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Using a parental checklist to identify diagnostic groups in children with communication impairment: a validation of the Children's Communication Checklist—2

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Abstract

Background: The Children's Communication Checklist (CCC 1998) was revised in 2003 (CCC-2) to provide a general screen for communication disorder and to identify pragmatic/social interaction deficits. Two validation studies were conducted with different populations of children with language and communication impairments.
Methods & Procedures: In Study 1, the questionnaire was given to families of 87 children attending full-time special education for specific language impairment, pragmatic language impairments or autistic spectrum disorders. In addition, the teachers of half the sample completed CCC-2 forms for the same children, providing evidence for interrater agreement. In Study 2, the sample was increased to include 24 children with similar diagnoses in educational contexts in Scotland and 27 children referred for clinical evaluation at a neurodevelopment centre.
Outcomes & Results: The CCC-2 distinguished children with communication impairments from non-impaired peers. Furthermore, the social-interaction deviance composite (SIDC) of the CCC-2 identified children with disproportionate pragmatic and social difficulties in relation to their structural language impairments. This measure also had good interrater agreement ($r = 0.79$).
Conclusions: CCC-2 provides a useful screening measure for communication impairment and can be helpful in identifying children who should be referred for more detailed assessment of possible autistic spectrum disorder. However,

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the present data highlight substantial overlap amongst groups with 'distinct' diagnoses. It is suggested that it is unrealistic to use the CCC-2 to make categorical distinctions on this continuum of disorder.

Introduction

Specific language impairment (SLI) is diagnosed when a child's language development does not follow the normal developmental course for no known reason. It is widely accepted that this definition by exclusion encompasses a heterogeneous population, but to date there has been little consensus about whether subgroups of language impairment exist and how best to delineate such groups. Progress in this area has been hampered for at least three reasons:

- Lack of assessments sensitive enough to capture certain aspects of language and communicative functioning that map onto clinical observations of children (Conti-Ramsden *et al.* 1997, Conti-Ramsden and Botting 1999, Adams 2002).
- Children's changing clinical picture over time (Stothard *et al.* 1998, Conti-Ramsden and Botting 1999, Conti-Ramsden *et al.* 2001b, Bishop and Norbury 2002).
- Overlap between language and communication behaviours seen in SLI and other developmental disorders such as autistic disorder (Shields *et al.* 1996a, b, Kjelgaard and Tager-Flusberg 2001, Bishop and Norbury 2002).

These challenges are particularly evident when one considers the case of pragmatic language impairment (PLI). Originally described as 'semantic–pragmatic deficit syndrome' (Rapin and Allen 1983) or 'semantic–pragmatic disorder' (Bishop and Rosenbloom 1987), the term 'PLI' has come to refer to children who experience significant difficulties with the *use* of language. Clinical accounts of PLI have suggested that unlike children with more typical SLI, children with PLI have adequate syntax and phonology and are often verbally fluent. However, they may exhibit a range of linguistic and communicative deficits such as comprehension deficits for connected speech, conversational inadequacies, poor turn-taking, atypical word choices, literal interpretation of figurative language, and poor topic maintenance (Rapin 1996, Adams 2001). Others have suggested fundamental deficits in social cognition, such as appreciating the thoughts and feelings of others (Shields *et al.* 1996).

PLI: where specific language impairment and autism meet?

Children with PLI pose many diagnostic dilemmas. One question that has preoccupied many has been the extent to which PLI constitutes a distinct subgroup of children with language impairment or autistic disorder (for a discussion, see Bishop 2000). Recent evidence has shown that children might exhibit substantial pragmatic impairments and yet not meet full diagnostic criteria for autism (i.e. do not have significant deficits in all three areas of the autistic triad: social interaction, communication and repetitive behaviours/restricted interests) (Botting and

Conti-Ramsden 1999, Bishop and Norbury 2002). Bishop and Norbury (2002) applied assessments considered to be 'gold standard' instruments to confirm a diagnosis of autism for research purposes to children thought to have PLI and more typical SLI. These children were attending special schools for children with communication impairments, and none had a formal diagnosis of autism. They found that a small percentage (19%) of children with PLI met full criteria for core autism on both current observation and parental report of early development. However, a similar percentage (21%) failed to meet criteria on either measure. The rest showed a range of autistic features, but varied enormously in the number and severity of these autistic features.

Furthermore, the majority of children with PLI studied by Bishop and Norbury presented with structural language difficulties. The variability of language and cognitive functioning within this 'group' was considerable, suggesting they do not form a homogeneous subgroup of their own. The most parsimonious characterization of these data is that rather than specifying a subgroup of language impairment or autistic disorder, PLI may be a variable correlate of either. Although it is a more common correlate of pervasive developmental disorders, it may also occur in other developmental disorders in which communication skills are vulnerable, including SLI.

A changing clinical picture

Evidence for change over time is provided by longitudinal studies of children with language impairments. The majority of these studies suggest that language impairments become less specific over time, with a decrease in non-verbal abilities, persistent literacy difficulties and increasing social impairments, especially in adolescence and early adulthood (Stothard *et al.* 1998, Conti-Ramsden and Botting 1999, Conti-Ramsden *et al.* 2001b, Howlin *et al.* 2000, Mawhood *et al.* 2000). Studies by Mawhood and colleagues reported the long-term outcomes for two groups of boys identified at the age of 7 years as having either receptive language disorder or autism. In early adulthood, the dividing line between the two disorders had become blurred, with many individuals in the language disorder group showing more features of autism as they became older. Conti-Ramsden and Botting (1999) found that although the pattern of impairment that defined the five subgroups of SLI they identified remained stable over time, group membership was far less stable, with 45% of children moving across subgroups in 1 year. The authors conclude that patterns of language strengths and weaknesses change with developmental time and may be subject to external factors such as intervention and educational placement.

