

Measuring Pragmatic Language in Speakers With Autism Spectrum Disorders: Comparing the Children's Communication Checklist—2 and the Test of Pragmatic Language

Joanne Volden

Linda Phillips

University of Alberta, Edmonton, Canada

Purpose: To compare the Children's Communication Checklist—2 (CCC—2), a parent report instrument, with the Test of Pragmatic Language (TOPL), a test administered to the child, on the ability to identify pragmatic language impairment in speakers with autism spectrum disorders (ASD) who had age-appropriate structural language skills.

Method: Sixteen rigorously diagnosed children with ASD were matched to 16 typically developing children on age, nonverbal IQ, and structural language skill. Both groups were given the TOPL, and their parents completed the CCC—2.

Results: The CCC—2 identified 13 of the 16 children with ASD as pragmatically impaired, while

the TOPL identified only 9. Neither test identified any of the children in the control group as having pragmatic language impairment.

Conclusions: In these children with ASD, who displayed age-appropriate structural language skills, the CCC—2 identified pragmatic language impairment better than the TOPL. Clinically, this can be useful in documenting the presence of language dysfunction when traditional standardized language assessments would not reveal communication problems.

Key Words: pragmatics, autism spectrum disorders, assessment

Autism is best characterized as a spectrum of developmental disorders known as autism spectrum disorders (ASD). According to recent comprehensive epidemiological studies (Fombonne, 2003), the prevalence of ASD is roughly one in 165 children, with only 25% of the cases exhibiting intellectual disability (Chakrabarti & Fombonne, 2001). Thus, ASD is much more common than previously thought and is not necessarily associated with severe cognitive impairment. While communicative dysfunction is one of the central characteristics of ASD, its profile of symptoms varies widely from person to person. At one extreme, there are children with ASD whose structural (i.e., lexical and syntactic) language is within normal limits (Landa, 2000), while at the other extreme, some children with autism remain essentially nonverbal (Bryson & Smith, 1998; Lord & Paul, 1997). Even when structural language appears intact, difficulties with pragmatic language (i.e., the appropriate social use of language) persist (Adams, 2002; Landa, 2000; Lord & Paul, 1997; Tager-Flusberg, 2004). Thus, pragmatics is consistently agreed to be the communicative domain that is universally impaired in ASD (Landa,

2000; Tager-Flusberg, Paul, & Lord, 2005; Young, Diehl, Morris, Hyman, & Bennetto, 2005).

Pragmatic language impairments in children with autism have been noted since the earliest descriptions of this condition (Kanner, 1943). For example, communication of children with autism has been described in clinical case reports as "peculiar and out of place in ordinary conversation, irrelevant" (Kanner, 1946, p. 243); "formal, demonstrating a lack of ease in the use of words" (Rutter, 1965, p. 41); "stereotypic, inappropriate" (Bartak, Rutter, & Cox, 1975, p. 137); and "metaphorical" (Cantwell, Baker, & Rutter, 1978, p. 357). Difficulties in initiating a conversation (Baron-Cohen, 1988; Tager-Flusberg, 1996) and in responding to others' initiations (Stone & Caro-Martinez, 1990) also have been reported. Once engaged in a conversation, speakers with ASD appear to have difficulty taking turns appropriately (Botting & Conti-Ramsden, 2003; Curcio & Paccia, 1987; Prizant & Duchan, 1981; Prizant & Rydell, 1984).

Topic maintenance and development also are problematic. Speakers with ASD may fail to develop the topic by contributing new, relevant information. Instead, they may reiterate

previously mentioned topics or fail to link their utterance to prior ones (Baltaxe, 1977; Bishop & Adams, 1989; Eales, 1993; McCaleb & Prizant, 1985; Tager-Flusberg & Andersen, 1991; Volden, 2002). In addition, sudden and inexplicable topic shifts may occur (Bishop, 1998; Bishop & Adams, 1989; Eales, 1993; Fine, Bartolucci, Szatmari, & Ginsberg, 1994; Tager-Flusberg & Andersen, 1991). Their conversation is often characterized as containing irrelevant, inappropriate, stereotypical, or bizarre comments (Adams, 2002; Gilchrist et al., 2001; Loveland, Tunali, McEvoy, & Kelley, 1989; Tager-Flusberg & Andersen, 1991; Volden, 2004). One example is a 10-year-old, high-functioning boy with ASD who said, "Did you know that a zebra is something like a horse?" in the middle of a task requiring descriptions of geometric shapes (Volden, Mulcahy, & Holdgrafer, 1997).

