calculating a total social competence score is also supported by the high level of correlation between the two second-order factors

(r = 0.71). Again, the possibility of applying weighting in calculating a total social competence score was examined. A weighted total score was calculated using the factor loadings of the domain scores on the overall factor of social competence (obtained from the higher order model with a single second-order factor). A very high level of correlation was obtained between the weighted and unweighted total scores (r = 0.99), suggesting that an unweighted total "social competence" score on the MSCS is sufficient for future analyses.

Distributions of Scores. The distributions of the domain, subscale and total scores of the MSCS for both the ASD and TD groups are illustrated in Figure 5 to Figure 14. As shown in the graphs, a wide range of scores for each domain/subscale/total scale are captured within the ASD group. As expected (given reduced levels of social difficulties), there is generally less variability in scores obtained within the TD group.

Figure 5: Distribution of Social Motivation domain scores in ASD and TD groups.

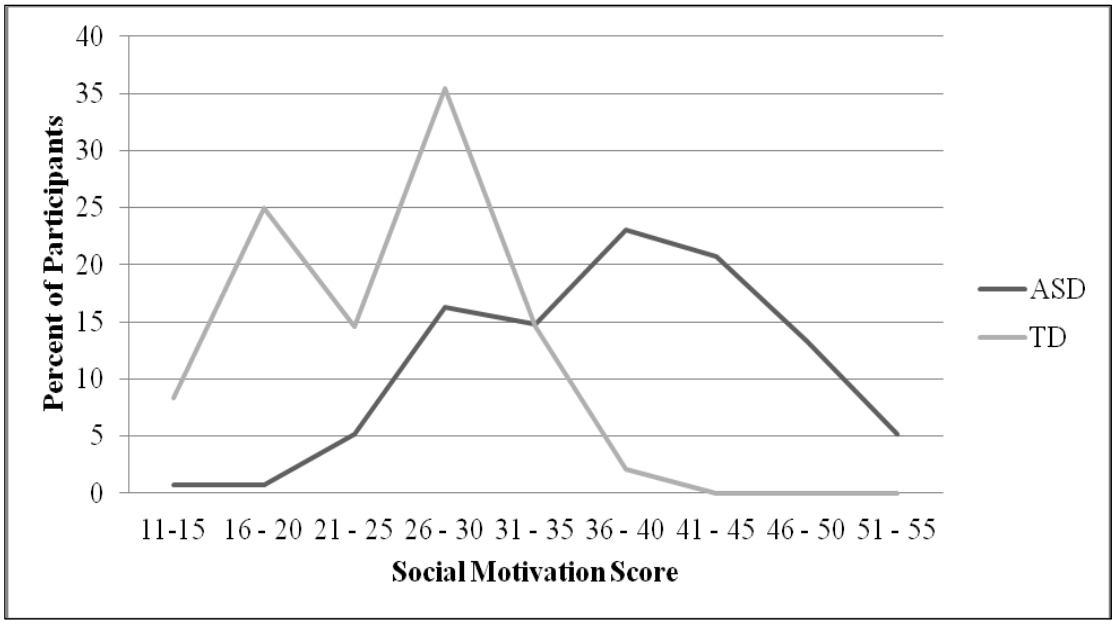


Figure 6: Distribution of Social Inferencing domain scores in ASD and TD groups.

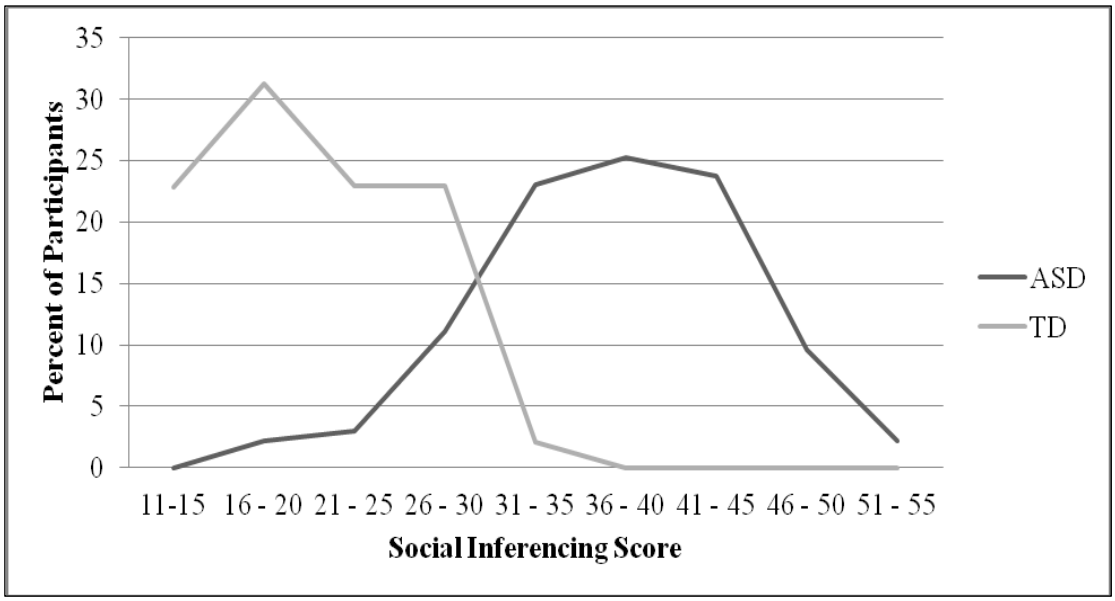


Figure 7: Distribution of Demonstrating Empathic Concern domain scores in ASD and TD groups.

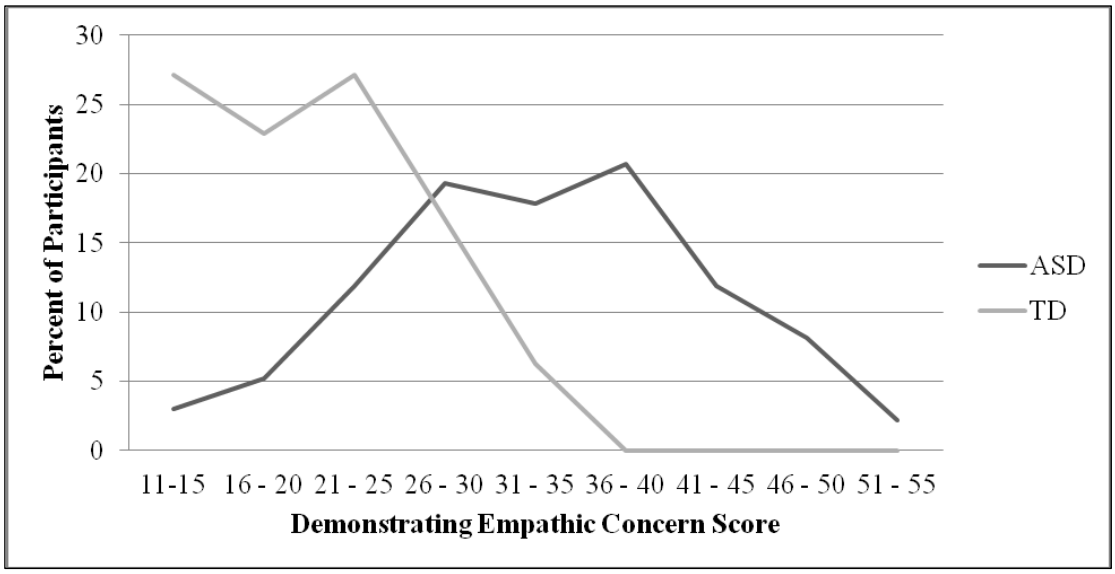


Figure 8: Distribution of Social Knowledge domain scores in ASD and TD groups.

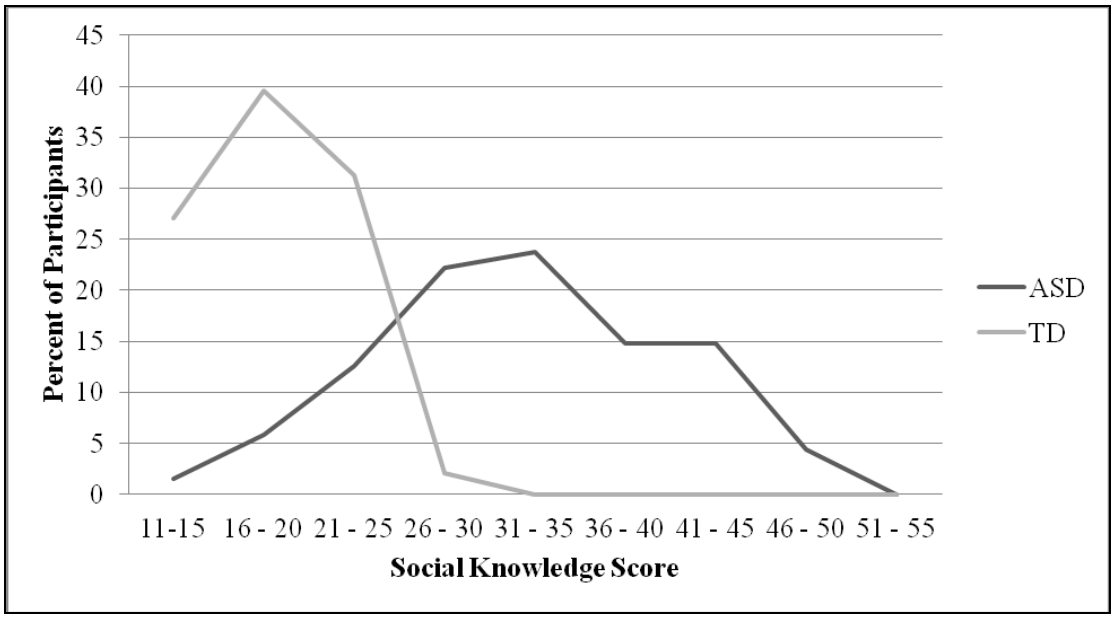


Figure 9: Distribution of Verbal Conversation Skills domain scores in ASD and TD groups.

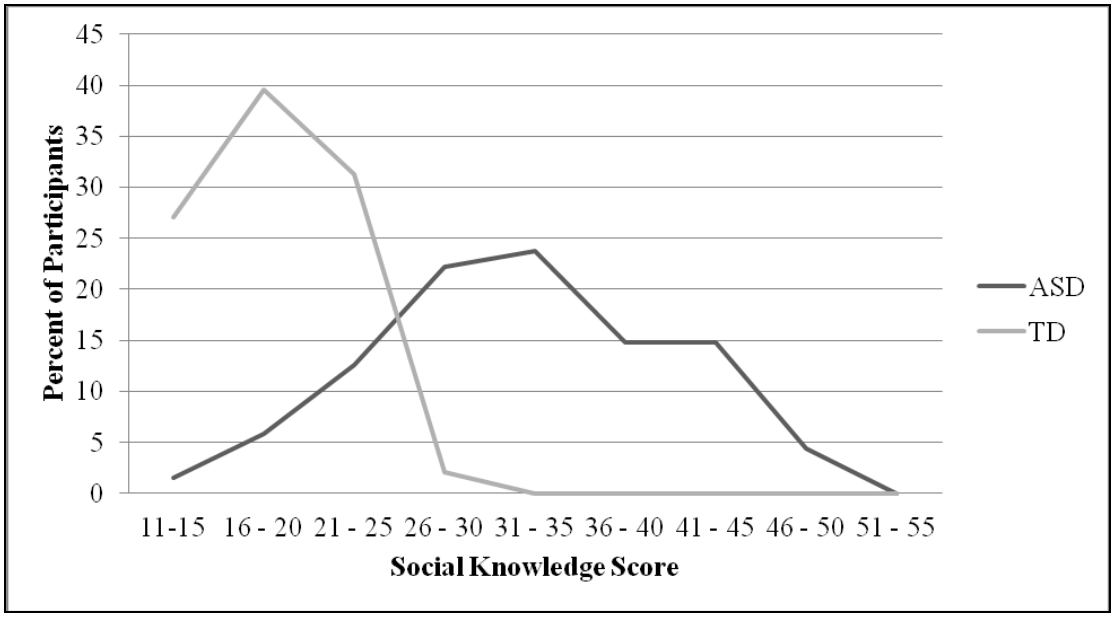


Figure 10: Distribution of Nonverbal Sending Skills domain scores in ASD and TD groups.

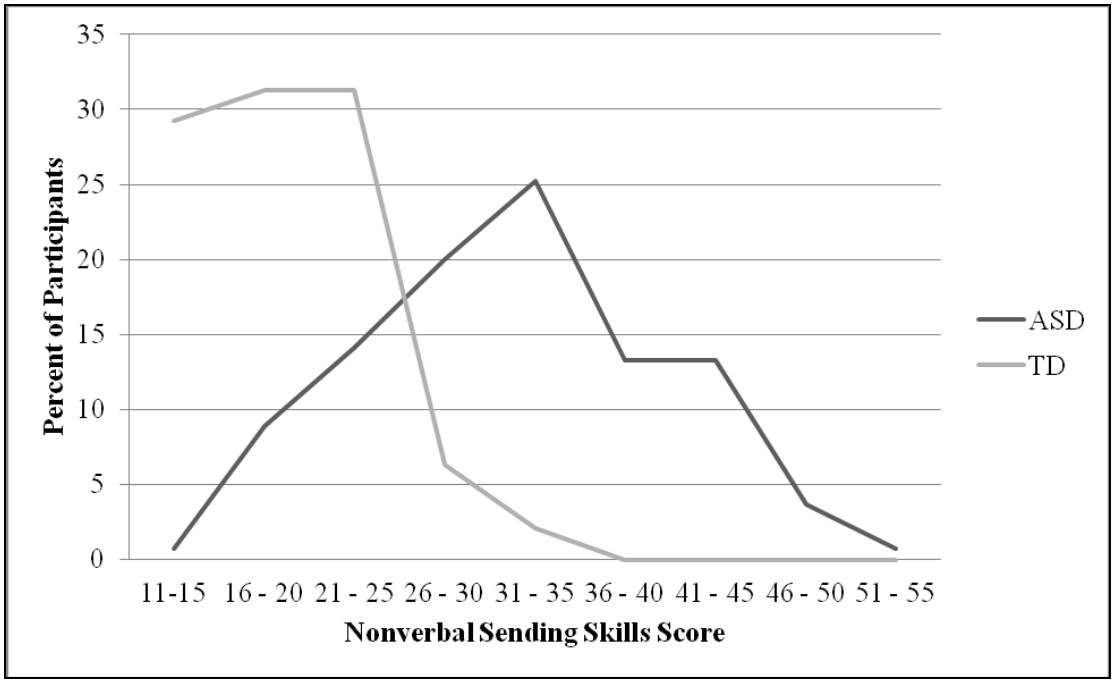


Figure 11: Distribution of Emotion Regulation domain scores in ASD and TD groups.