Identification of PLI

Clearly, objective means are needed to identify pragmatic language difficulties, but these have proved elusive to date. Conti-Ramsden *et al.* (1997) used cluster analysis to explore natural subgroupings of children with SLI. They found that those with a clinical diagnosis of PLI often scored within normal limits on standardized tests of language ability and that it was only when clinical opinion was entered in the analysis that the extent of their communication difficulties was evident. Others have attempted to devise tasks that, on theoretical grounds, should highlight difficulties proposed for children with PLI and distinguish them from both typically

developing children and those with typical SLI. These have included measures of inferencing (Bishop and Adams 1992, Norbury and Bishop 2002), referential communication (Bishop and Adams 1991), understanding of non-literal language (Vance and Wells 1994, Kerbel and Grunwell 1998) and narrative (Norbury and Bishop 2003). Such studies have largely failed to show disproportionate difficulties in children with PLI for two reasons. First, children with typical SLI frequently show unexpected deficits in the same area, suggesting that basic linguistic ability is an important factor in pragmatic functioning. Second, sometimes children with PLI do better than expected on a given task. It has been suggested that this occurs because such children benefit from the imposed structure, transparent expectations and adult support inherent in such tasks. Indeed, deficits specific to PLI are most apparent in naturalistic conversation, which is by nature very open-ended (Bishop *et al.* 1994, 2000). However, the analytical methods used to expose these deficits are time consuming and not practical for most clinicians and researchers.

One solution adopted by Bishop (1998) has been to systematize clinical opinion and present the key behaviours that lead to an impression of PLI in checklist form. The following section describes the development of the Children's Communication Checklist (CCC) and the changes made to the revised version (CCC-2) (Bishop 2003), which forms the basis of this study.

History of the Children's Communication Checklist

Recognizing the dearth of suitable assessment materials for identifying PLI, Bishop (1998) proposed the CCC as an attempt at systematizing clinical opinion and producing a more objective measure with acceptable levels of reliability and validity. The CCC was to be completed by someone (teacher, therapist or parent) who knew the child well and was likely to have observed the relevant behaviours over time and, therefore, could give a more representative account of the child's behaviour in everyday situations. It was designed to be quick and easy to complete and focused on pragmatic behaviours that were (1) difficult to measure with standardized tests and (2) atypical at any point in development (rather than charting the course of normal pragmatic development).

The CCC was a 70-item checklist that assessed children's communication behaviours (children had to be speaking in multiword phrases) across nine subscales. The first two subscales, speech and syntax, were designed to highlight possible deficits in structural language skills. The final two subscales, social interaction and interests, reflected autistic-type behaviours that might warrant further investigation. The middle five subscales comprised the pragmatic composite and included coherence, inappropriate initiation, stereotyped conversation, use of context and rapport. Each item was a statement of behaviour, such as 'talks constantly about things no one else is interested in', and respondents were asked to judge whether this: definitely applied (2 points), applied somewhat (1) or did not apply (0). An 'unable to judge' option was also available for each item.

An initial study was conducted with the CCC using a subset of children who had participated in a national study of children attending language units (Conti-Ramsden *et al.* 1997). Teachers and therapists were asked to give individual ratings for the same children in order to measure interrater reliability. They also provided diagnostic information along the following lines: SLI, semantic–pragmatic disorder-pure (SP-pure) and semantic–pragmatic disorder-plus autistic features (SP-plus).

Although there was a fair amount of overlap between the groups, the pattern of responses across subscales was as one might expect with the SP-plus group achieving the lowest scores, the SLI group the highest and the SP-pure group intermediate. For the pragmatic composite, a cut-off score of 132 was selected as giving the best discrimination between children with SLI (the majority of whom had scores >132) and those thought to have primary pragmatic difficulties (the majority having scores <132). Cronbach's α, which measures internal consistency, was reported to be 0.867 for one rater and 0.797 for the other, with interrater reliability between the two professionals being $r=0.80$.

In sum, the CCC looked like a promising measure for identifying pragmatic difficulties in children with identified communication impairments in that it was internally consistent and reliable, and valid in that it did appear to distinguish between children thought to have primary pragmatic difficulties and those with more typical SLI. Further studies by Bishop and colleagues (Norbury and Bishop 2002) have continued to demonstrate its utility in identifying children with PLI from a language impaired population and in identifying pragmatic deficits in the broader clinical context (Bishop and Baird 2001).

CCC-2

A revised version of the CCC was developed by Bishop (2003) and standardized on a large sample of typically developing children across the UK. Again, it is for use with children who use multiword utterances. It was standardized using parents as informants because they have the most contact with their children and their ratings have been shown to ally closely to clinical diagnosis (Bishop and Baird 2001). The CCC-2 differs from the CCC in four main respects (for more details, see Bishop 2003):

- Format of the items was changed to make the ratings more concrete and less subjective. In the CCC-2, respondents are asked to make a frequency judgement about how often behaviours occur, i.e. less than once a week, at least once a week (but not every day), once or twice a day, several times a day (or always).
- Order of items was also changed. In the CCC, items were grouped according to subscale and items tapping communicative strengths were interspersed with items tapping communicative deficits. This could be confusing, as a rating of 'definitely applies' could refer to a strength on one item and a deficit on another. In CCC-2, all 'deficit' items are grouped together in one section, with items from different subscales interspersed to avoid a response bias. Items referring to strengths are in a separate section at the end, with an explanation clearly provided.
- Number of subscales was increased to 10, and each subscale has five items addressing communicative deficits and two items measuring communicative strengths. A semantics subscale was also included and the syntactic scale enhanced. The aim was that together, the speech, syntax, semantics and coherence scales could assess a wider range of language functions apart from pragmatics, enabling the CCC-2 to be used as a more general screen for communication impairments, distinguishing affected from unaffected children. A list of all subscales in the CCC-2 is provided in table 1.