Difficulties with figurative language also are frequently noted (Happé, 1993). One example is a tendency to respond in an "over-literal" manner to questions (Bishop, 1998), such as the child who replied to a query of "Do you find it hard to get up in the morning?" by saying, "No, first you put one foot out of bed, then the other, and then you stand up."

None of the above pragmatic dysfunctions are measured on traditional language assessment instruments because traditional tests focus mostly on linguistic structure and meaning rather than on pragmatic language use (Anderson, Lord, & Heinz, 2005; Bishop, 1998; Bishop & Baird, 2001; Young et al., 2005). In other words, most of the assessment instruments that are commonly used by speech-language pathologists (SLPs) fail to test pragmatic skills at all. Thus, when a high-functioning child with ASD demonstrates intelligence scores in the normal range and obtains scores within normal limits on traditional language measures, it is difficult for parents or professionals to document the need for intervention even though the child's dysfunctional social language skills are evident in conversation and place him or her in jeopardy for full participation in school and community environments (Kamhi, 1998; Young et al., 2005).

Pragmatic language has proven difficult to assess for several reasons. First of all, pragmatics is defined as context-dependent behavior, so the generally rigid structure of formal testing procedures fails to capture flexible adjustment to changing circumstances (Adams, 2002). In addition, children with pragmatic difficulties can often perform much better when given clear instructions in a concrete context, such as a standardized testing situation, than they do in a naturalistic setting (Bishop & Adams, 1989). Also, if a particular behavior is not seen during the observation period, one is unsure whether it does not occur ever or does occur but just didn't happen within the sample collected (Adams, 2002; Bishop, 1998). Some formal measures have been developed, focusing on skills that emerge in the course of normal development. Unfortunately, this focus fails to capture the full range of abnormalities that are frequently reported in speakers with ASD (Bishop, 1998).

One such measure is the Test of Pragmatic Language (TOPL; Phelps-Terasaki & Phelps-Gunn, 1992). The TOPL samples a range of typically developing pragmatic behaviors. Pictures depicting common social situations are shown to the child, briefly described, and the child is asked to

generate a response for one of the pictured characters. For example, one picture shows a boy in a physician's office who is holding his stomach and has a distressed facial expression. The child is asked, "What do you think the boy is saying to the doctor?" The child's response is scored as correct or incorrect according to criteria provided in the TOPL manual.

In a recent study conducted by Young and her colleagues (2005), the TOPL successfully distinguished participants with ASD from those with typical development. Seventeen participants, age 6–14, with ASD and with normal cognition and structural language were compared with a group of 17 typically developing matched controls. As expected, the participants with ASD performed significantly worse than their typical counterparts, obtaining a mean TOPL standard score of 78 compared with 97 for the controls. Thus, among high-functioning children and adolescents with ASD, pragmatic language skills were, on average, a relative weakness. The authors also noted that variability in scores was greater in the group with ASD and that some of the children with ASD performed as well as some of the controls. Therefore, although the children with ASD performed significantly less well on the TOPL on average, an individual's performance might be the same as that of a person without ASD. Thus, the TOPL might not always succeed in identifying pragmatic impairment or in differentiating high-functioning children with ASD from those who are typically developing. The TOPL is also limited by a dichotomous scoring system in which responses are scored as either correct or incorrect so that the quality or completeness of responses is not factored into scoring (Young et al., 2005). In addition, the use of structured contexts with concrete directions may lead to inflated performance levels (Bishop, 1998). Finally, as previously mentioned, because the TOPL focuses on pragmatic skills that would emerge in the course of typical development, it does not capture the full range of pragmatic impairments that are commonly associated with ASD (Adams, 2002).