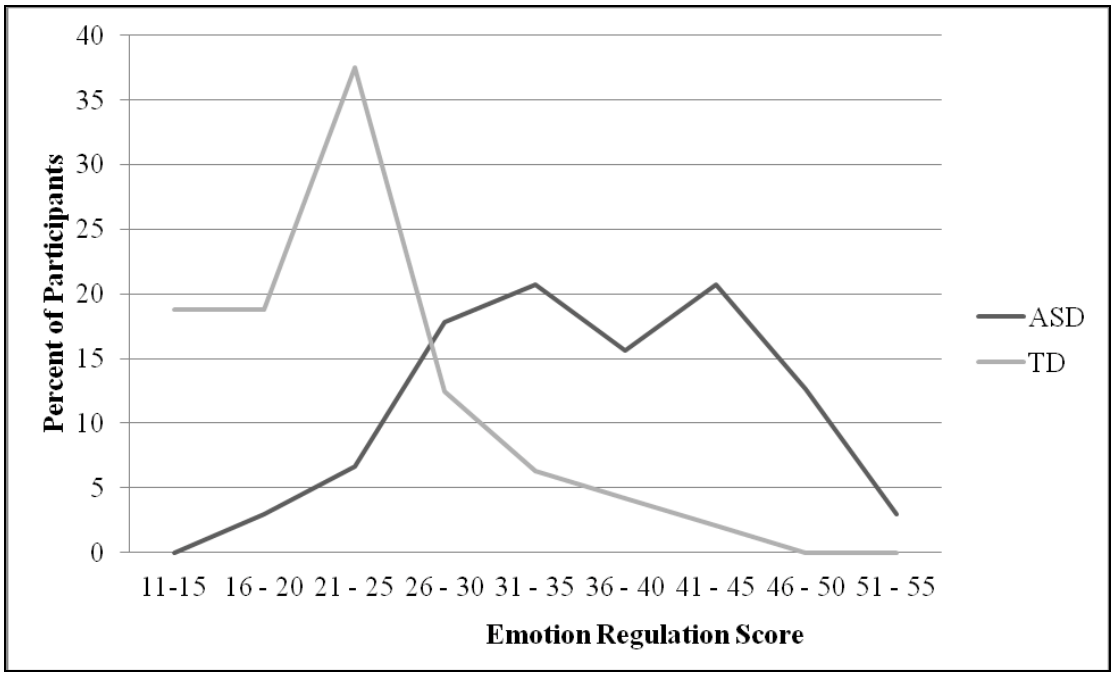


Figure 12: Distribution of Social Responsiveness subscale scores in ASD and TD groups.

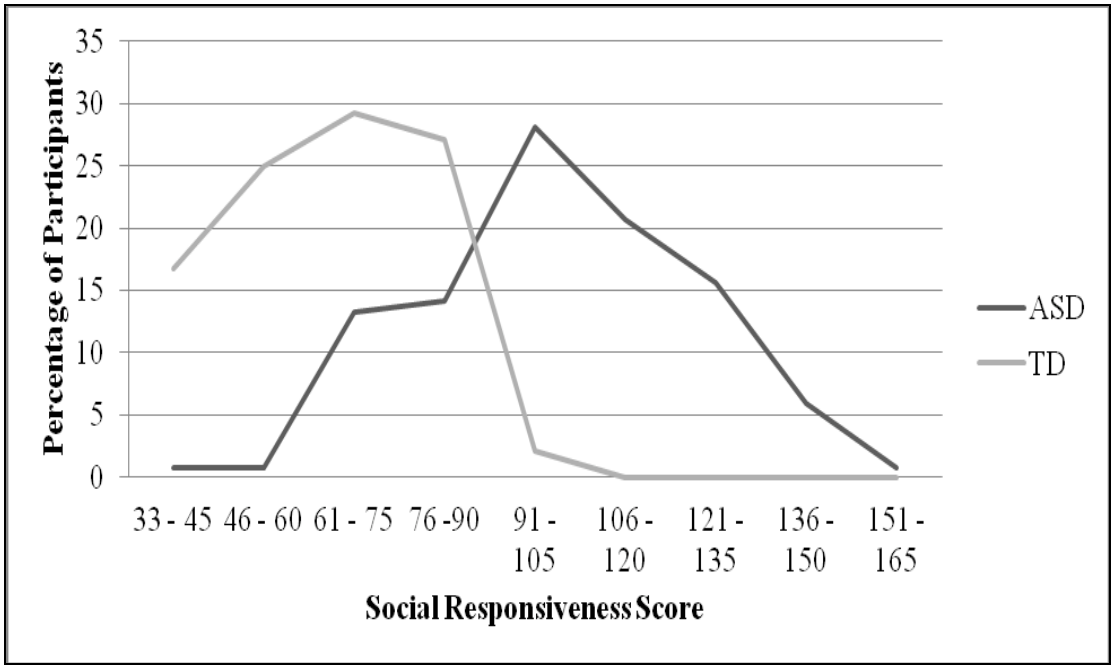


Figure 13: Distribution of Social Understanding/Emotion Regulation subscale scores in ASD and TD groups.

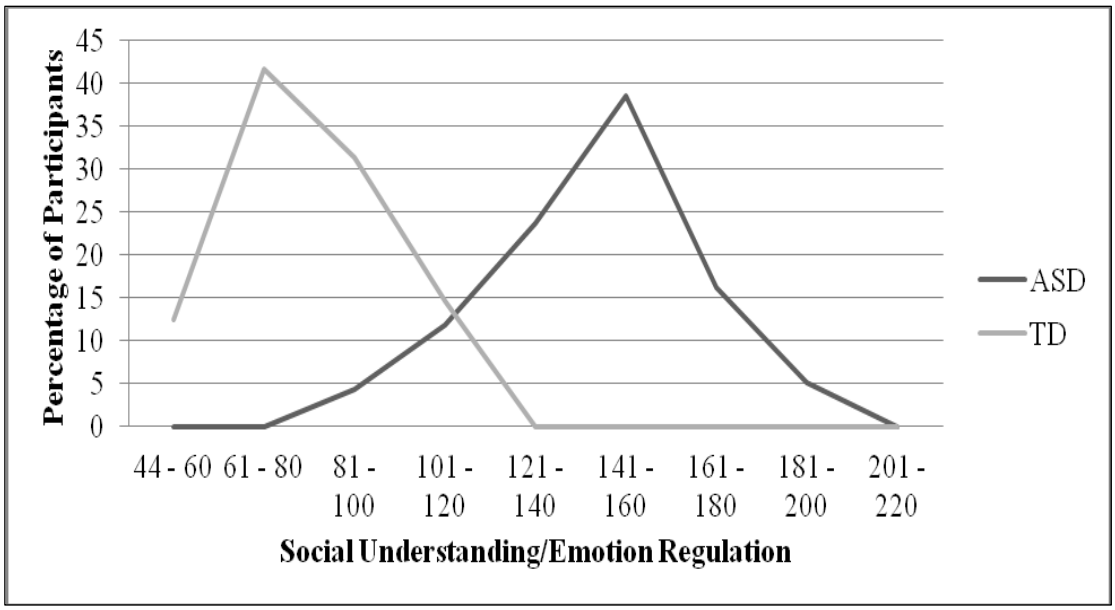
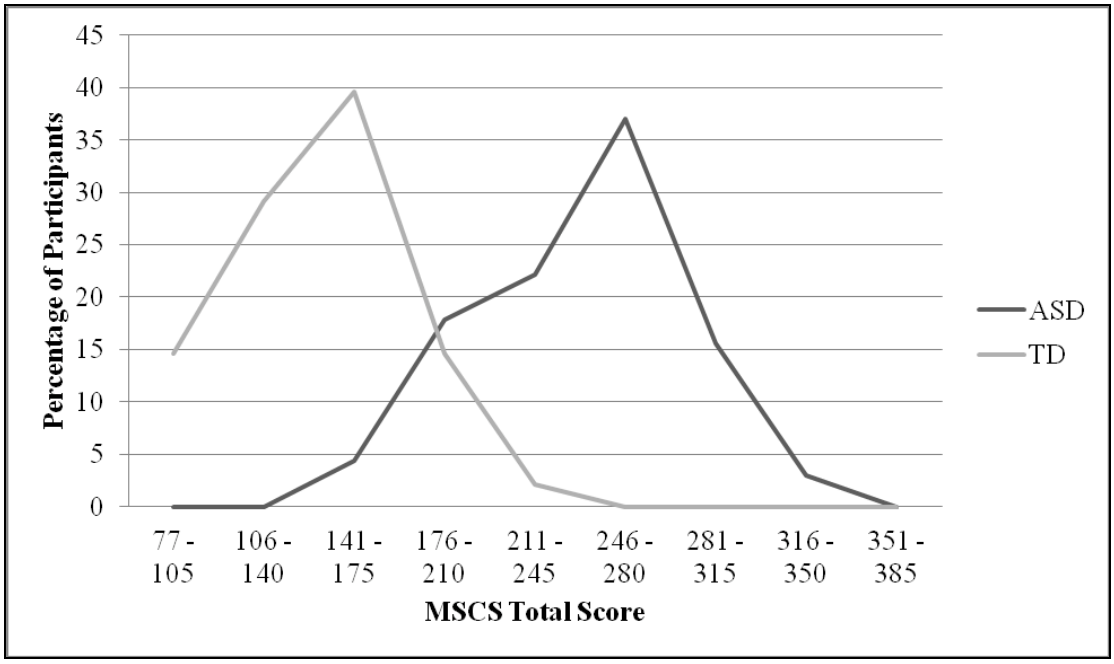


Figure 14: Distribution of MSCS total scores in ASD and TD groups.



Internal Consistency. The final 77 items of the MSCS were subjected to further analyses to confirm that the domains and subscales within the final version of the scale are internally consistent. Corrected item-whole correlations for each item (relative to the rest of the items in its domain) were greater than or equal to 0.34. The ranges and means of the corrected item-total correlations for the items within each domain/subscale are included in Table 14. The following Cronbach's alpha coefficients were obtained for the domains: 0.87 for Social Motivation; 0.87 for Social Inferencing; 0.90 for Demonstrating Empathic Concern; 0.84 for Social Knowledge; 0.88 for Verbal Conversation Skills; 0.87 for Nonverbal Sending Skills; and, 0.89 for Emotion Regulation. The Cronbach's alpha coefficient was 0.94 for Social Responsiveness, 0.93 for Social Understanding/Emotion Regulation, and 0.95 for all items (total scale).

Table 14: Ranges and mean corrected item-total correlation values for final 77 MSCS items within domains and subscales.

Domain/ Subscale	Minimum of corrected item-total correlation values	Maximum of corrected item-total correlation values	Mean of corrected item-total correlation values (SD)
Social Motivation	0.34	0.72	0.57 (0.10)
Social Inferencing	0.44	0.65	0.58 (0.06)
Demonstrating Empathic Concern	0.53	0.78	0.67 (0.09)
Social Knowledge	0.46	0.64	0.52 (0.05)
Verbal Conversation Skills	0.52	0.73	0.60 (0.07)
Nonverbal Sending Skills	0.47	0.69	0.57 (0.08)
Emotion Regulation	0.43	0.69	0.61 (0.10)
Social Responsiveness	0.35	0.67	0.54 (0.08)
Social Understanding/ Emotion Regulation	0.32	0.58	0.48 (0.07)

Preliminary Validation Analyses

Preliminary validation analyses were performed in order to ensure that the scale constitutes a valid measure of social competence in adolescents. Construct validity is defined as the degree to which an inventory assesses what it intends to measure. The process of validating a measure is typically an ongoing one in which a series of hypothesized relationships among constructs is examined and converging evidence is obtained (Clark & Watson, 1995). Although construct validity cannot be definitively "proven", it is supported by demonstrating a pattern of correlations that are consistent with hypothesized relationships with existing measures. The following analyses conducted on the MSCS constitute a preliminary examination of the scale's validity. Interpretations of effect sizes of correlation values are based on guidelines for research in autism as outlined by Cicchetti and colleagues (2011).

Convergent Validity. In order to assess convergent validity (correlation with alternative, existing measures of social competence), the association between the MSCS and the SRS was examined. The correlation between the total score of the MSCS and the total score SRS was significant ($p < 0.001$) and found to be very large ($r = 0.89$), suggesting strong convergent validity between the two scales in terms of their overall assessment of social competence.

Discriminant Validity. Preliminary evidence of discriminant validity of the MSCS (i.e., lower correlations with measures of theoretically unrelated or distinct constructs) was examined by obtaining the correlation between the total score and cognitive ability scores (ABIQ from the SB5). This correlation was based on results obtained from the smaller sample of adolescent participants (n = 85) who completed the cognitive testing in the lab. A small correlation (r = 0.20) that was not statistically significant ($p > 0.05$) was obtained between the ABIQ and the total score on the MSCS, suggesting that social competence and cognitive ability are relatively distinct constructs.

In addition, given that the MSCS was designed to assess subtle differences in social competence across the span of adolescence (age range of 11 to 18), it was important to ensure that parent ratings of social competence were not simply a reflection of age-related effects or developmental maturation (whereby all older individuals appear more socially competent). A trivial and statistically insignificant correlation (r = -0.07; $p > 0.05$) was obtained between the MSCS total score and chronological age, suggesting that there does not appear to be a systematic relationship between age and parent ratings of social competence on the MSCS.

Criterion-related Validity. Criterion-related validity refers to a scale's ability to predict performance on some objective criterion or outcome and can be further differentiated into predictive and concurrent validity (depending on the time when the criterion data is collected). Concurrent validity was examined by correlating MSCS domain, subscale and total scores with data obtained on the indicators of social competence (i.e., peer acceptance and friendships).