Table 1.   Subscales of the CCC-2

A. *Speech*
B. *Syntax*
C. *Semantics*
D. **Coherence**
E. **Inappropriate initiation**
F. **Stereotyped language**
G. **Use of context**
H. *Non-verbal communication*
I. *Social relations*
J. *Interests*

Items in **bold** are included in the general communication composite. Items in *italics* are included in the social-interaction deviance composite (sum of scales A–D minus sum of scales E+H+I+J).

- Two new composite scores are available in the CCC-2. One, the general communication composite (GCC), is based on all of the communication scales (A–H). This was designed to discriminate between children with communication impairments from typically developing children. The second, the SIDC, replaces the old pragmatic composite and was derived to give optimal discrimination between children with typical SLI and those with pragmatic difficulties that are disproportionate to their structural language abilities.

Current investigation

The current investigation was designed to provide validation for the CCC-2 in relation to the standardization data. It was conducted in two parts. Study 1 looked at the diagnostic validity of the CCC-2 within a diverse population of children with communication disorders. Study 2 provided further validation of the CCC-2 in both an educational context and a clinical setting. Overall, these studies had three aims:

- To determine the utility of the CCC-2 as a general screen for communication impairments.
- To determine the ability of the CCC-2 to identify PLIs, particularly in those children with scores on standardized tests of language ability within the normal range.
- To determine the extent to which the CCC-2 can discriminate PLI from children with more typical SLI on the one hand, and autistic spectrum disorders on the other.

Study 1

Method

Participants

The CCC-2 was standardized in the UK on 542 typically developing children aged 4–17 years, selected to give a sample that was representative of the UK population in geographic distribution and socio-economic status (Bishop 2003). An additional 20 families of typically developing children aged 8–15 years (13 males, seven

females) were recruited as a control group for Study 1. These children had no history of hearing loss or special educational needs and all were from a monolingual English-speaking home.

Eighty-six children with communication impairments (76 males, 10 females) were recruited through special schools and units throughout the South East of England to take part in a larger study. Children were recruited who fell into three broad categories: SLI, PLI and autistic spectrum disorders (ASD). The latter two groups were further subdivided in the following ways: the PLI group was divided into those with evidence of autistic features (PLI+) and those without autistic features (PLI). The ASD group was divided into those with a definite diagnosis of high-functioning autism (HFA) and those with a diagnosis of Asperger disorder (ASP), which assumes that normal language milestones were reached in early development. Children were assigned to these categories based on teacher/therapist report and diagnostic information available in the school records. In cases where both language and pragmatic impairments were evident, the PLI label took precedence.

Psychometric testing

Non-verbal ability. Non-verbal abilities were assessed for all children using the Weschler Abbreviated Scales of Intelligence (WASI; Wechsler 1999). Two sub-scales comprise the non-verbal composite: block design and matrix reasoning. All participating children had standard scores of 80 or above.

Language ability. Three indices of general language ability were administered to all children in the clinical sample. Two measured receptive language skills: the British Picture Vocabulary Scales, 2nd edn (BPVS; Dunn *et al.* 1997), a receptive vocabulary measure, and the Concepts and Directions (Concepts) subtest of the Clinical Evaluation of Language Fundamentals—III^{UK} (CELF-III^{UK}; Semel *et al.* 2000), which measures the child's ability to follow oral directions of increasing length and complexity.

The Recalling Sentences (Recall) subtest of the CELF-III^{UK} was administered to estimate expressive language ability. This test requires the child to repeat sentences of increasing length and complexity. This test has been shown to be a particularly sensitive measure for distinguishing individuals with SLI and/or pervasive developmental disorders from non-impaired peers (Conti-Ramsden *et al.* 2001a, Botting and Conti-Ramsden 2003).

To be included in the SLI group, children had to have standard scores of at least -1.25 SD on two of the three language measures. Language ability was not a selection criterion for any of the other groups, as previous investigations have suggested that children with primary PLI and ASD may do well on measures of structural language (Minshew *et al.* 1995, Conti-Ramsden *et al.* 1997). However, as will be shown below, the vast majority of children in these clinical groups had concomitant structural language deficits.

Questionnaire data. The CCC-2 was sent to every family who agreed to take part in the larger study. A total of 71% of participating families returned the CCC-2.

The CCC-2 was also given to teachers and speech–language therapists of participating children with clinical diagnoses. They were asked to complete the form if they had known the child for more than 3 months. A total of 51% of forms

were completed, giving a total of 54 children with communication impairment having full data from both a parent and a professional.

Results

Non-verbal and verbal abilities

Table 2 shows the mean age and scores on background verbal and non-verbal measures for each group. Although all children had non-verbal scores within the normal range, both the SLI and HFA groups had significantly lower scores than the control and ASP groups (SLI, $p < 0.005$; HFA, $p < 0.05$). Across the language measures, a similar pattern of results emerged: all clinical groups showed significant impairments relative to controls, except the ASP group, which did not differ from controls. Furthermore, children in the ASP group significantly outperformed those in the SLI and PLI+ groups in all measures.

  Despite previous descriptions of intact structural language skills in the face of poor pragmatics in children with PLI and HFA (Minshew *et al.* 1995), these data suggest significant deficits in comprehension and production of syntax in all clinical groups except those with a diagnosis of ASP. If the cut-off for language impairment as scores of –1.25 SD on two of the three measures (Tomblin *et al.* 1996) are applied, then 14/46 children (30%) with PLI or HFA have 'normal' structural language abilities. In contrast, 75% of children with ASP have language scores within the normal range.