Ratings of pragmatic behavior by someone who knows the child well are an alternative to clinician-administered, standardized pragmatic assessments. While limited by the possibility of subjective interpretation, parent/caregiver assessment offers some distinct advantages. First, parent/caregiver reports assess children's language in an authentic setting based on instances of language usage observed in the home. Second, because they are completed by someone who knows the child well, they are more likely to represent the child's typical level of functioning and be less influenced by day-to-day fluctuations. Third, they may be more comprehensive in their evaluation, because they allow for the assessment of a larger range of pragmatic abnormalities, including behaviors that would not occur in the course of typical development. Such behaviors may be difficult to elicit in test situations and may occur relatively infrequently, but they are nonetheless salient for the child's ability to function effectively in the environment (Bishop, 1998). Fourth, they take relatively little time. The Children's Communication Checklist—2 (CCC—2; Bishop, 2003, 2006 [CCC—2 U.S. Edition]) is one such instrument.

The CCC—2 is designed to screen for clinically significant communication problems of any type and to identify

pragmatic language impairment by obtaining judgments from parents or other adults who have regular contact with the child. Respondents are asked to rate the frequency with which the behavior described in each item occurs. For example, one item asks the rater to judge how often (less than once a week or never, at least once a week but not every day, once or twice a day, or several times a day or always) the child talks about memorized lists such as the names of the capital cities of the world (Bishop, 2003). Not only does the CCC-2 screen for overall communicative impairment, but it also includes an evaluation of pragmatic communication that most traditional language tests omit. Further, it taps a broad range of clinically significant pragmatic impairments reported as characteristic of ASD but which formal standardized pragmatic test instruments such as the TOPL fail to measure (Adams, 2002; Bishop, 1998). Thus, it may be more effective at identifying pragmatic impairment in speakers with ASD.

Several studies have used the Children's Communication Checklist (CCC; Bishop, 1998) or the CCC-2 (Bishop, 2003) to compare different diagnostic groups, including children with ASD, on pragmatic skills (Bishop & Baird, 2001; Botting, 2004; Geurts & Embrechts, 2008; Geurts et al., 2004; Gilmour, Hill, Place, & Skuse, 2004; Norbury, Nash, Baird, & Bishop, 2004; Philofsky, Fidler, & Hepburn, 2007; Verte et al., 2006). In general, these studies have found the CCC and the CCC-2 to be highly effective in differentiating communicatively impaired children from the typically developing population. For example, using the original CCC, both Bishop and Baird (2001) and Botting (2004) found that 100% of their samples of children with autism scored more than 2 *SDs* below the mean pragmatic composite score obtained either by a control sample of similar-age typically developing children (Bishop & Baird, 2001) or in comparison to published norms (Botting, 2004). Also using the original CCC and the pragmatic composite score, Geurts and her colleagues (2004) found significant differences ($p < .001$) between groups of children with high-functioning autism (HFA) and a group of typically developing controls.

Norbury et al. (2004) conducted a validation study of the CCC-2 in 2004. They found that general composite scores for the typically developing children were significantly higher than composite scores for the children with ASD. Even more compelling evidence of its discriminative ability came from observing that the distribution of scores for the children with ASD did not overlap with the distribution for the typically developing children. In addition, the Social Interaction Deviance Composite score (SIDC; called the Social Interaction Difference Index [SIDI] in the U.S. version) is a summary score that, when negative, yields ratings of disproportionate pragmatic problems. In Norbury et al.'s study, the SIDC scores were consistently below zero in participants with ASD. Geurts and Embrechts (2008) compared children with ASD to an age- and gender-matched group of typically developing children and found statistically significant differences on all subscales of the CCC-2 that assessed pragmatic function. Finally, Philofsky and her colleagues (2007) found mean General Communication Composite (GCC) scores that were more than 2 *SDs* from those of a younger typically developing

comparison group and negative average SIDC scores in the sample with ASD.

To our knowledge, though, results obtained from the parent report CCC-2 have never been compared with a standardized measure of pragmatic functioning that is directly administered to the child, such as the TOPL. In addition, we were particularly interested in those children with ASD who had scores within typical limits on a traditional comprehensive language test.

The current project was designed to compare the TOPL and the CCC-2 to determine their relative accuracy in identifying the pervasive pragmatic impairment in speakers with ASD who have nonverbal cognitive and structural language skills within normal limits. We expected that the CCC-2 would identify pragmatic language impairment in more children with ASD than the TOPL, due to the inclusion in the CCC-2 of measures of a broader range of impairments in pragmatic functioning.