Correlations between the friendship indicators and the MSCS domain, subscale, and total scores are outlined in Table 15. A large statistically significant correlation was found between the number of acquaintances and the total score on the MSCS (r = -0.53; $p < 0.01$). It appears that adolescents with more acquaintances demonstrate higher levels of parent rated social competence on the MSCS. Significant correlations between -0.33 and -0.56 (ps < 0.01) were obtained between the number of acquaintances and the MSCS domain and subscale scores. In particular, strong relationships with number of acquaintances (i.e., rs > 0.50) were obtained for the Social Responsiveness subscale and the Social Knowledge and Social Motivation domains. A large significant correlation was obtained between the number of close friends and total score on the MSCS (r = -0.69; $p < 0.01$), with adolescents with more close friends displaying higher ratings

of social competence. Significant correlations between -0.48 and -0.69 (*p*s < 0.01) were obtained between the number of close friends and the MSCS domain and subscale scores. All domain/subscale correlations with number of close friends were greater than -0.50 with the exception of Emotion Regulation (r = -0.48). A significant small correlation was found between having a best friend and total score on the MSCS (r = -0.29; *p* < 0.01), with adolescents having a best friend demonstrating slightly higher levels of parent rated social competence. Significant correlations ranging from -0.16 to -0.35 (*p*s <0.05) were obtained between having a best friend and the MSCS domain and subscale scores with the exception of the Emotion Regulation domain (r = -0.13, p>0.05). With respect to frequency of social contact with friends (outside of school or extracurricular activities), a significant medium correlation of 0.38 (*p* < 0.01) was obtained with the MSCS total score, suggesting that adolescents engaging in more frequent social contacts display slightly higher levels of parent rated social competence. Significant correlations ranging from 0.25 to 0.39 (*p*s< 0.01) were obtained between frequency of social contact and all the MSCS domain and subscale scores.

Table 15: Correlations between the friendship indicators and the MSCS domain, subscale, and total scores.

Domain/ Subscale	Correlation with number of acquaintances (n = 168)	Correlation with number of close friends (n = 167)	Correlation with having a best friend (n = 165)	Correlation with frequency of social contact (n = 169)
Social Motivation	-0.54*	-0.60*	-0.35*	0.38*
Social Inferencing	-0.41*	-0.61*	-0.22*	0.34*
Demonstrating Empathic Concern	-0.39*	-0.50*	-0.27*	0.27*
Social Knowledge	-0.56*	-0.69*	-0.31*	0.39*
Verbal Conversation Skills	-0.38*	-0.54*	-0.16*	0.25*
Nonverbal Sending Skills	-0.45*	-0.53*	-0.25*	0.29*
Emotion Regulation	-0.33*	-0.49*	*-0.13*	0.27*
Social Responsiveness	-0.52*	-0.61*	-0.33*	0.35*
Social Understanding/ Emotion Regulation	-0.48*	-0.67*	-0.23*	0.36*
MSCS Total Score	-0.53*	-0.69*	-0.29*	0.38*

* Correlation is significant at the 0.05 level

Table 16: Correlations between the peer acceptance indicators and the MSCS domain, subscale, and total scores.

Domain/Subscale	Correlation with being liked by peers (n = 148)	Correlation with getting along with classmates (n = 148)	Correlation with being teased/bullied (n = 144)	Correlation with being ignored by peers (n = 135)
Social Motivation	-0.50*	-0.37*	0.36*	0.54*
Social Inferencing	-0.51*	-0.41*	0.46*	0.55*
Demonstrating Empathic Concern	-0.45*	-0.37*	0.35*	0.48*
Social Knowledge	-0.59*	-0.52*	0.48*	0.56*
Verbal Conversation Skills	-0.56*	-0.57*	0.65*	0.53*
Nonverbal Sending Skills	-0.44*	-0.39*	0.42*	0.56*
Emotion Regulation	-0.55*	-0.57*	0.56*	0.47*
Social Responsiveness	-0.52*	-0.42*	0.42*	0.59*
Social Understanding/ Emotion Regulation	-0.63*	-0.60*	0.61*	0.60*
MSCS Total Score	-0.62*	-0.56*	0.54*	0.64*

* Correlation is significant at the 0.01 level

Correlations between the peer acceptance indicators and the MSCS domain, subscale, and total scores are outlined in Table 16. A significant large correlation (r = -0.62; $p < 0.01$) was found between being liked by one's peers at school and the total score on the MSCS, with well liked adolescents demonstrating overall higher ratings of social competence. Significant medium to large correlations (ranging from -0.44 to -0.63, *p*s< 0.01) were obtained between being liked by peers and the MSCS domain and subscale scores. All domain/subscale correlations with being liked by peers were significant and greater than -0.50 with the exception of Demonstrating Empathic Concern (r = -0.45) and Nonverbal Sending Skills (r = -0.44) (*p*s < 0.01). 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 the best with classmates demonstrating higher parent ratings of social competence. A range of significant small to large correlations were obtained between getting along with classmates and the MSCS domain and subscale scores (rs = -0.37 to -0.60; ps < 0.01). With respect to being teased or bullied at school, a significant large correlation (r = 0.54; $p < 0.01$) was obtained with the MSCS total score, indicating that adolescents who are teased/bullied more frequently demonstrate lower levels of parent rated social competence. A range of significant small to large correlations

were obtained between being teased/bullied and the MSCS domain and subscale scores (rs = 0.35 to 0.65; *ps* < 0.01). A significant large correlation was found between being teased/bullied and Social Understanding/ Emotion Regulation (r = 0.61, $p < 0.01$) and a significant medium correlation was found with Social Responsiveness (r = 0.42, $p < 0.01$). Finally, a significant large correlation was found between being ignored by peers and the total score on the MSCS (r = 0.64; $p < 0.05$), with adolescents described as more frequently ignored by peers demonstrating lower levels of parent rated social competence.

Known-groups Validity. Another type of criterion-related validity, known-groups validity, was also examined for the MSCS. Known-groups validity involves comparing identifiable groups of respondents on the scale of interest. As mentioned previously, a subset of participants with ASD and TD were individually matched on the basis of gender, age, and IQ. Mean scores on the MSCS total scale, domains, and subscales were compared for the ASD and TD groups using one-way analyses of variance. Significant group differences were found for all MSCS scores: Social Motivation ($F_{(1,42)} = 37.93$, $p < .01$); Social Inferencing ($F_{(1,42)} = 63.74$, $p < .01$); Demonstrating Empathic Concern ($F_{(1,42)} = 22.28$, $p < .01$); Social Knowledge ($F_{(1,42)} = 38.14$, $p < .01$); Verbal Conversation Skills ($F_{(1,42)} = 48.72$, $p < .01$); Nonverbal Sending Skills ($F_{(1,42)} = 47.79$, $p < .01$); Emotion Regulation ($F_{(1,42)} = 21.83$, $p < .01$); Social Responsiveness ($F_{(1,42)} = 46.66$, $p < .01$); Social Understanding/Emotion Regulation ($F_{(1,42)} = 62.62$, $p < .01$); and, MSCS Total Score ($F_{(1,42)} = 75.80$, $p < .01$). Consistent with predictions, individuals with ASD demonstrated higher scores on the MSCS (indicative of greater perceived social impairment) on all domains and subscales when compared to TD individuals.

Chapter 7
DISCUSSION

The primary goals of the current study were two-fold. Firstly, this research aimed to determine whether the construct of social competence in ASD could be measured in a multidimensional fashion. Secondly, preliminary evidence was collected in order to evaluate the psychometric properties of this newly developed parent rating scale.

The broader construct of social competence has remained ill-defined in the developmental literature over the years. Indeed, numerous conceptualizations have been proposed but no single unified theory of social competence has emerged (Stump, Ratliff, Wu, & Hawley, 2009). The development of MSCS was guided by Rose-Krasnor's model of social competence which suggests that social competence is best conceptualized as a higher order construct that can be studied empirically at two distinct levels of analysis – the *index* level (i.e., real-life summary indices of social competence) and the *motivation/skills* level (i.e., underlying dispositions and abilities that provide the "building blocks" of social interactions) (Rose-Krasnor, 1997). The MSCS was developed to assess a broad range of social motivation/skills relevant to adolescents with ASD in its attempt to operationalize social competence in a multidimensional manner.

On the basis of an extensive literature review, seven relatively distinct domains of motivation/skills were identified as being particularly relevant to the social difficulties observed in ASD. These domains were deemed to provide sufficient coverage of the construct of social competence in terms of content validity and included: Social Motivation, Social Inferencing, Demonstrating Empathic Concern, Social Knowledge, Verbal Conversation Skills, Nonverbal Sending Skills, and Emotion Regulation. Results obtained from factor analyses of the MSCS items supported the proposed multidimensional conceptualization of social competence. Indeed, indices of fit obtained with CFA indicated reasonable

fit with the seven factor model, thus supporting the presence of the seven hypothesized domains of social motivation/skills assessed by the MSCS. Thus, the findings of the current study suggest that these seven content domains are each relevant to the assessment of social competence but are distinguishable from one another.

Interestingly, the results of the current study also suggested that certain domains of social competence may be more strongly related than others. In particular, results from an EFA of the MSCS domain scores indicated that specific domains of the MSCS can be meaningfully grouped together to form two subscale scores which have been labeled Social Responsiveness and Social Understanding/Emotion Regulation. The Social Responsiveness subscale contains items reflecting Social Motivation, Demonstrating Empathic Concern, and Nonverbal Sending Skills while the Social Understanding/Emotion Regulation subscale contains items from the Social Inferencing, Social Knowledge, Verbal Conversation Skills, and Emotion Regulation domains.

It is possible that the domains within the Social Responsiveness subscale are collectively tapping into the extent to which an individual is oriented towards and responsive to others. It appears that individuals who are rated by their parents as more interested in and/or motivated to spend time with other people may also be more likely to be emotionally tuned in and to connect with others at a nonverbal level. Taken together, these domains of social competence may reflect more of a general disposition or temperament as opposed to social skills that can be learned and incorporated into one's repertoire of functioning. Although initially one might think of the Nonverbal Sending Skills domain as reflecting more of a learned social cognitive skill, its loading on this particular higher order subscale suggests that this may not be the case. Instead, nonverbal sending skills may represent an important mode of communicating one's interest and/or empathic concern for others, and thus, be more highly related to one's general level of social responsiveness. Perhaps individuals who are predisposed to being more interested in and/or concerned about others are more likely to develop appropriate nonverbal sending skills for engaging others socially (e.g., eye contact, gestures, tone of voice etc.). On the other hand, individuals who are less attuned to or responsive to others may not pay sufficient attention to nonverbal cues in critical early developmental periods to develop these skills. More specifically, from a developmental perspective, infants must first be oriented to social cues (such as faces and eyes) before they

can learn to use nonverbal cues strategically to engage others. Indeed, research suggests that individual differences in the social orienting of attention emerge early in development and impact the development of adaptive social functioning across the lifespan (Rombough, Barrie, & Iarocci, in press; Mundy & Sigman, 2006). Thus, it is possible that well developed nonverbal sending skills represent a possible down-stream manifestation (or marker) of higher levels of social responsiveness.

If the Social Responsiveness subscale of the MSCS does indeed represent more of a personal disposition than learned skills, it is possible that the component domains (Social Motivation, Demonstrating Empathic Concern, Nonverbal Sending Skills) may prove less amenable to interventions. Certainly, on an intuitive level, it seems challenging to "teach" an individual to be more interested in other people or to be more emotionally attuned to their needs. Nonverbal sending skills (such as tone of voice, appropriate eye contact, social smiles/facial expressions) are often targeted in social skills intervention programs (e.g., Kroeger, Schultz, & Newson, 2007; Tse, Strulovitch, Tagalakis, Meng, & Fombonne, 2007; Webb, Miller, Pierce, Strawser, & Jones, 2004). Although capable of making important gains in terms of their nonverbal sending skills, children and adolescents with ASD may have trouble reaching the point where their nonverbal communication skills appear seamless and natural in the context of real-life social interactions. If not targeted very early in development, these skills are likely acquired through alternative compensatory strategies involving more of an explicit or rule based approach (e.g., look at someone in the eyes for a specified number of seconds) and, thus, may retain a somewhat "artificial" quality.

On the other hand, the component domains of the Social Understanding/Emotion Regulation subscale appear to reflect more of the cognitive and behavioural skills needed to respond appropriately in social situations. In other words, individuals with strengths in these areas are rated by parents as being adept at interpreting social cues and understanding social norms. They are perceived as better able to apply their social understanding in order to have reciprocal conversations with others and to regulate their emotional responses such that they do not interfere with their ability to execute adaptive social skills. These skills-based domains may be more amenable to change than the aforementioned Social Responsiveness domains. Indeed, this collection of skills (e.g., conversation skills, reading social cues, awareness of

social rules, self-control) are commonly targeted in social skills training interventions with some success. For instance, Social Story interventions, thought to target deficits in social inferencing (i.e., theory of mind), have demonstrated some effectiveness in this population (Reynhout & Carter, 2006). Similarly, there is emerging empirical support for the efficacy of group-based social skills interventions that target a range of social-cognitive and behavioural skills (Rao, Beidel, & Murray, 2008; Williams-White, Keonig, & Scahill, 2007).

From a neurocognitive and behavioural genetics perspective, the emergence of the two higher-order subscales (Social Responsiveness and Social Understanding/Emotion Regulation) on the MSCS is also interesting. William's syndrome (WS) is a rare genetic disorder in which individuals display a unique social phenotype characterized by a strong interest in social interaction (e.g., hypersociability, heightened approach behaviour), social disinhibition, and nonverbal expressiveness (e.g., heightened affective expression, exaggerated vocal prosody, frequent smiling, prolonged eye contact) (Jones et al., 2000). Individuals with WS may also show high levels of empathic concern as research has suggested that they appear attuned to the emotions of others and highly responsive when others are in distress (Mervis & Klein-Tasman, 2000). Interestingly, deficits in social-cognitive skills such as theory of mind (Sullivan & Tager-Flusberg, 1999) and interpreting non-literal statements such as jokes and lies (Sullivan, Winner, & Tager-Flusberg, 2003) as well as emotion regulation (e.g., increased levels of anxiety; Dykens, 2003) have also been observed in this population. In other words, individuals with WS appear to display high levels of Social Responsiveness but weaknesses in Social Understanding/Emotion Regulation. The identification of such a pattern of strengths and weaknesses in individuals with a specific genetically based disorder lends further support to the notion that these subscales may represent dissociable aspects of social competence.

Overall, the results from the current study may be taken as empirical support for a more differentiated understanding of social difficulties. Such a finding has relevance for the ongoing development and refinement of theories of social competence in the wider developmental and social psychological literature.