CCC-2

General communication composite (GCC).   Table 3 shows mean CCC-2 scaled scores for subscales A–H in relation to a diagnostic group, with a normative mean of 10 and SD = 3 (obtained from the standardization sample). To investigate the

Table 2.   Mean (SD) scores on background verbal and non-verbal measures

Group	n	Age (years)	WASI	BPVS	Concept	Recall
SLI	19	12.46	94.84$_a$	80.79$_a$	4.68$_a$	4.58$_a$
		(2.40)	(6.79)	(11.76)	(1.83)	(1.92)
PLI	14	11.41	102.86$_{ab}$	90.64$_{ab}$	6.36$_{ab}$	5.71$_{ab}$
		(2.10)	(11.26)	(13.71)	(3.27)	(2.97)
PLI+	21	11.97	102.48$_{ab}$	82.10$_a$	5.19$_a$	4.86$_a$
		(2.04)	(11.87)	(12.95)	(2.68)	(2.53)
HFA	17	11.41	99.88$_{ab}$	87.47$_{ab}$	6.06$_{ab}$	5.71$_{ab}$
		(1.93)	(12.27)	(16.42)	(2.63)	(2.91)
ASP	16	12.23	108.75$_b$	102.38$_{bc}$	8.63$_{bc}$	8.25$_{bc}$
		(2.26)	(11.84)	(16.85)	(4.27)	(3.02)
Control	21	10.81	109.95$_b$	109.57$_c$	11.90$_c$	10.81$_c$
		(2.24)	(12.87)	(11.28)	(2.79)	(2.44)

WASI, Wechsler Abbreviated Scales of Intelligence (non-verbal subtests only); BPVS, British Picture Vocabulary Scales; Concept, Concepts and Directions subtest of the Clinical Evaluation of Language Fundamentals—III[UK] (CELF-UK[3]); Recall, Recalling Sentences subtest of the CELF-III[UK].
WASI and BPVS have a normative mean of 100 (SD = 15).
Concept and Recall have a normative mean of 10 (SD = 3).
Means in a given column with different subscripts differ significantly at the 0.05 level on a Scheffé test.

Table 3. Mean CCC-2 scaled scores (parent ratings) in relation to the diagnostic group

		SLI	PLI	PLI+	HFA	ASP	Control
	n	16	13	18	14	11	21
A. Speech	Mean	2.44	5.23	5.72	5.21	5.82	10.75
	SD	2.61	3.56	3.34	4.00	3.06	2.40
B. Syntax	Mean	2.75	4.92	4.78	3.79	6.27	11.20
	SD	3.19	3.59	3.92	3.24	3.82	1.24
C. Semantics	Mean	2.31	4.62	2.61	2.79	4.64	11.50
	SD	2.18	3.20	2.35	2.12	3.53	2.84
D. Coherence	Mean	2.56	4.62	3.28	2.21	3.27	11.65
	SD	1.50	2.50	2.61	2.19	3.00	2.35
E. Inappropriate initiation	Mean	5.38	6.23	3.83	3.57	3.27	9.85
	SD	2.06	2.80	1.42	2.14	2.33	3.03
F. Stereotyped language	Mean	3.69	6.38	4.61	2.36	3.36	10.90
	SD	1.35	2.87	3.22	2.31	3.29	2.63
G. Use of context	Mean	2.06	3.38	1.22	0.64	1.09	10.85
	SD	1.73	2.26	1.59	1.01	1.76	2.39
H. Non-verbal communication	Mean	5.00	4.92	4.11	2.57	2.18	11.70
	SD	2.07	2.84	2.93	1.45	2.99	2.18
I. Social relations	Mean	5.31	5.92	3.06	1.14	1.73	11.20
	SD	3.79	3.35	2.86	1.51	2.65	2.04
J. Interests	Mean	5.69	5.77	3.67	3.36	2.36	10.50
	SD	1.78	2.39	1.61	1.45	1.29	3.32

Scaled scores are derived from the standardization sample.

utility of the CCC-2 as a general population screen for communication impairment, a GCC score was calculated by summing these scales. The results (figure 1) show that this composite score clearly differentiates affected from
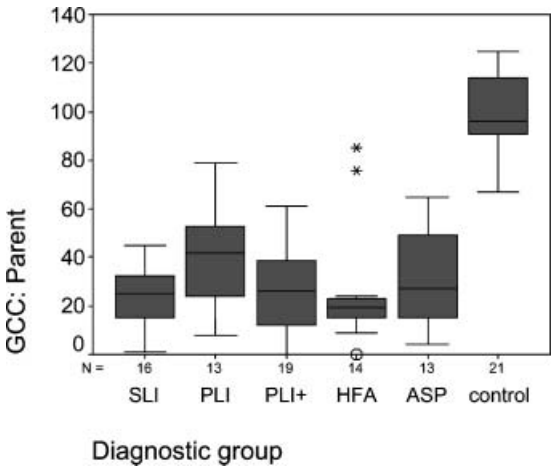

Figure 1.   Box plots showing parent ratings on the general communication composite (GCC) of the CCC-2. The box represents the 25th and 75th centiles, with the thick black line in the centre of the box illustrating the median. The smallest and largest values in the distribution are shown by the whiskers; the horizontal lines at the top and bottom of the box. Asterisks show extremes.

unaffected cases, with almost no overlap between controls and clinical cases. A one-way ANOVA was used to assess difference in means on the GCC across groups. This was highly significant ($F(5, 88) = 59.08$, $p < 0.001$). Group comparisons showed that the control group had significantly higher means than all of the clinical groups. Furthermore, the PLI group had significantly higher scores than the HFA group. There were no other differences amongst the clinical groups. Figure 2 compares parent and teacher ratings for the clinical cases on the GCC. Teachers tended to give children higher ratings overall, and this was especially true for the SLI, HFA and ASP groups. Interrater agreement on this metric was significant, but modest ($r = 0.40$, $p = 0.003$).