Method

Participants

Participants with ASD for this study were selected from those recruited through the autism follow-up clinic at a regional rehabilitation hospital for a larger study of pragmatic language skills in school-age children with ASD. Sixteen Caucasian boys with ASD (average age of 9 years) and with nonverbal IQ and structural language skills in the typical range were selected. Diagnoses had originally been assigned using *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 1994) criteria following a multidisciplinary assessment and case conference where consensus about diagnostic category was achieved. On recruitment to the research project, diagnoses were confirmed by administration of the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 2002) and the Autism Diagnostic Interview (ADI; Rutter, LeCouteur, & Lord, 2002). Agreement across these three sources is considered the gold standard for diagnoses of ASD (National Research Council, 2001). Four of the 16 were diagnosed with Asperger's syndrome, two were given diagnoses of pervasive developmental disorder-not otherwise specified (PDD-NOS), and the remaining 10 received diagnoses of HFA. Because Asperger's syndrome and HFA are frequently difficult to differentiate reliably (National Research Council, 2001), and because preliminary analyses showed no significant differences between participants with Asperger's or PDD-NOS and those with HFA on chronological age, nonverbal IQ, or language level, the participants were grouped together as participants with ASD in all subsequent analyses.

Participants with ASD were matched to typically developing controls ($n = 16$) on the basis of nonverbal cognitive ability as assessed by the Test of Nonverbal Intelligence (TONI; Brown, Sherbenou, & Johnsen, 1990) and language level as assessed by the Clinical Evaluation of Language Fundamentals, Fourth Edition (CELF-4; Semel, Wiig, & Secord, 2003). For the larger study, participants in the control group were recruited from regional public school boards. The following process was used: Flyers were distributed to

participating schools with a request to distribute them to children in the appropriate age range (6–10 years). When informed consent was obtained from those who volunteered, the TONI and the CELF–4 were administered to ensure that nonverbal IQs and language levels were within normal limits. Sixteen children were then selected for the control group for this study on the basis of their chronological age, nonverbal IQ, and language level. Children would have been excluded from the study if (a) they had cerebral palsy or another neuromotor disorder that would interfere with administration of assessment instruments, (b) they had a known genetic/chromosomal or neurological disorder, or (c) English was not the primary language spoken in the home. No children were excluded on these bases.

Procedure

Data were collected in 2–3 sessions conducted either at the Social Communication laboratory at the University of Alberta, at the family's home, or in a private room at the child's school. For children with ASD, parents were administered the ADI while a second clinician administered the ADOS and the TONI to the children in another room. The ADOS and ADI were administered by one of two trained examiners who had achieved at least 80% reliability with a certified trainer. Between the two examiners, interrater reliability on codes for both the ADOS and the ADI was calculated on approximately 80% of the administrations and was maintained at levels exceeding 80%. In a second and third session, the CELF–4 and the TOPL were administered. For children in the control group, autism diagnostic instruments were not administered, and the TONI, the CELF–4, and the TOPL were administered over two sessions. The CCC–2 protocol was given to parents of children in both groups to be completed at home. Once completed, it was returned in a stamped, self-addressed envelope.

Measures

TOPL. The TOPL (Phelps-Terasaki & Phelps-Gunn, 1992) is appropriate for children age 5;0 (years;months) to 13;11; it is administered by an SLP and takes approximately 90 min of clinician time for administration, scoring, and interpretation. As previously mentioned, children are shown a picture, read a short vignette, and then asked to generate a response for one of the characters in the picture. The summary score, called the Language Quotient, is expressed as a standard score with a mean of 100 ($SD = 15$). Language Quotients of 70–79 are interpreted as *poor*, and quotients below 70 are interpreted as *very poor* (Phelps-Terasaki & Phelps-Gunn, 1992). A cutoff score of 79 was chosen as indicating pragmatic impairment in line with the authors' suggested interpretation of scores and reflecting the notion that scores below this level fall at least 1.5 SD s below the mean (Paul, 2006).

The TOPL was standardized on 1,016 American children between the ages of 5 and 14. Split-half reliability coefficients averaged .82, and a criterion-related validity coefficient of .82 was also obtained in comparing TOPL test scores with teacher judgments of pragmatic skill. In 2007, a second edition of the TOPL was published (TOPL–2; Phelps-Terasaki

& Phelps-Gunn, 2007), but it was not used in the current study because it was not available when this study began.