The second goal of the current study was to provide a preliminary evaluation of the reliability and validity of this newly developed parent rating tool. Empirical results were encouraging and supported the utility of MSCS as a reliable and valid parent rating measure of social competence in adolescents

with high functioning ASD. As mentioned previously, the hypothesized multidimensional factor structure was supported by CFA analyses. In addition, the final subset of 77 items was found to be internally consistent (i.e., the domains and subscales demonstrated high levels of internal consistency). Preliminary support for the construct validity of the MSCS was also obtained. A high level of correlation was obtained between the total scale of the MSCS and the SRS (a commonly used screening measure of social functioning in individuals with ASD). In addition, the high levels of correlation obtained between the MSCS scores and various real-life indicators of social competence were consistent with predictions and provided further support for the criterion-related validity of the tool. In general, parent ratings of poor social competence on the MSCS were associated with parent reports of difficulties with friendships and peer acceptance. In particular, strong relationships (i.e., correlations with absolute values greater than 0.60) emerged between ratings of overall social competence on the MSCS and the following indicators: number of close friends, being liked by peers, and being ignored by peers.

Furthermore, the differential patterns of correlation that were obtained between these indicators and the specific MSCS domains/subscales lend further support to the multidimensional nature of social competence and the importance of obtaining more differentiated social profiles in research studies. In particular, the Social Motivation domain demonstrated strong relationships with indicators of friendship development (i.e., medium to large correlations), suggesting that individuals who are more interested in interacting with others may be better able to develop close friendships in their day to day lives. The Verbal Conversation Skills domain emerged as demonstrating particularly strong associations (i.e., large correlations obtained) with indicators of peer acceptance. This finding suggests that one's ability to initiate and maintain age appropriate back-and-forth conversations may be a particularly important factor in facilitating the acceptance of one's peers during adolescence.

Results from the current study also indicated that the MSCS is capable of differentiating individuals with ASD from TD (i.e., known groups validity). Although the scale was not intended to function as a diagnostic or screening tool, it was designed to assess the types of social deficits that are characteristic of individuals with ASD. Thus, the finding of significant group differences across all domains and scale scores supports its utility as a measure of social competence in ASD. Furthermore, the lack of significant correlations obtained

between the MSCS scores and age/cognitive functioning suggests that differences in parent ratings of social competence on the MSCS cannot be accounted for by age or level of intelligence. This result is consistent with literature suggesting that social competence is a domain of human functioning that is distinct from general cognition (Ford and Stanford, 1982). In addition, this finding is encouraging when one considers the potential utility of the MSCS in future social subtyping attempts as it is less likely that subtypes primarily reflecting age or developmental level will emerge.

It is hoped that the MSCS will find several applications in both research and clinical settings. Although other rating scales exist that are capable of assessing social competence in ASD to varying degrees, the MSCS is unique in a number of ways. In particular, its content was developed based on theories of social competence and an extensive literature review. It is specifically targeted to adolescents with high functioning ASD and provides comprehensive coverage of the types of deficits commonly observed within this subpopulation. The MSCS provides an multidimensional assessment of social competence while many others provide only a global assessment (or, as in the case of the SRS, includes subscales which have not been supported by factor analyses). The MSCS provides an overall summary score as well as domain/subscale scores, thus allowing for a differentiated approach to assessment of social competence in ASD (where there is such a wide range of social presentations). It is important to reiterate that the MSCS was not designed as a diagnostic/screening tool for ASD. 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, it is hoped that this more singular focus will provide for a more thorough and comprehensive assessment of social competence in a diverse clinical population.

In terms of research, it is hoped that future applications of the MSCS will contribute to the literature aimed at elucidating the nature of social dysfunction in high functioning ASD. Investigators have argued for the importance of documenting "specific deficits in this subgroup which may be different from those identified in other disorders inside or outside of autism spectrum" (Rao et al., 2008 p. 359). Given that a range of scores was obtained for each domain/ subscale within the ASD group, it appears that the MSCS is capable of

capturing heterogeneity in social competence within the autism spectrum. Parent ratings of social competence on the MSCS did not demonstrate universal impairment across each domain, as instead, areas of relative social strength and weakness emerged at an individual level. In other words, for each domain, there were individuals with ASD who were rated as being competent and others who were rated as demonstrating impairment. As a result, the MSCS may be well suited to facilitate the identification of distinct profiles of social competence in future subtyping analyses (e.g., using cluster analytic techniques). Such profiles of social competence may also prove useful in studies, such as those conducted in behavioural genetics research, in which a well specified behavioural phenotype or endophenotype is a more useful way of grouping participants than a clinical diagnosis (Iarocci, Yager, & Elfers, 2007).

From a clinical perspective, it is hoped that the MSCS may prove useful as an intervention planning tool. By characterizing individual profiles of social strength and weakness, the MSCS could help clinicians to better tailor interventions to their clients. Indeed, it has been argued that interventions run the risk of being inappropriate and/or ineffective when a comprehensive assessment of specific social skills deficits is not undertaken when working with youth with high functioning ASD (Rao et al., 2008). Furthermore, it has been argued that the limited effectiveness of social skills training programs in ASD may be due to their failure to match social skills strategies to the specific type of deficit displayed by an individual (Gresham, Sugai, & Horner, 2001). A tool such as the MSCS could prove useful in this respect. On the other hand, the paucity of empirical support for SST programs in ASD may also reflect the lack of assessment tools capable of providing reliable and valid measures of treatment outcomes (Hume, Bellini, & Pratt, 2005). Although further research is needed to ensure that the MSCS is sensitive to detecting change over time, it holds promise in this respect as well.

Results from the current study may be taken as providing preliminary empirical support for the utility of the MSCS; however, findings should be interpreted with some caution until they have been replicated in other samples. Although the sample size in the current study was relatively small for factor analyses, the loadings obtained were high enough to suggest reliability in the interpretations that were made (Guadagnoli & Velicer, 1988). Nonetheless, additional research should attempt to replicate the higher order factor structure found in the present study. Additional data collection (i.e., a larger sample)

may facilitate the development of norms (e.g., scale scores) and cut-off points (to empirically designate "high" versus "low" scores).

One significant methodological limitation of the current study was that parent report was used as the source for all data included (i.e., MSCS, SRS, information about indicators of social competence). Thus, further research should attempt to assess the convergent validity of the MSCS by collecting data from measures that rely on alternate informants (e.g., teachers, clinicians) and employ different methods of administration (e.g., observation, behavioural assessment). Another limitation of the current study was that intellectual data was not available for all participants (only the subset of local participants who were able to come into the lab). Unfortunately, this was not possible due to the practical constraints of recruiting outside of the Lower Mainland in order to obtain the large numbers of participants needed for the factor analysis portion of the study. In future studies, the collection of IQ data for the entire sample of participants would allow for more detailed descriptions of the sample and would also permit an evaluation of the suitability of the measure with a lower functioning sample. Although it was important to begin by developing the MSCS for a specific targeted group (i.e., adolescents with high functioning ASD), alternate versions that are suitable for younger children and/or those who are lower functioning may be developed in the future. Similarly, the scale may ultimately be extended for use with other clinical populations known to demonstrate impairments in social competence (e.g., ADHD, social anxiety).

In sum, the development of the MSCS was informed by a multi-dimensional conceptualization of social competence. An extensive survey of the literature (guided by Rose-Krasnor's "prism model") revealed seven domains of social competence thought to be relevant to adolescence and ASD. In terms of scale development, a combination of theory-driven and empirical (i.e., data-driven) approaches to test construction was applied. Preliminary evidence from the current study suggests that the MSCS is a psychometrically sound parent rating scale that is capable of providing a differentiated assessment of social competence in adolescents with high functioning ASD. Although additional studies are warranted to replicate the results and further document psychometric properties, the MSCS holds promise as a tool that will find many uses in both research and clinical settings. In particular, it is hoped that the scale may offer a means of parsing heterogeneity in ASD by identifying meaningful profiles or patterns of social competence.

REFERENCES

Adolphs, R. (2003). Cognitive neuroscience of human social behaviour. *Nature Reviews Neuroscience, 4*(3), 165-178.

APA. (2000). *Diagnostic and statistical manual of mental disorders - Fourth edition text revision*. Washington, DC: American Psychiatric Association.

Argyle, M., & Lu, L. (1990). Happiness and social skills. *Personality and Individual Differences, 11*, 1255–1261.

Baron-Cohen, S. (1989). The autistic child's theory of mind: A case of specific developmental delay. *Journal of Child Psychology and Psychiatry, 30*(2), 285-297.

Baron-Cohen, S., & Wheelwright, S. (2003). The Friendship Questionnaire: An investigation of adults with Asperger syndrome or high-functioning autism, and normal sex differences. *Journal of Autism and Developmental Disorders, 33*(5), 509-517.

Baron-Cohen, S., & Wheelwright, S. (2004). The empathy quotient: An investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. *Journal of Autism and Developmental Disorders, 34*(2), 163-175.

Bauminger, N., & Kasari, C. (2000). Loneliness and friendship in high-functioning children with autism. *Child Development, 71*(2), 447-456.

Bauminger, N., Solomon, M., Aviezer, A., Heung, K., Gazit, L., Brown, J., et al. (2008). Children with autism and their friends: A multidimensional study of friendship in high-functioning Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders, 36*, 135-150.

Beauchaine, T. P. (2003). Taxometrics and developmental psychopathology. *Development and Psychopathology, 15*(3), 501-527.

Beglinger, L. J., & Smith, T. H. (2001). A review of subtyping in autism and proposed dimensional classification model. *Journal of Autism and Developmental Disorders, 31*(4), 411-422.

Bentler, P.M. (1990). Comparative fit indices in structural models. *Psychological Bulletin, 107*, 238-246.

Bergman, L. R. (1996). Studying persons-as-wholes in applied research. *Applied Psychology: An International Review, 45*(4), 331-334.

Bergman, L. R., von Eye, A., & Magnusson, D. (2006). Person-oriented research strategies in developmental psychopathology. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology, Vol 1: Theory and method (2nd ed.)* (pp. 850-888). Hoboken, NJ, US: John Wiley & Sons, Inc.

Birnbrauer, J. S., & Leach, D. J. (1993). The Murdoch Early Intervention Program after two years. *Behaviour Change, 10*, 63-74.

Boomsma, A. (1982). The robustness of LISREL against small sample sizes in factor analysis models. In K.G. Joreskog & H. Wold (Eds.), *Systems under indirect observation: Causality, structure, prediction (Pan 1,* pp. 149-173). Amsterdam: North-Holland.

Borden, M. C., & Ollendick, T. H. (1994). An examination of the validity of social subtypes in autism. *Journal of Autism and Developmental Disorders, 24*(1), 23-37.

Bristol, M. M., Cohen, D. J., Costello, E. J., Denckla, M., Eckberg, T. J., Kallen, R., et al. (1996). State of the science in autism: Report to the National Institutes of Health. *Journal of Autism and Developmental Disorders, 26*, 121-154.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York: Guilford Press.

Browne, M.W. & Cudeck, R. (1993). Alternate ways of assessing model fit. In K.A. Bollen & J.S. Long (Eds.), *Testing structural equation models* (pp.136-162). Newbury Park, CA: Sage.

Brownell, H., & Martino, G. (1998). Deficits in inference and social cognition: The effects of right hemisphere brain damage on discourse. In M. Beeman & C. Chiarello (Eds.), *Right hemisphere language comprehension: Perspectives from cognitive neuroscience* (pp. 309–328). Mahwah, NJ, USA: Lawrence Erlbaum Associates, Inc., Publishers.

Buhrmester, D. (1990). Intimacy of friendship, interpersonal competence, and adjustment during preadolescence and adolescence. *Child Development, 61*(4), 1101-1111.

Buhrmester, D., Furman, W., Wittenberg, M. T., & Reis, H. T. (1988). Five domains of interpersonal competence in peer relationships. *Journal of Personality & Social Psychology, 55*(6), 991-1008.

Chakrabarti, S., & Fombonne, E. (2001). Pervasive developmental disorders in preschool children. *Journal of the American Medical Association, 285*(24), 3093-3099.

Chamberlain, B., Kasari, C., & Rotheram-Fuller, E. (2007). Involvement or isolation? The social networks of children with autism in regular classrooms. *Journal of Autism and Developmental Disorders, 37*(2), 230-242.

Cicchetti, D.V., Koenig, K., Klin, A., Volkmar, F.R., Paul, R., & Sparrow, S. (2011). From Bayes through marginal utility to Effect sizes: A guide to understanding the clinical and statistical significance of the results of autism research findings. *Journal of Autism and Developmental Disorders, 41*, 168-174.

Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment, 7*(3), 309-319.

Cohen, D. J., Paul, R., & Volkmar, F. (1987). Issues in the classification of PDD and associated conditions. In D. J. Cohen, A. M. Donnellan & R. R. Paul (Eds.), *Handbook of autism and pervasive developmental disorders* (pp. 20-40). New York: Wiley.

Constantino, J. N., Davis, S. A., Todd, R. D., Schindler, M. K., Gross, M. M., Brophy, S. L., et al. (2003). Validation of a Brief Quantitative Measure of Autistic Traits: Comparison of the Social Responsiveness Scale with the Autism Diagnostic Interview-Revised. *Journal of Autism and Developmental Disorders, 33*(4), 427-433.

Constantino, J. N., & Gruber, C. P. (2005). Social Responsiveness Scale (SRS). Los Angeles: Western Psychological Services.

Constantino, J. N., Przybeck, T., Friesen, D., & Todd, R. D. (2000). Reciprocal social behavior in children with and without pervasive developmental disorders. *Journal of Developmental & Behavioral Pediatrics, 21*(1), 2-11.

Coolican, J., Bryson, S. E., & Zwaigenbaum, L. (2008). Brief report: Data on the Stanford-Binet Intelligence Scales (5th ed.) in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 38*(1), 190-197.

Courchesne, E., Yeung-Courchesne, R., & Pierce, K. (1999). Biological and behavioral heterogeneity in autism: Roles of pleiotropy and epigenesis. In S. H. Broman & J. M. Fletcher (Eds.), *The changing nervous system: Neurobehavioral consequences of early brain disorders* (pp. 292-338). New York, NY: Oxford University Press.

Dykens, E.M. (2003). Anxiety, fears, and phobias in persons with Williams syndrome. *Developmental Neuropsychology, 23*, 291-316.

Eaves, L. C., Ho, H. H., & Eaves, D. M. (1994). Subtypes of autism by cluster analysis. *Journal of Autism and Developmental Disorders, 24*(1), 3-22.

Ehlers, S., Nyden, A., Gillberg, C., Dahlgren Sandberg, A., Dahlgren, S.O., Hjelmquist, E., et al. (1997). Asperger syndrome, autism, and attention disorders: A comparative study of the cognitive profiles of 120 children. *Journal of Child Psychology and Psychiatry, 38*, 207-217.

Eisenberg, N., & Harris, J. D. (1984). Social competence: A developmental perspective. *School Psychology Review, 13*(3), 267.