Pragmatic composite.   Initially, a general pragmatic composite was computed by summing subscales D–H. This was comparable with the subscales used in the original CCC pragmatic composite (Bishop 1998). Figure 3 shows box plots depicting parent and teacher ratings of the sum of the pragmatic subscales for each clinical group.

The expected mean for typically developing children on this measure would be 50, since it is formed by summing five scales with an expected mean of 10. A surprising finding was the relatively poor scores on pragmatic scales obtained by children with SLI, especially on parent report. Figure 3 suggests that this composite does not discriminate between children with SLI and those thought to have primary pragmatic impairments. This was confirmed on ANOVA, comparing group scores on parental report. There is a significant group difference, with all clinical groups scoring below the control mean ($F(5, 82) = 37.39$, $p < 0.001$). In addition, the HFA group scored significantly below the SLI and PLI groups ($p = 0.038$ and 0.001, respectively). There are no other differences amongst the clinical groups.
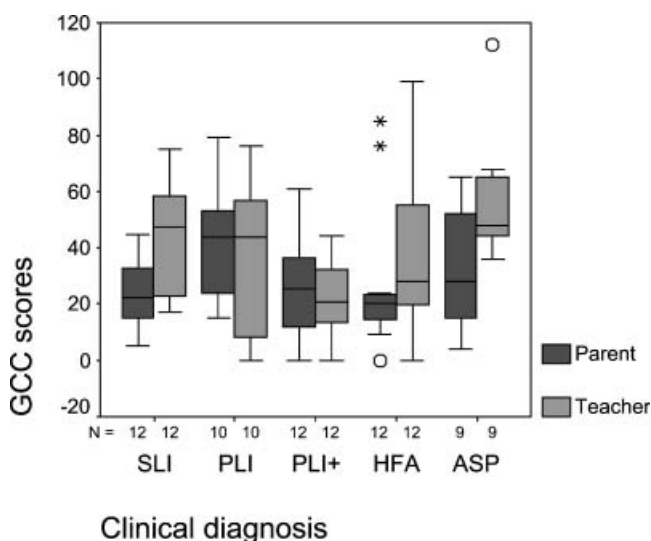

Figure 2.   Box plots depicting parent and teacher ratings for the different clinical groups on the GCC. Circles represent outlier scores between 1.5 and 3 box lengths from the edge of the box. Asterisks represent extremes.
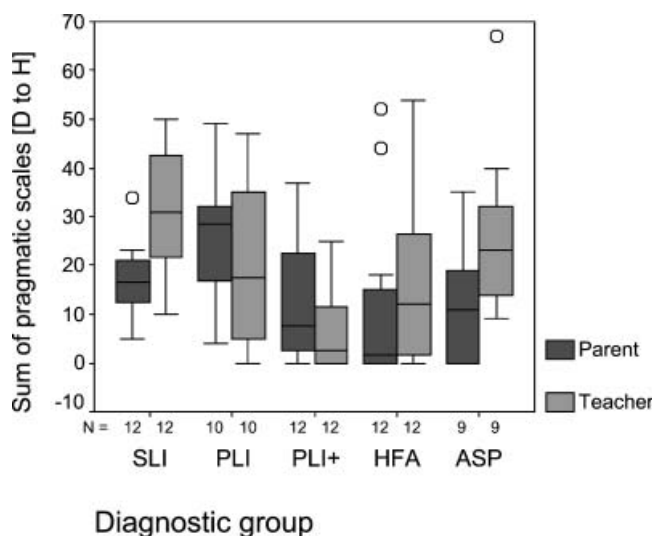
Figure 3. Box plots depicting parent and teacher ratings on the sum of all pragmatic scales in the CCC-2 (scales D–H). The lower boundary of the box represents the 25th percentile, whilst the upper boundary of the box is the 75th percentile. The median is shown by the black line through the centre of the box. Circles represent outlier scores.

Teachers tended to rate the children with SLI somewhat higher, but the difference between the SLI and PLI groups was still non-significant ($p = 0.39$). The interrater agreement between parents and professionals for this composite was significant but low at $r = 0.301$ ($p < 0.03$). Clearly, a pragmatic composite similar to the one used in the original CCC would not be very satisfactory at discriminating subgroups of children with communication impairments, especially if one was relying solely on parental report.

Social-interaction deviance composite (SIDC). The results of the general pragmatic composite seem to suggest that a structural language deficit compromises one's pragmatic abilities. However, it was notable that the SLI group was different from the other clinical groups in that their ratings on scales A–D were depressed relative to their ratings on other scales. Furthermore, scale D (coherence) did not discriminate between the SLI group and the groups thought to have more severe pragmatic difficulties, as was the case in Bishop and Baird (2001) using the older version of the CCC. Although scale D had originally been designated a 'pragmatic' scale, it is plausible that structural language difficulties may lead to low scores on items tapping coherence. For example, children who have difficulty formulating sentences will find it difficult to give a coherent account of a past event. Scale D was therefore reclassified as a structural language scale. With regard to the pragmatic scales, the SLI group achieved significantly higher scores on subscales E (inappropriate initiation) and H (use of non-verbal communication) than the other groups, demonstrating strengths in these areas. They also outscored the other groups on the two scales tapping autistic type behaviours, I and J. However, there were no group differences on

the scales F (stereotyped language) and G (use of context). It is possible that structural language difficulties may influence ratings on these items. For instance, a child with limited expressive output may rely on a few set phrases that might appear stereotyped. In addition, children with language comprehension difficulties may not make appropriate use of contextual information because they fail to understand the context. Nevertheless, because children with pragmatic difficulties may display stereotyped language and poor use of context even when other language skills are intact, it was decided not to recategorize scales F and G as 'structural language' scales.