CCC–2. The CCC–2 (Bishop 2003, 2006) consists of 70 multiple-choice items divided into 10 scales, with seven items each. Five items on each subscale tap into communicative deficits, and two items target communicative strengths. As previously mentioned, an informant who knows the child well (typically a parent) rates the frequency of occurrence for each item on a scale ranging from 0 for *less than once a week or never* to 3 for *several times a day or always*. Subscales for Speech, Syntax, Semantics, and Coherence assess aspects of articulation and phonology, language structure, vocabulary, and discourse. Subscales labeled Initiation, Scripted Language, Context, and Nonverbal Communication address pragmatic aspects of communication that are not readily assessed by conventional language assessment. Pragmatic impairments such as failing to initiate topics about reciprocal interests, repetitive initiations, and talking too much are assessed on the Initiation subscale. The Scripted Language subscale includes items that target the overuse of “learned chunks” in conversations, unusual prosody, and being overly “precise.” The subscale on Context evaluates use and understanding of social rules governing conversation such as politeness, as well as understanding sarcasm and humor. The Nonverbal Communication subscale targets the understanding and use of gestures and facial expressions. The remaining two subscales—Social Relations and Interests—focus on behaviors that are usually impaired in children with ASD, with items directed at the child's interest and participation in relationships with peers and whether or not the child has restricted and/or repetitive interests and limited flexibility.

The CCC–2 takes approximately 15 min of a parent's time to complete and another 15 min of an SLP's time to score and interpret. Two composite scores are derived: (a) the GCC, expressed as a standard score with mean of 100 ($SD = 15$), which may be used to identify children likely to have a clinically significant communication problem of any kind, and (b) the SIDI. The GCC is calculated by summing the scaled scores of the first eight subtests and converting that sum to a standard score. GCC scores less than 80 indicate a communicative impairment (Bishop, 2006). The SIDI is calculated by subtracting total scaled scores of the subtests that measure Initiation, Nonverbal Communication, Social Relations, and Interests (i.e., pragmatic language and ASD-related behaviors) from the total scaled score of subtests measuring Speech, Syntax, Semantics, and Coherence (i.e., structural language competence). A negative SIDI score results when deficits in pragmatic skill are greater than deficits in structural language. Thus, a negative SIDI reflects disproportionate problems in pragmatic skill—that is, pragmatic problems that exceed those expected given the child's general level of language competence.

Scores are interpreted as follows: When the GCC score is less than 80 (i.e., indicative of clinically significant communicative problems), an SIDI score below 0 indicates that there is also a disproportionate difficulty in pragmatic language use. In the event of an SIDI score below –15, Bishop (2003) suggests that pragmatic language impairment is present regardless of the GCC score. In the latter scenario, the absence of structural language difficulties leads to a GCC

score in the typical range while pragmatic and social difficulties are markedly disproportionate. In the current study, a child was considered to have a pragmatic impairment if (a) his or her SIDI score was lower than -15 or (b) his or her GCC was less than 80 and his or her SIDI was below 0 (Bishop, 2003).

The U.S. Edition of the CCC-2 was standardized on 950 American children. Internal consistency reliability coefficients ranged from .94 to .96 across age groups. Validity was assessed by calculating classification rates for a variety of matched clinical groups based on GCC scores at 1, 1.5, and 2.0 SDs below the mean. For the group with ASD, 89% of the children were identified as such based on a GCC 1.0 SD below the mean. Based on these results, the CCC-2 demonstrates good reliability and validity (Bishop, 2006).

Results

Preliminary Analysis

A series of univariate analyses of variance (ANOVAs) with diagnostic group as the independent variable and chronological age, nonverbal IQ, and language level as dependent variables were conducted to ensure adequate matching of groups. There were no statistically significant group differences, indicating that the groups were well matched on chronological age, $F(1, 30) = 0.324, p = .573$ (ASD $M = 9;0$, control $M = 8;7$), nonverbal IQ, $F(1, 30) = 2.27, p = .142$ (ASD $M = 108$, control $M = 100$), and core language score, $F(1, 30) = 2.52, p = .123$ (ASD $M = 106$, control $M = 111$).