Fein, D., Stevens, M., Dunn, M., Waterhouse, L., Allen, D., Rapin, I., et al. (1999). Subtypes of pervasive developmental disorder: Clinical characteristics. *Child Neuropsychology, 5*(1), 1-23.

Fine, J., Bartolucci, G., Szatmari, P., & Ginsberg, G. (1994). Cohesive discourse in pervasive developmental disorders. *Journal of Autism and Developmental Disorders, 24*, 315-329.

Floyd, F.J. & Widaman, K.F. (1995). Factor analysis in the development and refinement of clinical assessment instruments. *Psychological Assessment, 7*(3), 286-299.

Folstein, S., Haines, J., & Santangelo, S. (1998). The genetics of autism. *Neuroscience News, 1*, 14-17.

Frith, U. (1991). *Autism and Asperger syndrome.* New York, NY: Cambridge University Press.

Frith, U. (2003). *Autism: Explaining the enigma.* Oxford: UK: Blackwell Publishing.

Furr, R. M., & Funder, D. C. (1998). A multimodal analysis of personal negativity. *Journal of Personality and Social Psychology, 74*, 1580–1591.

Ghaziuddin, M. (2008). Defining the behavioral phenotype of Asperger syndrome. *Journal of Autism and Developmental Disorders, 38*(1), 138-142.

Green, J., Gilchrist, A., Burton, D., & Cox, A. (2000). Social and psychiatric functioning in adolescents with Asperger Syndrome compared with Conduct Disorder. *Journal of Autism and Developmental Disorders, 30*(4), 279-293.

Greenspan, S. (1981). Defining childhood social competence: A proposed working model. *Advances in Special Education, 3*, 1-39.

Gresham, F. M., & Elliot, S. N. (1990). Social Skills Rating System (SSRS). Circle Pines, MN: American Guidance Service.

Gresham, F.M., Sugai, G., & Horner, R.H. (2001). Interpreting outcomes of social skills training for students with high-incidence disabilities. *Exceptional Children, 67*(3), 331-344.

Guadagnoli, E. & Velicer, W.F. (1988). Relation of sample size to the stability of component patterns. *Psychological Bulletin, 103*(2), 265-275.

Happe, F., Ronald, A., & Plomin, R. (2006). Time to give up on a single explanation for autism. *Nature Neuroscience, 9*(10), 1218-1220.

Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.

Hume, K., Bellini, S., & Pratt, C. (2005). The usage and perceived outcomes of early intervention and early childhood programs for young children with autism spectrum disorder. *Topics in Early Childhood and Special Education, 25*(4), 195-207.

Iarocci, G., Yager, J., & Elfers, T. (2007). What gene-environment interactions can tell us about social competence in typical and atypical populations. *Brain and Cognition, 65*(1), 112-127.

Iarocci, G., Yager, J., Rombough, A., & Mclaughlin, J. (2008). The development of social competence among persons with down syndrome: From survival to social inclusion. *International Review of Research in Mental Retardation, 35*, 87-119.

Ingram, R. E., Miranda, J., & Segal, Z. V. (1998). *Cognitive vulnerability to depression*. New York: The Guilford Press.

Jones, W., Bellugi, U., Lai, Z., Chiles, M., Reilly, J., Lincoln, A., et al. (2000). Hypersociability in Williams syndrome. *Journal of Cognitive Neuroscience, 12*(Suppl 1), 30–46.

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2*, 217-250.

Klin, A., Pauls, D., Schultz, R., & Volkmar, F. (2005). Three diagnostic approaches to Asperger syndrome: implications for research. *Journal of Autism and Developmental Disorders, 35*(2), 221-234.

Klin, A., & Volkmar, F. R. (1997). The pervasive developmental disorders: Nosology and profiles of development. In S. S. Luthar, J. A. Burack, D. Cicchetti & J. R. Weisz (Eds.), *Developmental psychopathology: Perspectives on adjustment, risk, and disorder.* (pp. 208-226). New York: Cambridge University Press.

Kline, P. (1986). *A handbook of test construction: Introduction to psychometric design*. New York, NY: Methuen.

Klinger, L. G., Dawson, G., & Renner, P. (2003). Autistic disorder. In E. J. Mash & R. A. Barkley (Eds.), *Child psychopathology (2nd edition)* (pp. 409-454). New York: Guilford Press.

Koning, C., & Magill-Evans, J. (2001). Social and language skills in adolescent boys with Asperger syndrome. *Autism, 5*(1), 23-36.

Kraemar, H. C. (1996). Biostatistical recommendations. *Journal of Autism and Developmental Disorders, 26*, 150-153.

Kroeger, K.A., Schultz, J.R., & Newson, C. (2007). A comparison of two group-delivered social skills programs for young children with autism. *Journal of Autism and Developmental Disorders, 37*(5), 808-817.

Kugler, B. (1998). The differentiation between autism and Asperger syndrome. *Autism, 2*(1), 11-32.

Lecavalier, L., Aman, M.G., Hammer, D., Stoica, W., & Mathews, G.L (2004). Factor analysis of the Nisonger Child Behavior Rating Form in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 34*(6), 709-721.

Lecavalier, L., & Aman, M. G. (2005). Rating Instruments. In J. L. Matson , R. B. Laud & M. L. Matson (Eds.), *Behavior modification for persons with developmental disabilities: Treatments and supports* (Vol. I, pp. 160-189). Kingston, NY: National Association for the Dually Diagnosed Press.

Lopes, P. N., Salovey, P., Cote, S., Beers, M., & Petty, R. E. (2005). Emotion regulation abilities and the quality of social interaction. *Emotion, 5*(1), 113.

Lord, C., Rutter, M., Goode, S., Heemsbergen, J., Jordan, H., Mawhood, L., et al. (1989). Autism diagnostic observation schedule: A standardized observation of communicative and social behavior. *Journal of Autism and Developmental Disorders, 19*(2), 185-212.

Maag, J. W. (1989). Assessment in social skills training: Methodological and conceptual issues for research and practice. *RASE: Remedial & Special Education, 10*(4), 6-17.

Maestro, S., Muratori, F., Cesari, A., Cavallaro, M. C., Paziente, A., Pecini, C., et al. (2005). Course of autism signs in the first year of life. *Psychopathology, 38*(1), 26-31.

Matson, J. L., & Swiezy, N. (1994). Social skills training with autistic children. In J. L. Matson (Ed.), *Autism in children and adults: Etiology, assessment, and intervention* (pp. 241-260). Belmont, CA: Thomson Brooks/Cole Publishing Co.

Mayes, S. D., Calhoun, S. L., & Crites, D. L. (2001). Does DSM-IV Asperger's disorder exist? *Journal of Abnormal Child Psychology, 29*(3), 263-271.

McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American Journal of Mental Retardation, 97*(4), 359-391.

Mervis, C.B. & Klein-Tasman, B.P. (2000). Williams Syndrome: Cognition, personality, and adaptive behavior. *Mental Retardation and Developmental Disabilities Research Reviews, 6*, 148-158.

Mill, J., Caspi, A., Williams, B. S., Craig, I., Taylor, A., Polo-Tomas, M., et al. (2006). Prediction of heterogeneity in intelligence and adult prognosis by genetic polymorphisms in the dopamine system among children with attention-deficit/hyperactivity disorder: Evidence from 2 birth cohorts. *Archives of General Psychiatry, 63*(4), 462-469.

Miller, J. N., & Ozonoff, S. (1997). Did Asperger's cases have Asperger Disorder? *Journal of Child Psychology and Psychiatry, 38*, 247-251.

Moffitt, T. E. (1993). Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychological Review, 100*(4), 674-701.

Mundy, P. & Sigman, M. (2006). Joint attention, social competence, and developmental psychopathology. In D. Cicchetti & D.J. Cohen (Eds.), *Developmental psychopathology, Vol.1: Theory and method (2nd ed.)* (pp. 293-332). Hoboken, NJ: John Wiley & Sons Inc.

Nagin, D. S. (1999). Analyzing developmental trajectories: A semiparametric, group-based approach. *Psychological Methods, 4*(2), 139-157.

Netemeyer, R. G., Bearden, W. O., & Sharma, S. (2003). *Scaling procedures: Issues and applications*. Thousand Oaks, Calif.: Sage Publications.

Newcomb, A. F., Bukowski, W. M., & Pattee, L. (1993). Children's peer relations: A meta-analytic review of popular, rejected, neglected, controversial, and average sociometric status. *Psychological Bulletin, 113*(1), 99-128.

Nigg, J. T., Willcutt, E. G., Doyle, A. E., & Sonuga-Barke, E. J. (2005). Causal heterogeneity in attention-deficit/hyperactivity disorder: Do we need neuropsychologically impaired subtypes? *Biological Psychiatry, 57*(11), 1224-1230.

Pennington, B. F., & Ozonoff, S. (1991). A neuroscientific perspective on continuity and discontinuity in developmental psychopathology. In D. Cicchetti & S. L. Toth (Eds.), *Rochester Symposium on Developmental Psychopathology, Vol. 3: Models and integrations.* (pp. 117-159): University of Rochester Press.

Prior, M. (1987). Biological and neuropsychological approaches to childhood autism. *British Journal of Psychiatry, 150*, 8-17.

Rao, P. A., Beidel, D. C., & Murray, M. J. (2008). Social skills interventions for children with Asperger's Syndrome or high-functioning autism: A review and recommendations. *Journal of Autism and Developmental Disorders, 38*(2), 353-361.

Reynhout, G., & Carter, M. (2006). Social stories for children with disabilities. *Journal of Autism and Developmental Disorders, 36*(4), 445-469.

Roid, G. H. (2003). Stanford Binet intelligence scales (5th ed.). Itasca, IL: Riverside Publishing.

Rombough, A., Barrie, J.N., & Iarocci, G. (in press).Orienting to social cues is a distinct form of visual spatial orienting: Evidence from behavioural, neuro-imaging, and developmental research. In J. A. Burack, J. T. Enns, & N. Fox (Eds.), *Cognitive science, development, and psychopathology: Typical and atypical pathways of attention*. New York, NY: Oxford University Press.

Rose-Krasnor, L. (1997). The nature of social competence: A theoretical review. *Social Development, 6*(1), 111-135.

Rubin, K. H., Bukowski, W. M., & Parker, J. G. (2006). Peer interactions, relationships, and groups. In N. Eisenberg, W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology: Vol 3, Social, emotional, and personality development (6th ed.)* (pp. 571-645). Hoboken, NJ, US: John Wiley & Sons Inc.

Russell, E., & Sofronoff, K. (2005). Anxiety and social worries in children with Asperger syndrome. *Australian and New Zealand Journal of Psychiatry, 39*(7), 633-638.

Rutter, M., Le Couteur, A., & Lord, C. (2003). Autism Diagnostic Interview-Revised. Los Angeles: Western Psychological Services.

Sameroff, A. J., Seifer, R., & Bartko, W. T. (1997). Environmental perspectives on adaptation during childhood and adolescence. In S. S. Luthar, J. A. Burack, D. Cicchetti & J. R. Weisz (Eds.), *Developmental psychopathology: Perspectives on adjustment, risk, and disorder* (pp. 507-526). New York, NY: Cambridge University Press.

Schmitt, N. (1996). Uses and abuses of coefficient alpha. *Psychological Assessment, 8*(4), 350-353.

Schneider, R. J., Ackerman, P. L., & Kanfer, R. (1996). To 'act wisely in human relations': Exploring the dimensions of social competence. *Personality and Individual Differences, 21*(4), 469.

Sevin, J. A., Matson, J. L., Coe, D., Love, S. R., Matese, M. J., & Benavidez, D. A. (1995). Emprically derived subtypes of pervasive developmental disorders: A cluster analytic study. *Journal of Autism and Developmental Disorders, 25*, 561-578.

Shanker, S. G. (2004). Autism and the dynamic developmental model of emotions. *Philosophy, Psychiatry, & Psychology, 11*(3), 219-233.

Sparrow, S. S., Balla, D., & Cicchetti, D. (1984). Vineland Adaptive Behaviour Scales (Survey Form). Circle Pines, MN: American Guidance Service.

Spector, P. E. (1992). *Summated rating scale construction: An introduction*. Thousand Oaks, CA, US: Sage Publications, Inc.

Spence, S. H. (2003). Social skills training with children and young people: Theory, evidence and practice. *Child and Adolescent Mental Health, 8*(2), 84-96.

Streiner, D. L., & Norman, G. R. (2003). *Health measurement scales: A practical guide to their development and use (3rd ed.)*. New York: Oxford University Press.

Stump, K.N., Ratliff, J.M., Wu, Y.P., & Hawley, P.H. (2009). Theories of social competence from the top-down to the bottom-up: A case for considering foundational human needs. In J.L. Matson (Ed.), *Social behavior and skills in children* (pp. 23-37). New York, NY: Springer.

Sullivan, K. & Tager-Flusberg, H. (1999). Second-order belief attribution in Williams Syndrome: Intact or impaired? *American Journal on Mental Retardation, 104*(6), 523-532.

Sullivan, K., Winner, E., & Tager-Flusberg, H. (2003). Can adolescents with Williams Syndrome tell the difference between lies and jokes? *Developmental Neuropsychology, 23*(1&2), 85-103.

Szatmari, P. (1992). The validity of autistic spectrum disorders: A literature review. *Journal of Autism and Developmental Disorders, 22*(4), 583-600.

Szatmari, P. (2000). Perspectives on the classification of Asperger syndrome. In A. Klin, F. Volkmar & S. S. Sparrow (Eds.), *Asperger Syndrome* (pp. 403-417). New York: Guilford Press.

Szatmari, P., Bartolucci, G., & Bremner, R. (1989). Asperger's syndrome and autism: Comparison of early history and outcome. *Developmental Medicine & Child Neurology, 31*, 709-720.

Szatmari, P., Georgiades, S., Bryson, S., Zwaigenbaum, L., Roberts, W., Mahoney, W., et al. (2006). Investigating the structure of the restricted, repetitive behaviours and interests domain of autism. *Journal of Child Psychology and Psychiatry, 47*(6), 582-590.

Tager-Flusberg, H. (2004). Strategies for conducting research on language in autism. *Journal of Autism and Developmental Disorders, 34*(1), 75-80.

Tager-Flusberg, H., & Joseph, R. M. (2003). Identifying neurocognitive phenotypes in autism. In U. Frith & E. Hill (Eds.), *Autism: Mind and brain* (pp. 43-66). New York, NY: Oxford University Press.

Tanguay, P. E., Robertson, J., & Derrick, A. (1998). A dimensional classification of autism spectrum disorder by social communication domains. *Journal of the American Academy of Child & Adolescent Psychiatry, 37*(3), 271-277.