The authors were then interested in the possibility of identifying children who had social communication difficulties that were disproportionate to their structural language difficulties. The pragmatic and social interaction subscales that were best at discriminating SLI from other communication impairments (E+H+I+J) were taken and subtracted from the subscale scores that tapped structural language abilities (A+B+C+D). This was termed the SIDC rather than just pragmatics, because it included scales I and J, which are not solely concerned with communication. A child with predominantly structural language difficulties (SLI) would receive a positive value (0 or above), whilst a negative value would be indicative of a child with pragmatic and/or social difficulties disproportionate to structural language impairments. The SIDC is used to ascertain the nature of an identified communication impairment and should therefore usually only be considered when the GCC < 55. The exception would be an extreme SIDC of -15 or more. A score this extreme was not seen in the standardization sample and is more typical of high-functioning children with autism or ASP. The distribution of SIDC scores is shown in figure 4.

Considering just the clinical groups, a one-way ANOVA with parent ratings revealed significant group differences on the SIDC ($F(4, 70) = 13.95$, $p < 0.001$),
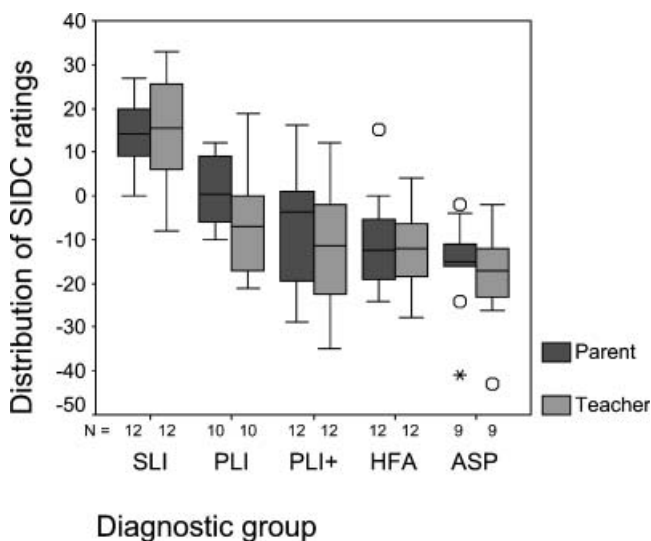

Figure 4.   Box plots depicting parent and teacher ratings on the SIDC. Negative scores represent disproportionate pragmatic difficulties in relation to structural language ability.

with the PLI+, HFA and ASP groups all achieving lower scores than the SLI group (all $p < 0.001$). Though the SLI group tended to have higher means than the PLI group, this difference was not reliable ($p = 0.211$). Looking at teacher ratings, a similar pattern of results was observed, although this time the SLI group had significantly higher ratings than the PLI group ($p = 0.003$). Parent–teacher agreement on this metric was impressive ($r = 0.79$, $p < 0.001$).

Current autistic behaviour. Although not designed as a screening measure for autism, scales I and J were sensitive to current autistic type behaviours. Scales I (social relations) and J (interests) were combined to give an index of current autistic behaviour. The means from parental report are shown in table 4. Here, there is a clearer mapping between clinical opinion and reported scores. Children in the SLI and PLI groups achieved equivalent means that were significantly higher than the other three clinical groups, all thought to exhibit autistic type behaviours ($F(4, 69) = 6.85$, $p < 0.001$, post-hoc comparison all $p < 0.02$). However, note that the SLI and PLI groups had means of 10, which are well below the expected value of 20 for typically developing children. There were no differences amongst the PLI+, HFA or ASP groups on this measure.

Discussion: Study 1

A clear strength of the CCC-2 was its ability to discriminate children with communication impairments from a typically developing population. Scores on the GCC showed very little overlap between these groups, suggesting the CCC-2 could be useful as a general screening questionnaire.

A more theoretically interesting question was the extent to which parental questionnaires could be used to identify pragmatic language deficits and autistic features in children with wide ranging communication impairments. As expected, children with diagnosed autistic spectrum disorders, including ASP, showed high levels of pragmatic difficulty. The relationship between the questionnaire and other clinical diagnoses was less clear cut. All children with communication impairments were rated as having pragmatic deficits in relation to their peers, with no significant differences between those thought to have more typical SLI and those thought to have primary pragmatic difficulties.

However, a metric on the CCC-2 was devised that identified children with pragmatic difficulties that were disproportionate to their structural language deficits. The SIDC was more in keeping with the clinical diagnoses the children had been

Table 4. Mean (SD) parent ratings of autistic features in clinical groups: scales I+J of CCC-2

Group (n)	Mean I+J (SD)
SLI (16)	10.31 (5.90)[a]
PLI (13)	10.69 (6.29)[a]
PLI+ (19)	4.05 (5.48)[b]
HFA (14)	2.79 (5.81)[b]
ASP (13)	2.54 (3.69)[b]

Means with different subscripts differ significantly at the 0.05 level on a Scheffé test.

given and the interrater agreement between parents and teachers on this score was impressive. However, the SIDC was derived only after inspecting data from the different groups on the CCC-2. It was therefore important to validate it in a new sample.