Study Analyses

Average summary scores for each of the language measures are displayed in Table 1. A multivariate ANOVA with diagnostic group as the independent variable and the three summary scores generated by the CCC-2 and the TOPL as dependent variables revealed significant differences in pragmatic performance between the groups, $F(3, 28) = 43.90, p < .001, \eta_p^2 = .995$. Follow-up univariate ANOVAs revealed significantly lower scores in the group with ASD on each: GCC, $F(1, 30) = 94.64, p < .001, \eta_p^2 = 0.759$; SIDI, $F(1, 30) = 67.70, p < .001, \eta_p^2 = 0.693$; and TOPL, $F(1, 30) = 17.164, p < .001, \eta_p^2 = 0.364$. Also in each case, effect sizes as indicated by partial eta squared exceeded 0.14, the conventional standard for a large effect size (Green & Salkind, 2004).

To compare effectiveness of the CCC-2 and the TOPL in identifying pragmatic language impairment, we calculated the sensitivity and specificity of each test. Sensitivity refers to the probability that someone who has the condition will test positive for it, and specificity refers to the probability that someone who does not have the condition will test negative (Bishop, 2006). In other words, sensitivity is a summary statistic that reveals whether a given instrument will capture *all* of the cases, whereas specificity is a summary statistic that indexes whether a particular instrument identifies *only* those cases that actually have the condition. Nine of the 16 participants with ASD were identified as pragmatically impaired by the TOPL, using a cutoff score of 79 (Phelps-Terasaki & Phelps-Gunn, 1992), while 13 of the 16 were identified by the CCC-2, using Bishop's (2003) criteria of GCC scores less than 80 coupled with a negative SIDI, or SIDI scores less than -15 regardless of GCC score. Thus, the TOPL displayed a sensitivity of 0.56, while the CCC-2's sensitivity was 0.81. None of the typically developing controls were identified as pragmatically impaired by either test, so specificity for both tests was 1.0.

To determine whether there were particular subtests on the CCC-2 that contributed more than others to identifying pragmatic impairment, an exploratory analysis of the pattern of scores was performed. Results are shown in Figure 1. Of the 13 identified on the CCC-2 as demonstrating pragmatic language impairment, the pattern of impairment across subtests was very similar. Only one of the 13 scored below the 10th percentile on the Speech and Syntax subscales, and only two scored below the 10th percentile on the Semantics subscale. Thus, on the major subscales investigating structural language skill, participants in this group generally scored well within normal limits. On the remaining seven subscales, nine scored below the 10th percentile on subscales measuring Coherence, Initiation, and Scripted Language, while 10 scored at that level on the subscale measuring Context. All 13 scored below the 10th percentile on the Nonverbal Communication subscale, while 11 of the 13 scored below the 10th percentile on subscales measuring Social Relations and Interests. The TOPL does not lend itself to a similar analysis, as there are no subtests or a priori established groups of items. A detailed analysis of item-by-item response patterns on the TOPL of the group with ASD was beyond the scope of this project.

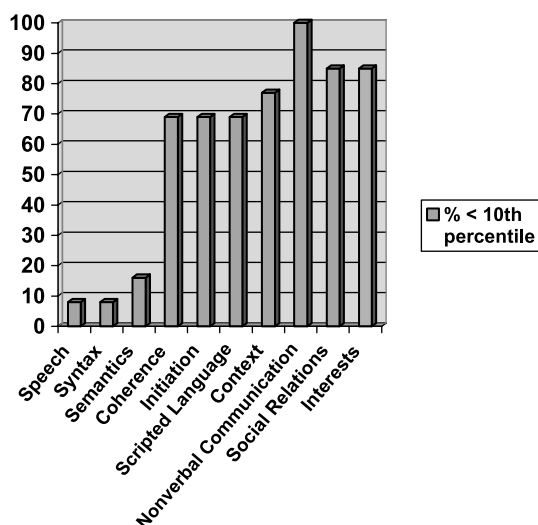
Neither test identified all of the children with ASD as pragmatically impaired, yet pragmatic impairment is considered

TABLE 1. Results on language measures by group (means and standard deviations).