Tantam, D. (1988). Asperger's syndrome. *Journal of Child Psychology and Psychiatry, 29*(3), 245-255.

Tantam, D. (2000). Adolescence and adulthood of individuals with Asperger syndrome. In A. Klin, F. Volkmar & S. S. Sparrow (Eds.), *Asperger syndrome* (pp. 87-102). New York: Guilford Press.

Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications*. Washington, DC, US: American Psychological Association.

Tsai, L. (1992). Diagnostic issues in high-functioning autism. In E. Schopler & G. Mesibov (Eds.), *High functioning individuals with autism* (pp. 11-40). New York: Plenum Press.

Tse, J., Strulovitch, J., Tagalakis, V., Meng, L., & Fombonne, E. (2007). Social skills training for adolescents with Asperger Syndrome and high-functioning autism. *Journal of Autism and Developmental Disorders, 37*(10), 1960-1968.

Verte, S., Geurts, H. M., Roeyers, H., Rosseel, Y., Oosterlaan, J., & Sergeant, J. A. (2006). Can the Children's Communication Checklist differentiate autism spectrum subtypes? *Autism, 10*(3), 266-287.

Volkmar, F. R., & Klin, A. (2000). Diagnostic issues in Asperger Syndrome. In A. Klin, F. Volkmar & S. S. Sparrow (Eds.), *Asperger Syndrome*. (pp. 25-71). New York: Guilford.

Volkmar, F. R., & Klin, A. (2005). Issues in the classification of autism and related conditions. In F. R. Volkmar, R. Paul, A. Klin & D. Cohen (Eds.), *Handbook of autism and developmental disorders. Third edition* (Vol. 1) (pp. 5-41). Hoboken, NJ: John Wiley & Sons, Inc.

von Eye, A., & Bergman, L. R. (2003). Research strategies in developmental psychopathology: Dimensional identity and the person-oriented approach. *Development and Psychopathology, 15*(3), 553-580.

Walker, D. R., Thompson, A., Zwaigenbaum, L., Goldberg, J., Bryson, S. E., Mahoney, W. J., et al. (2004). Specifying PDD-NOS: A comparison of PDD-NOS, Asperger Syndrome, and Autism. *Journal of the American Academy of Child & Adolescent Psychiatry, 43*(2), 172-180.

Ward-King, J., Cohen, I.L., Penning, H., & Holden, J.A. (2010). Brief report: Telephone administration of the Autism Diagnostic Interview-Revised: Reliability and suitability for use in research. *Journal of Autism and Developmental Disorders, 40*(10), 1285-1290.

Waterhouse, L., Morris, R., Allen, D., Dunn, M., Fein, D., Feinstein, C., et al. (1996). Diagnosis and classification in autism. *Journal of Autism and Developmental Disorders, 26*(1), 59-86.

Waterhouse, L., Wing, L., & Fein, D. (1989). Re-evaluating the syndrome of autism in the light of empirical research. In G. Dawson (Ed.), *Autism: Nature, diagnosis, and treatment.* (pp. 263-281). New York, NY: Guilford Press.

Waters, E., & Sroufe, L. A. (1983). Social competence as a developmental construct. *Developmental Review, 3*(1), 79-97.

Webb, B.J., Miller, S.P., Pierce, T.B., Strawser, S., & Jones, W.P. (2004). Effects of social skill instruction for high-functioning adolescents with autism spectrum disorders. *Focus on Autim and Other Developmental Disabilities, 19*(1), 53-62.

Williams-White, S., Keonig, K., & Scahill, L. (2007). Social skills development in children with autism spectrum disorders: A review of the intervention research. *Journal of Autism and Developmental Disorders, 37*(10), 1858-1868.

Willemsen-Swinkels, S. H. N., & Buitelaar, J. K. (2002). The autistic spectrum: Subgroups, boundaries and treatment. *Psychiatric Clinics of North America, 25*(4), 811-836.

Wing, L., & Gould, J. (1979). Severe impairments of social interaction and associated abnormalities in children: Epidemiology and classification. *Journal of Autism and Developmental Disorders, 9*(1), 11-29.

Wyman, P. A., Sandler, I., Wolchik, S., & Nelson, K. (2000). Resilience as cumulative competence promotion and stress protection: Theory and intervention. In D. Cicchetti, J. Rappaport, I. Sandler & R. P. Weissberg (Eds.), *The promotion of wellness in children and adolescents* (pp. 133-184). Washington, DC, US: Child Welfare League of America.

APPENDICES

APPENDIX A
ORIGINAL MSCS ITEMS WITHIN CONTENT DOMAINS

Social Motivation (35 items)

Low:

1) Prefers to spend time alone (e.g., may seem most content when left on his/her own).
2) Avoids talking to people when possible (e.g., looks, moves, or walks away).
3) Shows little interest in people.
4) Interacts with people (e.g., parents, teachers, kids) mostly for a specific purpose. For example, he/she might only talk to people when he/she wants help or information about something. Or, he/she might interact with people when he/she wants to tell him/her about a favourite topic. This is different from being social because he/she enjoys being with people.
5) Does not seem to notice or respond to people. For example, he/she might be so focused on what he/she is doing that he/she doesn't seem to notice when people enter or leave the room or try to talk to him/her. Or, he/she might walk right past someone he/she knows without saying hello. In other words, he/she might seem as if they are in their "own world" much of the time.
6) Does not like group activities.
7) Needs to be told (or prompted) to interact with people.
8) Stays in the "background" in group social situations (e.g., keeps to him/herself, may not be noticed)
9) Is extremely shy.
10) Is not interested in having many friends.
11) He/she avoids new or difficult social situations.
12) Needs to be prompted to respond when other people greet him/her or say goodbye.
13) Has trouble with activities that are social but don't seem to have a point (e.g., group games, sing-a-longs, "hanging out", chatting).

High:

1) Enjoys meeting new people.
2) When excited or happy, seems to want others to share his/her enjoyment. For example, he/she might try to include them in activity or tell them about it.
3) Expresses an interest in dating or marriage (either for now or the future). For example, he/she might talk about getting married when he/she grows up.
4) Shows people things that he/she is interested in or proud of. For instance, he/she might show something that he/she made or found. This is often done for no particular purpose other than to share one's interests or achievements with another person.
5) Seeks out people to spend time with (e.g., family members, friends, other kids).

6) Is interested in finding out "gossip" about people.
7) Initiates get-togethers with other kids (e.g., calls or emails them to make plans).
8) Talks about friends (either his/her current friends or wanting more friends).
9) Talks about kids he/she knows from school or elsewhere.
10) Likes getting to know new people.
11) Chooses to be involved in social activities/ groups (e.g., clubs, sports).
12) Talks or asks about people when they are not around (e.g., relatives, other kids, teachers).
13) Wants to "fit in" with other kids his/her age.
14) Asks people questions about themselves or their lives (e.g., how they are doing, what they've been up to).
15) Seems to want people to like him/her.
16) Initiates friendly "chit-chat" with people. For example, he/she might ask about what's new with the other person or talk about the weather or events. These are casual conversations that often have no specific purpose.
17) Remembers what is going on in people's lives (e.g., if someone went on a trip, asks how it went).
18) Seems interested in other people and what they are doing (e.g., he/she may watch or observe people; or, he/she may try to join in their activities).
19) Wants to appear "cool" in front of his/her peers.
20) Introduces him/herself to people (without being told to).
21) Comments on small changes in other people's appearance (e.g., notices a new haircut or outfit).
22) Seems interested in what other people say.

Social Inferencing (35 items)

Low:

1) Is easily convinced to do things or manipulated by others.
2) Is naïve (believes whatever he/she is told).
3) Doesn't pick up on the subtleties of social interaction.
4) Has trouble reading facial expressions (e.g., can't tell what people are feeling just by looking at their face).
5) Has trouble telling whether someone else's actions are meant to be friendly or mean. For example, he/she may have trouble telling the difference between friendly kidding around and mean teasing.
6) Has trouble judging who is trustworthy (e.g., who to share secrets or personal information with).
7) Misinterprets what other people say.
8) Expects people to know his/her thoughts, feelings or opinions without sharing them.
9) Seems to assume that other people will understand what he/she is talking about. For example, he/she might not give enough detail or background information.
10) Misreads social cues.
11) Has trouble predicting what other people will do or how they will react.

12) Has trouble recognizing people he/she has met before. This might be especially true if their appearance has changed a bit (e.g., wearing glasses, different hairstyle).
13) Expects others to feel the same way as he/she does about things.
14) Seems confused by other people's reactions or behaviours.
15) Repeats the same information when talking about things (even if the other person has heard it before).
16) Does not seem to notice when people are bored or no longer interested in what he/she is talking about.
17) Is suspicious of other people and their intentions.

High:

1) Picks up on subtle hints and indirect requests. For example, he/she would understand that when someone asks "Can you reach that book?" they are asking him/her to pass it to them. In other words, he/she can "read between the lines" when others are talking.
2) Understands when people are being sarcastic.
3) Can see things from another person's perspective.
4) Can tell when it is best to leave someone alone.
5) Notices when people do not understand what he/she is saying. For example, he/she might rephrase or try explaining it in a different way.
6) Can tell when someone is lying to him/her.
7) Is aware when he/she has had a negative or awkward social interaction with someone.
8) Can tell when people are joking.
9) Knows generally what people in his/her life (e.g., family members, close friends) like to do or are interested in.
10) Can tell the difference between something done by accident or "on purpose". For example, he/she could tell if someone bumped into him/her or broke one of his/her things by accident vs. on purpose.
11) Recognizes unfriendly actions. For example, he/she knows when someone is making fun of him/her in a mean-spirited way. Or, he/she recognizes when a peer is pressuring him/her to do something he/she shouldn't or doesn't want to do.
12) When he/she gives gifts to people, the gifts are thoughtful (e.g., something that person would like or could use).
13) Can tell when people are in a "bad mood" (e.g., upset or angry).
14) Tells small lies (e.g., to get out of trouble, to avoid talking about something, etc.).
15) Is good at playing fun "tricks" on people.
16) Knows what his/her social status is with other kids (e.g., if popular, accepted, rejected, or ignored).
17) Is good at persuading people to change their mind about something.
18) Recognizes when people are trying to take advantage of him/her.

Demonstrating Empathic Concern (23 items)

Low:

1) Is rough with animals – even if unintentionally (e.g., holds them too tightly).
2) Seems indifferent or "oblivious" to people who are upset (or in distress).
3) Insults or puts people down.
4) Does not offer to help people (unless asked or told to).
5) Goes too far when playfully teasing others. For example, he/she may not mean to hurt the other person's feelings, but may not know when is the right time to stop or back off.
6) Reacts inappropriately when others are hurt or upset. For example, he/she may not mean to be rude but might find it funny and laugh if someone trips or hurts him/herself.
7) Is quick to point out when other people are doing something the "wrong way" (e.g., other people's mistakes).
8) Seems like he/she is detached from people emotionally.
9) Acts "better" than others (e.g., brags, talks about how smart he/she is or how he/she is an "expert" on a topic).
10) Tells people what to do (e.g., comes across as bossy, rude, or the "rule police").
11) Blurts out hurtful or rude comments (e.g., doesn't seem to think about how his/her words might affect other people).

High:

1) Offers comfort to people (e.g., to someone who is upset, not feeling well, hurt etc.). For instance, he/she may try to hug the person or provide a comforting object (e.g., blanket) as a way of trying to make the other person feel better.
2) Is sensitive to the feelings and concerns of others.
3) Gives suggestions or advice in a sensitive way.
4) Expresses concern for others when they are upset or distressed (e.g., may ask "are you alright?" or ask if they need anything).
5) Makes reassuring comments when people are upset (e.g., "it'll be alright" or "don't worry").
6) Appears visibly upset when he/she sees people suffering (in real life or on tv/film).
7) Apologizes after he/she hurts someone (without being prompted or told to).
8) Seems concerned about other people and their problems (e.g., talks about someone who is having a hard time).
9) Tries to cheer people up (when they are down).
10) Offers to share things with other people (e.g., food, toys, taking turns playing a video game or using an object). These offers of sharing are spontaneous – that is, not prompted or requested by another person.
11) Congratulates people when good things happen to them.
12) Gives compliments to people.

Social Knowledge (30 items)

Low:

1) Talks about private things in inappropriate ways. For example, he/she might give too much information, talk loudly about private things in public, or talk about personal things with strangers.
2) Does "private" behaviours in public. For example, he/she might burp, pick their nose, touch or scratch themselves, or undress in public.
3) Is inappropriate with strangers (e.g., overly friendly, talks to them as if he/she knew them well).
4) Has trouble figuring out what he/she is expected to do in different social situations (e.g., doesn't know the "social rules"). For example, he/she might need to be told or reminded what to do and what not to do.
5) Touches people in inappropriate or odd ways. For example, he/she might touch strangers or stroke people's hair or clothes because he/she likes the feel of it.
6) Mistakes acquaintances for close friends (e.g., might refer to all kids in class as his/her friends).
7) Says things that are odd. These comments/questions may be unusual in terms of their content (e.g., "Do you like to eat monkeys?"). Or, they may be odd in their timing (e.g., not relevant to the conversation or situation).
8) Uses very formal language for his/her age. For example, he/she might use adult-like vocabulary, sound like a "professor", or try to be very "precise".
9) Takes (or uses) other people's things without asking permission.
10) Laughs inappropriately or at odd times. For example, he/she might laugh to him/herself for no apparent reason or laugh loudly in public when reading something funny. Or, he/she might laugh when other people make mistakes or when he/she doesn't know how else to respond.
11) Has trouble using humour appropriately. For instance he/she might have an odd sense of humour (e.g., say jokes that don't make much sense or aren't funny to other people). Or, he/she might go too far with jokes until they wear out or repeat the same ones over and over. He/she might also have trouble recognizing appropriate times for humour (e.g., trying to be funny during a class discussion or a serious moment).
12) Makes odd sounds/noises in public (e.g., squealing sounds, mumbling, talking to self etc.)
13) Asks questions or makes comments that are embarrassing (e.g., about people's age, race appearance, or other personal issues). These types of comments may come across as insensitive – even if he/she did not mean to be rude.

High:

1) Understands what makes a true friend.
2) Dresses appropriately for his/her age and social situations. For example, he/she would dress up for formal events and wear more casual clothes on weekends. His/her clothes would be generally considered acceptable by kids his/her age.
3) Uses slang words or phrases that are commonly used within his/her age group.
4) Understands the "social hierarchy" at school or in other settings (e.g., who has more power/control).