Study 2 was conducted to replicate and extend these findings in different populations of children with communication impairments.

Study 2

Method

Participants

Participants were drawn from two sources: speech and language therapy services in Lothian, Scotland, UK, and a neurodevelopmental clinic in London. Because the diagnosis of PLI is not part of the conventional diagnostic framework used by practitioners, such a subgroup in Study 2 was not included, but the aim was to compare four subgroups: SLI, pervasive developmental disorder not otherwise specified (PDDNOS), HFA and ASP. (One would expect the PDDNOS group to include cases that would have been categorized as either PLI or PLI+ in Study 1.)

The children from Lothian were participating in a larger study. From an initial sample of 30 families, parents of 27 children aged 6–10 years completed the CCC-2. Children were recruited with diagnoses of speech–language impairment and/or autistic spectrum disorder. All children had a non-verbal IQ of 80 or above (sample mean $=102.2$, SD $=14.31$), and met typical exclusionary criteria (i.e. no significant permanent hearing loss, English as the first language at home, no major neurological syndrome or physical handicap). Two checklists were discarded because they failed the CCC-2 consistency check, which establishes whether responses to positive and negative items are consistent, and a further checklist was excluded because only 91% of items were completed. This left a sample of 24 children. Fourteen had a diagnosis of SLI: half of these were attending special education provision (a language unit) and the remainder were in mainstream school. Professionals working in schools (including speech and language therapists) were asked to indicate whether the child had problems in the domains of speech, expressive language, receptive language and pragmatics. These data and language test data on these children indicated a wide range of difficulties: only half met the criteria used for language impairment in Study 1; the remainder had more circumscribed problems that predominantly affected phonology. None of those with a diagnosis of SLI was considered by school staff to have significant pragmatic difficulties.

The remaining 10 Lothian children had clinical diagnoses of 'language impairment with autistic features' or 'autistic disorder', and all were identified as having pragmatic difficulties. The former subset ($n=5$) were included in a subgroup with PDDNOS. Those with an autism diagnosis ($n=5$) were all judged to meet ICD-10 criteria for autism, and were included in a subgroup with HFA.

The second group of school-aged children was comprised of referrals to a neurodevelopmental clinic specializing in the diagnosis of pervasive developmental disorders. Parents were sent the CCC-2 with their initial appointment letter and asked to bring it to the clinic. Of 57 parents sent the CCC, 39 (68.4%) completed

it. One CCC-2 was excluded because of incomplete data, and 11 others were excluded because the child had a non-English speaking home background or because the final diagnosis was not of a primary communication impairment or autistic spectrum disorder. The remaining 27 children were categorized according to final diagnosis and added to the children from the Lothian sample to give the following groups: SLI (12 boys, three girls), PDDNOS (seven boys, three girls), HFA (16 boys, three girls) and ASP (seven boys).

Results

Mean scores on the GCC and SIDC for these four groups are shown in table 5, together with the percentages of children with scores below a cut-off of 55 on the GCC (10th percentile in relation to norms) and below 0 on SIDC (indicative of disproportionate pragmatic difficulties in relation to structural language skills). It is apparent that nearly all the cases of SLI, PDDNOS and HFA score below the 10th centile on the GCC, whereas only 43% of the ASP group do this poorly. However, the ASP group is markedly abnormal on the SIDC, with none scoring above zero. Those with HFA or PDDNOS are more variable, with SIDC scores above and below zero, though none of the HFA cases scored >8.

Overall, the pattern of results for different groups was broadly in line with that seen in Study 1. In Study 2, the SLI group obtained marginally higher scores than in Study 1, and a substantial proportion of ASP cases obtained a GCC = 55 or above. On the SIDC, the profile of scores in the four groups was close to that seen in Study 1, except that the HFA group had fewer children with negative values than in Study 1. The principal differences are likely to reflect the fact that children in Study 2 included those children who were attending mainstream school and had milder phonological and language impairments, whereas those in Study 1 were all receiving special educational provision for severe and persistent SLI.

General discussion

The studies reported here investigated the diagnostic validity of the CCC-2 applied to children with a range of language and communication impairments. In particular,

Table 5. GCC and SIDC scores for CCC-2 parent ratings in relation to diagnostic group: Study 2

	n	SLI 15	PDDNOS 10	HFA 19	ASP 7	F	p	η^2
GCC	mean	33.07_a	25.6_a	28.16_a	60.86_b	9.87	<0.001	0.386
	SD	(14.11)	(8.76)	(14.39)	(22.22)			
	range	13–63	9–42	1–57	23–88			
	percent <55	93.30%	100%	89.50%	42.90%			
SIDC	mean	8.93_a	2.20_{ab}	-1.21_b	-25.00_c	26.82	<0.001	0.631
	SD	(5.69)	(9.27)	(8.61)	(10.95)			
	range	0–17	–12–16	–26–8	–42–7			
	percent <0	0%	40.0%	36.8%	100%			

Means with different subscripts differ significantly at the 0.05 level on a Scheffé test. For comparison, the typically developing children in Study 1 ($n=21$) had a mean GCC 100.24 (SD = 16.25) with a range of 67–125. Their mean SIDC score was −0.81 (5.01).

of interest were the extent to which parental report could be used to identify autistic features and pragmatic impairments, and whether this checklist adequately discriminated children with clinically 'distinct' diagnoses from one another.