Group	CELF-4 Composite Language Score		CCC-2 General Communication Composite		CCC-2 Social Interaction Difference Index		TOPL Language Quotient	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Autism spectrum disorders (<i>n</i> = 16)	105.5	11.88	78.81	10.85 ^a	-14.31	6.68 ^b	82.75	13.84 ^c
Control (<i>n</i> = 16)	111.63	9.85	114.13	9.65 ^a	2.25	4.49 ^b	98.94	7.26 ^c

Note. Means with the same superscript are significantly different, $p < .001$. CELF-4 = Clinical Evaluation of Language Fundamentals, Fourth Edition (Semel et al., 2003); CCC-2 = Children's Communication Checklist-2 (Bishop, 2003, 2006); TOPL = Test of Pragmatic Language (Phelps-Terasaki & Phelps-Gunn, 1992).

FIGURE 1. Percentage of participants below 10th percentile by Children's Communication Checklist—2 subtest.



universally dysfunctional in children with ASD. In an attempt to direct future investigations of pragmatic assessment, the characteristics of those participants who were *not* identified as having pragmatic impairment by each of the tests were also explored by comparing them with participants who had been identified with pragmatic impairment by the same test. The three participants with ASD who were not identified on the CCC-2 were not significantly different from the 13 who were identified (a) on structural language scores, as measured by the CELF-4, or (b) on autism symptoms, as measured by the ADOS or the ADI. Thus, children who were identified with pragmatic impairment by the CCC-2 neither displayed more symptoms of autism nor exhibited weaker structural language than children who were not identified with pragmatic impairment. On the TOPL, the seven children *not* identified were similar to the nine children identified with pragmatic impairment in terms of ADOS and ADI scores but, on average, were significantly better in CELF-4 expressive language performance: subgroup not identified on TOPL, expressive language standard score $M = 110.14$; subgroup identified on TOPL, expressive language standard score $M = 98.25$, $t(13) = 2.22$, $p = .045$, Cohen's $d = 0.83$. This degree of difference reflects a large effect size (Green & Salkind, 2004).

Discussion

The primary aim of this study was to compare the CCC-2 and the TOPL on their ability to identify pragmatic language impairment in high-functioning children with ASD who had structural language skills in the typical range. Participants with ASD were matched to typically developing peers on chronological age, language level, and nonverbal IQ. When given a battery of language tests, both groups exhibited age-appropriate levels of structural language competence, as measured by the CELF-4, but children with ASD scored significantly worse on language measures that included pragmatic language. Therefore, both the CCC-2 and the TOPL

measured skills beyond structural language competence, and the pragmatic weakness of speakers with ASD relative to typically developing children is evident on both tests. The tests were not, however, equally effective. The TOPL identified 56% of the participants in this high-functioning group as pragmatically impaired, while 81% were identified by the CCC-2. Both tests were equally specific, identifying none of the typically developing controls as pragmatically impaired.

In addition, it's important to note that the mean summary standard score on the TOPL for speakers with ASD was 82.75. While this is significantly lower than the average score for the control group, it is not, on average, below the identified cutoff score of 79. A score of 83 would be interpreted as pragmatic skills that were "below average" but not "poor" or "very poor." On the CCC-2, the average GCC of 78.81 was just below the cutoff score of 80, indicating some sort of communicative impairment. If identification of pragmatic impairment on the CCC-2 depended solely on the GCC index, the two tests would not have been differentially effective. A key factor in the interpretation of the CCC-2, however, is the consideration of the GCC in concert with the SIDI. A negative SIDI coupled with a GCC below the cutoff indicates disproportionate pragmatic problems in the presence of some overall communicative impairment. When language is fluent, as would be the case with a GCC over 80, the discrepancy between structural skill and pragmatic impairment often becomes more glaring (Norbury et al., 2004), leading to considerably lower SIDI scores. For this reason, pragmatic impairment is also identified when SIDI scores are equal or lower than -15 , regardless of the GCC score. In the current study, average SIDI scores approached the -15 cutoff used to identify pragmatic impairment without low GCC. This finding suggests substantial pragmatic impairment in this group despite generally adequate structural language and underscores the need for a sensitive measure of pragmatic skills for these children with ASD. If our findings are substantiated by replication, they would suggest that almost half of the high-functioning population with ASD and with fluent structural language would not be identified with pragmatic language impairment even by tests that focus on pragmatic skills.