5) Seems to understand that some social situations can be dangerous or risky (e.g., parties with drinking/drugs, internet chat rooms, talking to strangers).
6) Chooses appropriate kids to make friends with. For example, good potential friends might be similar ages or have similar interests.
7) Uses polite expressions (e.g., "excuse me", "please", "thank you") when appropriate.
8) Knows about the latest trends for his/her age (e.g., in clothes, music, tv shows/movies, music).
9) Follows social "rules" around privacy. For example, he/she respects people's privacy when they are changing or are in the washroom. He/she would also knock on closed doors instead of barging in.
10) Changes his/her behaviour to suit the situation. For example, he/she might be more polite/formal around authority figures like teachers but be more casual around other kids. As another example, he/she might change his/her way of speaking depending on who he/she is talking to (e.g., talk more simply to a young child).
11) Understands that it is important to have good personal hygiene (e.g., smelling and looking clean).
12) His/her expectations of friends are reasonable. For example, he/she knows they have other friends or are not always available.
13) Changes the volume of his/her voice depending on where he/she is. For example, he/she would be quiet at the library or a movie theatre but louder when playing outside or at a sporting event.
14) Answers the phone (and takes messages) properly.
15) Acts appropriately for his/her age when in public places (e.g., restaurants, movie theatres, libraries, doctor's waiting rooms).
16) Hides his or her true feelings (when necessary) so that he/she doesn't come across as rude. For example, he/she might hide feelings of disappointment when given a gift that he or she doesn't like or when someone breaks something of theirs by accident.
17) Tells "white lies" so that he/she won't hurt people's feelings (e.g., about someone's cooking or a new haircut). In other words, he/she understands that sometimes it is rude to be completely honest.

Verbal Conversation Skills (24 items)

Low:

1) Talks about the same things over and over ("gets stuck" on certain topics).
2) Provides too much detail when talking about a topic. For example, he/she might list a bunch of facts rather than expressing a main message or exchanging information.
3) Goes off track during conversations. For example, he/she might changes topics suddenly as if thinking aloud or reminded of something else. Or, he/she might gradually get sidetracked or lose track of his/her original point.
4) Says little in conversations (e.g., gives brief answers, does not offer much information).

5) Dominates conversations so that it can be hard for others to "get a word in". For example, he/she might ramble on and on about a favourite topic of interest. He/she might also need reminders/prompting to let others speak.
6) Has trouble joining conversations appropriately. For example, he/she might interrupt or "butt in" instead of waiting for a good time to join in. Or, he/she may start talking about a topic of interest to him/her regardless of the on-going conversation.
7) Talks "at" people (e.g., almost like he/she is giving a lecture).
8) He/she shifts conversations to his/her favourite topic or interest.
9) "Talks around" things (e.g., doesn't seem to make a specific point).
10) Makes long pauses in conversations (e.g., takes a while to respond when it's his/her turn to talk; stops talking mid-sentence; or, there are frequent "uncomfortable silences" when talking with him/her).
11) Ends conversations suddenly (e.g., just walks away).
12) Talks "over" people in conversations (e.g., interrupts a lot, doesn't wait for others to finish speaking).
13) Talks too much.
14) Has trouble making conversation with other people.

High:

1) Brings up different things to talk about in conversations.
2) Stays on topic during conversations (e.g., makes comments or asks questions relevant to the topic at hand).
3) Builds on what other people say in conversations (e.g., responds to and comments on/adds to what they say).
4) Is flexible when there is a change in the topic of conversation (e.g., can go with the "flow" of conversations; can follow what other people want to talk about even when it is not a topic of interest to him/her).
5) Can make "small talk" with people when appropriate (e.g., chat casually about the weather, current events).
6) Is good at taking turns in conversations. For example, his/her conversations have appropriate amounts of back-and-forth with each person getting a chance to talk. He/she responds appropriately to what other people are saying.
7) Gives other people a chance to speak in conversations (e.g., pauses, asks them questions, etc.).
8) Is polite when he/she has to interrupt (e.g., says "excuse me" or "sorry to interrupt").
9) Can keep conversations going.
10) Brings up conversation topics that will be interesting to the person they are talking to.

Nonverbal Sending Skills (25 items)

Low:

1) His/her smiles seem forced or awkward.
2) His/her gestures are awkward or exaggerated. For example, he/she might wave his/her arms around when waving goodbye.

3) Does not look people in the eye when talking to them. For example, he/she might look down at the floor, at something else, or even at other parts of the person's face (e.g., between the eyes, mouth).
4) Facial expressions seem "flat" (e.g., his/her face may be like a "blank slate" or seem overly serious).
5) Speaks with a flat, monotonous tone of voice.
6) Speaks in an unusual sounding way. For example, he/she might be too loud/quiet, too fast/slow, halting or jerking, or put an unusual emphasis on certain words.
7) He/she sounds the same (has the same tone and intonation in his/her voice) regardless of how he/she is feeling. In other words, it is hard to tell what he/she is feeling based on the way his/her voice sounds.
8) Stares at people – even if unintentional. For example, he/she may not be very subtle when looking at someone who looks different or is attractive to him/her.
9) Stands or sits too close to people (e.g., when standing in line, sitting on the bus, talking to people etc.)
10) His/her emotional reactions don't match the situation (e.g., laughs when getting in trouble, does not show happiness/excitement when having a good time).
11) Speaks very loudly (e.g., needs to be reminded to speak quietly, use his/her "inside voice").

High:

1) Makes eye contact when greeting someone. For example, when people say "hi" or introduce themselves, he/she would look them in the eye.
2) Uses appropriate gestures when communicating with people. For example, he she might nod/shake his/her head to say "yes" or "no", wave goodbye, point at something interesting, give thumbs up, or put his/her finger to his/her lips to tell someone to "be quiet".
3) Turns and faces people when talking to them.
4) Shows a range of facial expressions (e.g., embarrassed, guilty, surprised, disgusted, pleased).
5) His/her facial expressions are easy to read.
6) It is easy to tell how he/she is feeling just by looking at him/her.
7) Speaks with a varied tone of voice.
8) Looks people in the eye when talking to them.
9) Uses eye contact to get other people's attention (e.g., to start a conversation or ask a question).
10) Smiles appropriately in social situations. For example, he/she might smile if given a compliment, when greeting someone, or in response to someone smiling at him/her.
11) Keeps a comfortable physical distance between him/herself and others. In other words, he/she doesn't invade people's personal space.
12) Points at things when appropriate (e.g., to get another person to look at something far away).
13) Changes tone of voice appropriately (e.g., to make a point, tell a joke, express different emotions).

14) Uses hugs/kisses appropriately (e.g., to show affection, greet close relatives/friends; comfort someone; give thanks for a gift).

Emotion Regulation (27 items)

Low:

1) When he/she gets mad or upset, he/she has trouble getting over it.
2) Has "meltdowns" (e.g., sudden outbursts, `blow ups', temper tantrums).
3) His/her emotional responses tend to be extreme. For example, he /she might be extremely angry or frustrated in response to relatively small problems.
4) Acts out of control.
5) Gets very upset if things are not done his/her way.
6) Is difficult to reason with when upset.
7) Refuses to talk when upset.
8) Gets very anxious.
9) He/she gets frustrated easily.
10) His/her moods change suddenly.
11) Has a tendency to "blow up".
12) Acts out when angry or upset (e.g., yells at, hits, or shoves people).
13) He/she is overwhelmed easily.
14) His/her emotions tend to be "all or nothing" ("all on" or "all off").
15) Tends to "shut down" when upset about something.
16) Has trouble handling intense emotions – whether positive or negative. For example, he/she might start to "act out" or cry when feeling extremely excited.
17) Makes extreme threats when upset – even if over a seemingly small issue. For example, he/she might threaten to harm him/herself or other people.

High:

1) Controls his/her temper.
2) He/she gets over setbacks or disappointments quickly.
3) Stays calm when problems come up.
4) Handles his/her feelings well.
5) Can deal with small disappointments (e.g., stays calm, does not "overreact").
6) Can take "no" for an answer without getting upset.
7) Is patient (e.g., when waiting).
8) Responds appropriately when others try to provoke him/her (e.g., when others try to fight or "push his/her buttons").
9) Can disagree with people without fighting or arguing.
10) Can "let go" of an argument or disagreement.

APPENDIX B
FAMILY DEMOGRAPHICS QUESTIONNAIRE FOR ASD GROUP

Family Demographics Questionnaire

Date: _____ Name of person completing form: _____

Relationship to child: _____

Identification Information

Name of child with autism: _____ Date of birth: _____

Address: _____

_____

Telephone number: _____ Email: _____

Family Information

Primary language spoken at home: _____

Other language(s) spoken: _____

What is your family's cultural or ethnic background? (e.g., Italian, Métis, Korean) _____

_____

Child's parents are: (circle one) Married Divorced Separated Other

With whom does the child live? (please list all members of the household)

Name	Age	Relationship (e.g., mother, brother, grandparent)

If the child lives in more than one household at times, please describe the arrangement and the people involved _____

_____

What is the **primary** employment status of the child's parents? (please circle one answer for each parent)

Mother	Father
1. Unemployed	1. Unemployed
2. Retired	2. Retired
3. Employed part time	3. Employed part time
4. Employed full time	4. Employed full time
5. Homemaker	5. Homemaker
6. Student	6. Student

Occupation of parents:

Mother: _____

Father: _____

Highest educational level of parents (please check one for each):

	Mother	Father
Elementary school	_____	_____
High school	_____	_____
Professional diploma	_____	_____
University degree	_____	_____
Graduate degree	_____	_____

Do any family members **other than** the child with autism experience significant cognitive, emotional or medical problems? _Yes _No (if Yes, please describe below) ___

_____

Diagnostic Information

What is your child's "official" diagnosis?

_____Autism

_____PDD-NOS (pervasive developmental disorder-not otherwise specified)

_____Asperger's syndrome

_____Other (describe): _____

Where/by whom was your child diagnosed? _____

When was your child diagnosed? _____

Has your child ever been provided with a diagnosis of "global developmental delay", "intellectual disability", or "mental retardation"? _Yes _No

Has your child been given any additional diagnoses? _Yes _No

What? _____

By whom? _____

When? _____

Does your child have any other medical conditions (e.g., seizures, Tourette's syndrome, etc.)? _Yes _No (if Yes, what are they?) _____

_____

Does your child take any prescription medications regularly? _Yes _No (if Yes, please list) _____

Educational Information

Does your child attend school outside of the home? _No _Yes Current Grade: _____

If no, please explain academic situation: _____

_____

_____

Please indicate whether this young person has had any of the following school experiences.

Has changed schools for reasons other than normal academic progression (e.g., elementary to high school). _No _Yes

If yes, when and why? _____

_____

Is currently placed in a special education class. _No _Yes

If yes, what type of class? _____

Hours per day? _____

Is currently completing the regular academic curriculum for his/her grade level. __No _Yes

If no, how is his/her program modified? _____

Receives extra help in school. _No _Yes

If yes, please describe. _____

_____

Peer Acceptance at School

(If child is currently home-schooled, please skip this section)

Who does your child typically spend free time with at school (e.g., during lunch, breaks)?

(Please circle one) Alone Teacher(s) Peers Close Friends Don't Know

Is your child part of a consistent social group at school (e.g., hangs out with the same kids regularly at school)? Yes No Don't Know

How well do the following statements describe your child?

Is liked by peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Is considered "odd" or "weird" by peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Gets along with his/her classmates.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Is teased or bullied by peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Is ignored by peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Is invited to parties/other social events by peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Attends parties/ other social events with peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know

Friendships

How many acquaintances does your child have? (kids whom he/she interacts with regularly at school/extracurricular activity/church etc.) 0 1 2 3 4 5+

How many close friends does your child have (kids whom he/she knows well and spends time with outside of school/extracurricular activities)? 0 1 2 3 4 5+

Does your child have a best friend? Yes No Don't Know

How often does your child spend time with a friend (in person) outside of school/extracurricular activities?

(If it occurs at least once per week on a regular basis, indicate the number of days/week. If it occurs less often, indicate approximately how many times per month OR per year it occurs on average.)

_____ *Times Per Week*

OR

_____ *Times Per Month*

OR

_____ *Times Per Year*

APPENDIX C
FAMILY DEMOGRAPHICS QUESTIONNAIRE FOR ASD GROUP

Family Demographics Questionnaire

Date: _____ Name of person completing form: _____

Relationship to child: _____

Identification Information

Family name: _____

Name of child in study: _____ Date of birth: _____

Address _____

_____

Telephone number: _____ Email: _____

Family Information

Primary language spoken at home: _____

Other language(s) spoken: _____

What is your family's cultural or ethnic background? (e.g., Italian, Métis, Cantonese, English Canadian) _____

Child's parents are: (circle one) Married Divorced Separated Other

With whom does the child live? (please list all members of the household)

Name	Age/Date of Birth	Relationship (e.g., mother, brother, aunt)

If the child lives in more than one household at times, please describe the arrangement and the people involved: _____

_____

What is the **primary** employment status of the child's parents? (please circle one answer for each parent)

Mother	Father
1. Unemployed	1. Unemployed
2. Retired	2. Retired
3. Employed part time	3. Employed part time
4. Employed full time	4. Employed full time
5. Homemaker	5. Homemaker
6. Student	6. Student

Occupation of parents:

Mother: _____

Father: _____

Highest educational level of parents (please check one for each):

	Mother	Father
Elementary school	_____	_____
High school	_____	_____
Professional diploma	_____	_____
University degree	_____	_____
Graduate degree	_____	_____

Does your child experience significant cognitive, emotional, or medical problems? _Yes _No (if Yes, please describe below) _____

_____

Do any other family members experience significant cognitive, emotional or medical problems? _Yes _No (if Yes, please describe below) _____

_____

Educational Information

Does your child attend school outside of the home? _No _Yes Current Grade: _____

If no, please explain academic situation: _____

_____

_____

Please indicate whether this young person has had any of the following school experiences.

Has changed schools for reasons other than normal academic progression (e.g., elementary to high school). _No _Yes

If yes, when and why? _____

_____

Is currently placed in a special education class. _No _Yes

If yes, what type of class? _____

Hours per day? _____

Is currently completing the regular academic curriculum for his/her grade level. _No _Yes

If no, how is his/her program modified? _____

Receives extra help in school. _No _Yes

If yes, please describe. _____

_____

Peer Acceptance at School

(If child is currently home-schooled, please skip this section)

Who does your child typically spend free time with at school (e.g., during lunch, breaks)?