The CCC-2 was administered to two different populations of children with different clinical diagnoses, all of whom had communication impairments. Perhaps the most surprising finding was that the general pragmatic composite of the CCC-2 (similar to the pragmatic composite used in earlier versions of the CCC) did not distinguish between those thought to have PLIs and those with more typical SLI. Studies using the earlier CCC did show significant differences between these groups of children, although there was overlap between groups and children with SLI did have significantly lower mean composite scores than their typically developing peers (Bishop and Norbury 2002). The validation sample used by Bishop (1998) were all aged between 7 and 9 years and subsequent studies using the CCC have focused on children of primary school age. It may be that as children with SLI grow older and social demands increase, their pragmatic abilities appear to worsen. Some evidence for this hypothesis is provided by the longitudinal studies of Mawhood and colleagues (Howlin *et al.* 2000, Mawhood *et al.* 2000) who followed up two groups of boys originally diagnosed as having either a specific developmental receptive language disorder or autistic disorder. In adulthood, the children with language impairment were showing far more pervasive difficulties and experiencing social difficulties of a similar kind to those with early diagnoses of autism, although not as severe.

Another major difference between findings for the original CCC and the current study is the use of parental report. Validation studies of the CCC and subsequent studies have relied on professionals (teachers and speech and language therapists) in specialist educational settings. Bishop and Baird (2001) found only moderate interrater reliability between teachers and parents on the CCC ($r = 0.45$), but found that parent ratings were more closely aligned to clinical diagnoses. Discrepancies between parent/teacher ratings of child behaviour are not uncommon (Verhulst and Akkerhuis 1989). Redmond and Rice (1998) showed poor parent–teacher agreement on ratings of children's emotional and behavioural difficulties. Teachers consistently gave children with SLI higher ratings of social impairment than parents. This may reflect the possibility that at least some communicative and social behaviours are context dependent.

These findings raise questions about the extent to which pragmatic impairments are a secondary consequence of speech and language disorder (Rice *et al.* 1991, Rice *et al.* 1993, Nathan 2002). It is apparent that language impairment adversely affects social interaction. However, the present data show that some children have pragmatic impairments out of keeping with their structural language skills. This is in line with previous studies showing that children with good structural language can nevertheless have pragmatic difficulties (Conti-Ramsden *et al.* 1997).

Validity of the CCC-2

The current study had three main aims, as outlined in the Introduction. First, the greatest strength of the CCC-2 is its ability to distinguish children with communication impairments from typically developing children. There was very little overlap in the GCC scores of the two populations, suggesting the CCC-2 is a valid screening measure for communication disorder.

A second aim of the CCC-2 is to identify pragmatic difficulties not typically picked up by other standard language measures. Using the SIDC, it was possible to identify children who scored within normal limits on language measures yet showed clear pragmatic deficits on CCC-2. This is particularly striking for some children with ASP, many of whom achieved exceptionally high language scores of >1 SD above the mean. Perhaps more importantly, the CCC-2 gives an indication of children's ability to communicate in real-world environments as opposed to a contrived testing situation.

Finally, it had been hoped that the CCC-2 would distinguish children thought to have PLI from those with more typical SLI. This presented a complicated picture. The vast majority of the children in the SLI group showed clinically significant pragmatic difficulties. Furthermore, 60% of children with PLI (with or without additional autistic features) had significant structural language impairments. This is in line with mounting evidence that clear boundaries between SLI, PLI and indeed autistic disorder simply do not exist (Bishop 2002, Bishop and Norbury 2002).

However, a metric (SIDC) was derived that identified children with disproportionate pragmatic and social impairments. This is more in keeping with traditional clinical descriptions of children with PLI as having poor pragmatic skills in the face of *relatively* spared structural language abilities. Not all of these children would meet diagnostic criteria for autism. However, the SIDC provided the best discrimination between groups when subscales I and J, which tap current autistic behaviours, were included in the composite. Therefore, any child with a negative score on the SIDC should be considered for further diagnostic evaluation.

Implications

The literature on subtypes of communication disorder has been dominated by attempts to find the one measure that will clearly identify children with PLIs as a distinct diagnostic entity. The assumption is that in doing so, the understanding of the different aetiologies, intervention needs and prognoses of different disorders will be furthered. For instance, Botting and Conti-Ramsden (2003) suggested that it might be helpful to subdivide children with PLI into two groups according to their scores on 'interests' and 'social interaction' scales of the original CCC. Intriguingly, the members of their PLI+ group, who had greater evidence of autistic-like behaviours on these scales, had better scores on language tests than those in the PLI pure group, sometimes scoring within normal limits. Nevertheless, language test 'markers' did not clearly isolate the PLI+ cases as a distinct subgroup. This is consistent with the present results: there was considerable within-group variation among children with PLI. These data lend further support to the idea that rather than continuing to think categorically, one should move the field forward by taking a dimensional view of pragmatic impairment. Pragmatic ability will be affected, for example, by linguistic skill, autistic-type behaviour, attention and social cognition. It is plausible that children may have any of these deficits in any combination, which will contribute to individual differences in linguistic, cognitive and pragmatic ability, even for children within the same diagnostic 'group'. Clinically, the CCC-2 provides information about one of the dimensions that contributes to a child's communicative profile and should be seen as complementing other sources of information rather than as providing the diagnostic answer itself. In research

contexts, in might be desirable to divide children into discrete subgroups, and it would be possible to do this using the CCC-2. A cut-off score of zero or below consistently identifies pragmatic/social interaction difficulties, with only one child diagnosed with SLI in the present study scoring below this level. At the other end of the distribution, children with confirmed diagnoses of autistic spectrum disorder rarely achieve SIDC scores >8, indicating that scores >8 are more consistent with a diagnosis of typical SLI. However, adopting this strategy would exclude a substantial number of children with intermediate profiles. In many research contexts, it might therefore be more fruitful to look for correlates of the SIDC score rather than to use it to categorize children into distinct groups. Indeed, the present findings suggest that such discrete groups are not realistic.

Acknowledgements

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