These results are in line with our hypothesis that the CCC-2 would identify more children as pragmatically impaired than the TOPL. In the introduction to this article, we suggested that the CCC-2 would be better at identification because the test included items designed to tap a broad range of pragmatic symptoms that are frequently reported as characteristic of ASD, including unusual or bizarre utterances that would not occur in the course of typical development. Other possible explanations include the advantages of indirect versus direct measurement. That is, caregivers have the opportunity to observe the child in the course of everyday life where pragmatic problems are likely most pronounced, and where they do not need to occur in a specific structured circumstance and on demand in order to be counted or scored (Adams, 2002; Bishop, 1998). It's likely that the inclusion of items directed to clinically significant pragmatic dysfunction as well as the advantages of indirect assessment methods both contributed to the CCC-2's success at identifying pragmatic impairment in this group.

Clinical Implications

Participation in this study was restricted to those with adequate structural language in order to address a group about which there is considerable clinical concern. Clinicians and parents often express frustration in gaining access to services for children who score within normal limits on traditional standardized language instruments but whose social language skills interfere with their ability to make friends, learn well in school, and participate in the community. Clinicians are increasingly likely to have children like these on their caseloads, due to the increased prevalence of ASD over the past decade (Centers for Disease Control and Prevention, 2007) and recent estimates that as few as 25% of the cases with ASD will have an intellectual disability (Chakrabarti & Fombonne, 2001). In this study, the CCC-2 was substantially more effective at identifying pragmatic language impairment in high-functioning children with ASD than the original TOPL. Whether or not the CCC-2 retains this advantage in comparison with the revised TOPL-2 (Phelps-Terasaki & Phelps-Gunn, 2007) remains an open question.

The profile of pragmatic performance across subscales may also be helpful in determining appropriate therapeutic targets (Philofsky et al., 2007). Delineating the parameters of atypicality should lead to a richer understanding of the difficulties encountered by speakers with ASD, and the scope of behaviors sampled in the CCC-2 should help focus the clinician's attention on relevant dimensions that need attention. Of course, no standardized test should be considered a substitute for careful observation across a variety of contexts (Landa, 2000), but differential performance on CCC-2 subscales could guide the clinician in his or her development of semistructured observations or systematic informal probe activities. Another possibility is that the CCC-2 could be used as an index of progress in therapy. If pragmatic skill is targeted as an intervention priority, the true measure of therapy's effectiveness will be the spontaneous use of appropriate pragmatic language in the speaker's daily life. The CCC-2, through measuring a parent's perception of the child's functioning, provides a measure of everyday pragmatic functionality.

Limitations and Future Work

This study is limited by its small sample size and by restricting participation to those who had structural language scores within typical limits. Both factors restrict generalization of the results. Making sweeping conclusions from few participants is always dangerous. Further, the majority of children with ASD will exhibit some sort of structural language impairment, and thus our sample is not representative of children with ASD as a whole. Analysis of a companion data set in which the CCC-2 and the TOPL were administered to high-functioning children with ASD who also had structural language impairment is under way in our lab.

Another limitation is that not all participants with ASD were identified as exhibiting a pragmatic impairment, even though pragmatic dysfunction is seen as a universal deficit in ASD. Factors that allowed three of the 16 participants with ASD to escape detection of pragmatic impairment on the CCC-2 could not be identified in this study, and they remain

an area of interest for future investigation. On the TOPL, however, participants who were not identified had a higher expressive language score than those who were identified as pragmatically impaired. In other words, even though all participants scored within normal limits on the CELF-4, those with higher levels of expressive language escaped detection of pragmatic impairment on the TOPL. The degree to which structural language skill influences performance on the TOPL should be further investigated.

Overall, our findings suggest that the CCC-2 is a more sensitive tool than the TOPL for identifying pragmatic language impairment in high-functioning speakers with ASD who also have structural language and nonverbal cognitive scores within typical limits. While this may be a select group of children, they are precisely the ones whose communicative difficulties have bedeviled clinicians and parents alike as they have sought to obtain appropriate services. Lacking documentation of pragmatic dysfunction, and with scores on traditional language measures in the typical range, these children often have been neglected. Our findings suggest that the CCC-2 is useful for identifying children who might otherwise "slip through the cracks."

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Contact author: Joanne Volden, University of Alberta—Speech Pathology and Audiology, 3-10 Corbett Hall, Edmonton, Alberta T6G 2G4, Canada. E-mail: joanne.volden@ualberta.ca.

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