(Please circle one) Alone Teacher(s) Peers Close Friends Don't Know

Is your child part of a consistent social group at school (e.g., hangs out with the same kids regularly at school)? Yes No Don't Know

How well do the following statements describe your child?

Is liked by peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Is considered "odd" or "weird" by peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Gets along with his/her classmates.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Is teased or bullied by peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Is ignored by peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Is invited to parties/other social events by peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know
Attends parties/ other social events with peers.	Never	Rarely	Sometimes	Frequently	Often	Don't Know

Friendships

How many acquaintances does your child have? (kids whom he/she interacts with regularly at school/extracurricular activity/church etc.) 0 1 2 3 4 5+

How many close friends does your child have (kids whom he/she knows well and spends time with outside of school/extracurricular activities)? 0 1 2 3 4 5+

Does your child have a best friend? Yes No Don't Know

How often does your child spend time with a friend (in person) outside of school/extracurricular activities?

(If it occurs at least once per week on a regular basis, indicate the number of days/week. If it occurs less often, indicate approximately how many times per month OR per year it occurs on average.)

_____ *Times Per Week*

OR

_____ *Times Per Month*

OR

_____ *Times Per Year*

Thank you very much for completing this form!

APPENDIX D
105 MSCS ITEMS SUBMITTED TO CONFIRMATORY FACTOR ANALYSIS

Social Motivation

1) Prefers to spend time alone (e.g., may seem most content when left on his/her own).
2) Needs to be told or prompted to talk or interact with people.
3) Stays in the "background" in group social situations (e.g., keeps to him/herself, may not be noticed)
4) Shows little interest in people.
5) Chooses to be involved in social activities/ groups (e.g., clubs, sports).
6) Avoids talking to people when possible (e.g., looks, moves, or walks away).
7) Has trouble with activities that are social but don't seem to have a point (e.g., group games, sing-a-longs, "hanging out", chatting).
8) Enjoys meeting new people.
9) Introduces him/herself to people (without being told to).
10) Is not interested in having many friends.
11) Needs to be prompted to respond when other people greet him/her or say goodbye.
12) Initiates friendly "chit-chat" with people. For example, he/she might ask about what's new with the other person or talk about the weather or events. These are casual conversations that often have no specific purpose.
13) Seeks out people to spend time with (e.g., family members, friends, other kids).
14) Initiates get-togethers with other kids (e.g., calls or emails them to make plans).
15) Asks people questions about themselves or their lives (e.g., how they are doing, what they've been up to).

Social Inferencing

1) Recognizes when people are trying to take advantage of him/her.
2) Is easily convinced to do things or manipulated by others.
3) Is naïve (believes whatever he/she is told).
4) Understands when people are being sarcastic.
5) Has trouble judging who is trustworthy (e.g., who to share secrets or personal information with).
6) Is good at persuading people to change their mind about something.
7) Knows what his/her social status is with other kids (e.g., if popular, accepted, rejected, or ignored).
8) Misreads social cues.
9) Doesn't pick up on the subtleties of social interaction.
10) Can see things from another person's perspective.

11) Picks up on subtle hints and indirect requests. For example, he/she would understand that when someone asks "Can you reach that book?" they are asking him/her to pass it to them. In other words, he/she can "read between the lines" when others are talking.
12) Has trouble predicting what other people will do or how they will react.
13) Recognizes unfriendly actions. For example, he/she knows when someone is making fun of him/her in a mean-spirited way. Or, he/she recognizes when a peer is pressuring him/her to do something he/she shouldn't or doesn't want to do.
14) Can tell when people are joking.
15) Can tell when someone is lying to him/her.

Demonstrating Empathic Concern

1) Is sensitive to the feelings and concerns of others.
2) Expresses concern for others when they are upset or distressed (e.g., may ask "are you alright?" or ask if they need anything).
3) Offers comfort to people (e.g., to someone who is upset, not feeling well, hurt etc.). For instance, he/she may try to hug the person or provide a comforting object (e.g., blanket) as a way of trying to make the other person feel better.
4) Congratulates people when good things happen to them.
5) Tries to cheer people up (when they are down).
6) Apologizes after he/she hurts someone (without being prompted or told to).
7) Seems indifferent or "oblivious" to people who are upset (or in distress).
8) Seems concerned about other people and their problems (e.g., talks about someone who is having a hard time).
9) Appears visibly upset when he/she sees people suffering (in real life or on tv/film).
10) Gives compliments to people.
11) Does not offer to help people (unless asked or told to).
12) Blurts out hurtful or rude comments (e.g., doesn't seem to think about how his/her words might affect other people).
13) Offers to share things with other people (e.g., food, toys, taking turns playing a video game or using an object). These offers of sharing are spontaneous – that is, not prompted or requested by another person.
14) Seems like he/she is detached from people emotionally.
15) Gives suggestions or advice in a sensitive way.

Social Knowledge

1) Knows about the latest trends for his/her age (e.g., in clothes, music, tv shows/movies, music).
2) Changes his/her behaviour to suit the situation. For example, he/she might be more polite/formal around authority figures like teachers but be more casual around other kids. As another example, he/she might change his/her way of speaking depending on who he/she is talking to (e.g., talk more simply to a young child).

3) Dresses appropriately for his/her age and social situations. For example, he/she would dress up for formal events and wear more casual clothes on weekends. His/her clothes would be generally considered acceptable by kids his/her age.
4) Uses slang words or phrases that are commonly used within his/her age group.
5) Changes the volume of his/her voice depending on where he/she is. For example, he/she would be quiet at the library or a movie theatre but louder when playing outside or at a sporting event.
6) Hides his or her true feelings (when necessary) so that he/she doesn't come across as rude. For example, he/she might hide feelings of disappointment when given a gift that he or she doesn't like or when someone breaks something of theirs by accident.
7) Tells "white lies" so that he/she won't hurt people's feelings (e.g., about someone's cooking or a new haircut). In other words, he/she understands that sometimes it is rude to be completely honest.
8) Understands the "social hierarchy" at school or in other settings (e.g., who has more power/control).
9) Follows social "rules" around privacy. For example, he/she respects people's privacy when they are changing or are in the washroom. He/she would also knock on closed doors instead of barging in.
10) Understands that it is important to have good personal hygiene (e.g., smelling and looking clean).
11) Understands what makes a true friend.
12) Acts appropriately for his/her age when in public places (e.g., restaurants, movie theatres, libraries, doctor's waiting rooms).
13) His/her expectations of friends are reasonable. For example, he/she knows they have other friends or are not always available.
14) Does "private" behaviours in public. For example, he/she might burp, pick their nose, touch or scratch themselves, or undress in public.
15) Makes odd sounds/noises in public (e.g., squealing sounds, mumbling, talking to self etc.)

Verbal Conversation Skills

1) Dominates conversations so that it can be hard for others to "get a word in". For example, he/she might ramble on and on about a favourite topic of interest. He/she might also need reminders/prompting to let others speak.
2) He/she shifts conversations to his/her favourite topic or interest.
3) Talks about the same things over and over ("gets stuck" on certain topics).
4) Provides too much detail when talking about a topic. For example, he/she might list a bunch of facts rather than expressing a main message or exchanging information.
5) Talks "over" people in conversations (e.g., interrupts a lot, doesn't wait for others to finish speaking).
6) Talks too much.
7) Has trouble joining conversations appropriately. For example, he/she might interrupt or "butt in" instead of waiting for a good time to join in. Or, he/she may

start talking about a topic of interest to him/her regardless of the on-going conversation.

8) Talks "at" people (e.g., almost like he/she is giving a lecture).
9) Goes off track during conversations. For example, he/she might changes topics suddenly as if thinking aloud or reminded of something else. Or, he/she might gradually get sidetracked or lose track of his/her original point.
10) Is good at taking turns in conversations. For example, his/her conversations have appropriate amounts of back-and-forth with each person getting a chance to talk. He/she responds appropriately to what other people are saying.
11) Gives other people a chance to speak in conversations (e.g., pauses, asks them questions, etc.).
12) "Talks around" things (e.g., doesn't seem to make a specific point).
13) Ends conversations suddenly (e.g., just walks away).
14) Has trouble making conversation with other people.
15) Brings up conversation topics that will be interesting to the person they are talking to.

Nonverbal Sending Skills

1) Facial expressions seem "flat" (e.g., his/her face may be like a "blank slate" or seem overly serious).
2) Speaks with a flat, monotonous tone of voice.
3) He/she sounds the same (has the same tone and intonation in his/her voice) regardless of how he/she is feeling. In other words, it is hard to tell what he/she is feeling based on the way his/her voice sounds.
4) His/her facial expressions are easy to read.
5) Looks people in the eye when talking to them.
6) His/her smiles seem forced or awkward.
7) Changes tone of voice appropriately (e.g., to make a point, tell a joke, express different emotions).
8) Points at things when appropriate (e.g., to get another person to look at something far away).
9) Uses appropriate gestures when communicating with people. For example, he she might nod/shake his/her head to say "yes" or "no", wave goodbye, point at something interesting, give thumbs up, or put his/her finger to his/her lips to tell someone to "be quiet".
10) Shows a range of facial expressions (e.g., embarrassed, guilty, surprised, disgusted, pleased).
11) Speaks in an unusual sounding way. For example, he/she might be too loud/quiet, too fast/slow, halting or jerking, or put an unusual emphasis on certain words.
12) Smiles appropriately in social situations. For example, he/she might smile if given a compliment, when greeting someone, or in response to someone smiling at him/her.
13) Speaks with a varied tone of voice.
14) Stares at people – even if unintentional. For example, he/she may not be very subtle when looking at someone who looks different or is attractive to him/her.
15) Uses eye contact to get other people's attention (e.g., to start a conversation or ask a question).

Emotion Regulation

1) Has "meltdowns" (e.g., sudden outbursts, "blow ups" temper tantrums).
2) He/she gets frustrated easily.
3) His/her moods change suddenly.
4) Is patient (e.g., when waiting).
5) Acts out when angry or upset (e.g., yells at, hits, or shoves people).
6) His/her emotional responses tend to be extreme. For example, he /she might be extremely angry or frustrated in response to relatively small problems.
7) Gets very upset if things are not done his/her way.
8) He/she is overwhelmed easily.
9) He/she gets over setbacks or disappointments quickly.
10) Gets very anxious.
11) Can disagree with people without fighting or arguing.
12) His/her emotions tend to be "all or nothing" ("all on" or "all off").
13) Stays calm when problems come up.
14) Is difficult to reason with when upset.
15) Responds appropriately when others try to provoke him/her (e.g., when others try to fight or "push his/her buttons").

APPENDIX E
FINAL 77 MSCS ITEMS

Social Motivation

1) Prefers to spend time alone (e.g., may seem most content when left on his/her own).
2) Needs to be told or prompted to talk or interact with people.
3) Stays in the "background" in group social situations (e.g., keeps to him/herself, may not be noticed)
4) Shows little interest in people.
5) Avoids talking to people when possible (e.g., looks, moves, or walks away).
6) Enjoys meeting new people.
7) Introduces him/herself to people (without being told to).
8) Initiates friendly "chit-chat" with people. For example, he/she might ask about what's new with the other person or talk about the weather or events. These are casual conversations that often have no specific purpose.
9) Seeks out people to spend time with (e.g., family members, friends, other kids).
10) Initiates get-togethers with other kids (e.g., calls or emails them to make plans).
11) Asks people questions about themselves or their lives (e.g., how they are doing, what they've been up to).

Social Inferencing

1) Recognizes when people are trying to take advantage of him/her.
2) Understands when people are being sarcastic.
3) Has trouble judging who is trustworthy (e.g., who to share secrets or personal information with).
4) Misreads social cues.
5) Doesn't pick up on the subtleties of social interaction.
6) Can see things from another person's perspective.
7) Recognizes unfriendly actions. For example, he/she knows when someone is making fun of him/her in a mean-spirited way. Or, he/she recognizes when a peer is pressuring him/her to do something he/she shouldn't or doesn't want to do.
8) Picks up on subtle hints and indirect requests. For example, he/she would understand that when someone asks "Can you reach that book?" they are asking him/her to pass it to them. In other words, he/she can "read between the lines" when others are talking.
9) Is naïve (believes whatever he/she is told).
10) Has trouble predicting what other people will do or how they will react.
11) Can tell when people are joking.

Demonstrating Empathic Concern

1) Is sensitive to the feelings and concerns of others.
2) Expresses concern for others when they are upset or distressed (e.g., may ask "are you alright?" or ask if they need anything).
3) Offers comfort to people (e.g., to someone who is upset, not feeling well, hurt etc.). For instance, he/she may try to hug the person or provide a comforting object (e.g., blanket) as a way of trying to make the other person feel better.
4) Congratulates people when good things happen to them.
5) Tries to cheer people up (when they are down).
6) Apologizes after he/she hurts someone (without being prompted or told to).
7) Seems indifferent or "oblivious" to people who are upset (or in distress).
8) Seems concerned about other people and their problems (e.g., talks about someone who is having a hard time).
9) Appears visibly upset when he/she sees people suffering (in real life or on tv/film).
10) Gives compliments to people.
11) Does not offer to help people (unless asked or told to).

Social Knowledge

1) Knows about the latest trends for his/her age (e.g., in clothes, music, tv shows/movies, music).
2) Changes his/her behaviour to suit the situation. For example, he/she might be more polite/formal around authority figures like teachers but be more casual around other kids. As another example, he/she might change his/her way of speaking depending on who he/she is talking to (e.g., talk more simply to a young child).
3) Dresses appropriately for his/her age and social situations. For example, he/she would dress up for formal events and wear more casual clothes on weekends. His/her clothes would be generally considered acceptable by kids his/her age.
4) Changes the volume of his/her voice depending on where he/she is. For example, he/she would be quiet at the library or a movie theatre but louder when playing outside or at a sporting event.
5) Hides his or her true feelings (when necessary) so that he/she doesn't come across as rude. For example, he/she might hide feelings of disappointment when given a gift that he or she doesn't like or when someone breaks something of theirs by accident.
6) Understands the "social hierarchy" at school or in other settings (e.g., who has more power/control).
7) Follows social "rules" around privacy. For example, he/she respects people's privacy when they are changing or are in the washroom. He/she would also knock on closed doors instead of barging in.
8) Understands that it is important to have good personal hygiene (e.g., smelling and looking clean).
9) Understands what makes a true friend.
10) Acts appropriately for his/her age when in public places (e.g., restaurants, movie theatres, libraries, doctor's waiting rooms).

11) His/her expectations of friends are reasonable. For example, he/she knows they have other friends or are not always available.

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