Semantic and inferencing abilities in children with communication disorders

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Abstract

Background: Semantic and inferencing abilities have not been fully examined in children with communication difficulties. **Aims**: This project aims to investigate the inferential and semantic abilities of children with communication difficulties using newly designed tasks. **Method:** Children with different types of communication disorder were compared to each other and to three groups of typically developing children: those of the same chronological age and two groups of younger children. In total 25 children aged 11 years with Specific Language Impairment (SLI) and 22 children also 11 years of age with primary pragmatic difficulties (PD) were recruited. Typically developing groups aged 11 (n=35; age-match), and those aged 9 (n=40) and 7 (n=37;language similar) also participated as comparisons. **Results:** . For Semantic Choices, children with SLI performed significantly more poorly than 9 and 11 year olds, whilst the PD group scored significantly lower than all the typically developing groups. Borderline differences between SLI and PD groups were found. For inferencing, children with communication impairments performed significantly below the 11 year old peers, but not poorer than 9 and 7 year olds, suggesting that this skill is in line with language ability. Six children in the PD group who met diagnosis for autism, performed more poorly than the other two clinical groups on both tasks but not statistically significantly so. **Conclusions**: Both tasks were more difficult for those with communication impairments compared to peers. Semantic, but not inferencing abilities showed a non-significant trend for differences between the two clinical groups and children with PD performed more poorly than all typically developing groups. The tasks may relate to each other in varying ways according to type of communication difficulty.

Introduction

Semantic skill and inferencing ability are areas of language which have been less studied than more formal linguistic performance in populations with specific language impairment (SLI). This is despite the fact that these areas are core skills in early language learning, are essential to competent conversation (Leionenen and Kerbel, 1999) and are frequently reported as difficulties in children with communication disorders (Norbury and Bishop, 2002).

Semantic ability in typical development

Semantic ability concerns understanding the meanings of words or phrases and the expression of these. There has been much literature written about the very early stages of semantic development. Semantic skills are important from the earliest speech development, and indeed, most study has been conducted before the ages of 2 or 3 years by which time many children are fluent talkers and competent comprehenders. It is believed for example that infants learning language use the connection between utterance and semantic context as an essential cue. There is also evidence that children use their ideas about the speaker's focus of attention to guide interpretation of language and that semantic cues (along with phonological ones) can guide syntax learning (Tomasello, 2001; Tabossi, Collina and Sanz , 2002).

However semantic development continues throughout childhood. Very young typically developing children cannot always correctly mark semantic roles for agent and patient using novel verbs (Conti-Ramsden & Windfuhr, 2002). Furthermore, McGregor and colleagues (2002) conducted a series of insightful experiments with 5 year olds which showed that the semantic lexicon includes functional and physical features, and that the risk of semantic

retrieval error for a word is related to the degree of semantic knowledge about that lexicon. Nevertheless, beyond early development, semantic skill has been somewhat neglected by developmental scientists, and the more subtle semantic understanding that develops as children get older is not as well documented. This creates a difficulty for clinicians, especially as the implications of semantic understanding stretch further than oral language development. In a recent study by Roth, Speece and Cooper (2002) semantic abilities such as oral definitions were found to predict later reading abilities, particularly passage comprehension, better than phonological awareness. Thus semantic ability has important implications for educational and social progress.

Inferencing ability in typical development

Inferencing refers to the abstraction of information that is not explicitly presented. The ability to infer information is complex and requires a number of different skills. Like semantic skill, the ability to make inferences also influences normal language development. For example, children asked to choose objects as referents for proper nouns will infer that the animate object is the correct target (Jaswal & Markman, 2001). The ability to make inferences relies on adequate comprehension of presented material and on the ability to meta-represent (that is hold more than one concept in one's head simultaneously) and begins as young as 2 years of age. Depending on the type of inference, an ability to perspective-take may also be needed. For example, Pillow (1999) showed that 6 year olds but not 4 year olds inferred that a puppet knew the colour of a toy inside a can if the puppet had looked into it. The conceptual development of inference is also related to linguistic skill (Weist et al, 1997). This is particularly true when children are asked to infer mood or social behaviour. Other researchers have found that inferencing skill is affected by pragmatic factors such as the salience of information in the development of story concepts (Ackerman, Paine and Silver,

1991). Inferencing is also related to educational progress. For example, Cain, Oakhill and colleagues (1999; 2001) have shown that inferencing plays a key role in text comprehension. In their studies children with poor reading comprehension ability were also poorer at inferring information from a text even when availability of relevant knowledge was controlled for.

Semantic and inferencing skills in children with language impairment

Clinicians have long realised that it is important to assess impairment in these areas because it often signals a failure in conversational skills and therefore the possibility of a breakdown in naturalistic language and even social relationships. However objective assessment has been difficult in practice. As children with language impairments develop, they become increasingly able to perform well on standardised tasks of semantic and comprehension ability whilst still manifesting crucial impairments in real life interaction (Botting et al, 1997). Thus the face validity of such tests appears weakened with age. A substantial proportion of children with communication disorders are known to have semantic difficulties (58% of a sample reported in Conti-Ramsden & Botting, 1999). However these are less understood than other areas of difficulty and may take many forms. Although word finding has been addressed to some extent in the literature (e.g.,Dockrell, Messer, George and Wilson, 1998) semantic understanding has been less well examined. Clinically, some subgroups of children with language impairment, especially those with marked pragmatic difficulties (PD) are thought to have more difficulties with these subtle skills than those with a more linguistic deficit typical of specific language impairment (SLI).

Speech and language therapists are likely to have contact with children with two groups of children with PD: Individuals with pragmatic language impairment (PLI) and children with

autistic spectrum disorder (ASD). Those with PLI have a difficulty with appropriacy of language, coherence, the amount of information given, speaker-listener roles, turn-taking and the relevance of language in conversation. At the same time, these children do not meet formal diagnoses for autism or Asperger's disorder, largely because they do not appear to have the same degree of cognitive rigidity or obsessional tendency seen in those with ASD. This group of children are the same as those previously described as having semantic pragmatic disorder (Bishop and Rosenbloom, 1987; Rapin & Allen, 1983; Rapin, 1996), but this group is now often referred to as having PLI following findings that semantic difficulties are not any more characteristic of this group than of children with typical SLI (Bishop, 1998). Furthermore, when semantic errors are made, they are qualitatively different in children with PLI representing a more serious 'pragmatic' breakdown of conversation rather than purely word finding difficulties (Botting and Conti-Ramsden, 1999; Conti-Ramsden et al, 1997). Although children with ASD may have similar conversational problems, they also meet current diagnostic criteria for autism, comprising the "triad" of impairment: social impairment; communicative impairment; and an impairment in creativity, flexibility of thinking and generalisation (DSM IV, APA, 1994).

There is an ongoing issue about defining these groups of children as distinct from one another which has proved controversial in itself (Boucher, 1998; Brook and Bowler, 1992; Gagnon, Mottron and Joanette, 1997). This may be partly due to the apparent heterogeneity of both groups and because of the ever-widening definition of ASD (Botting and Conti-Ramsden, 1999). The lack of clearly defined subgroups has inevitably made it difficult to evaluate and implement research findings, with clinicians now sometimes unsure how the receptive skills and weaknesses of the groups can be measured, and how they compare to other children with language impairments.

More recently, studies have begun to look at this problem again, with the added help of better definitions of the difficulties experienced. In (1998) Bishop published the Children's Communication Checklist (CCC), a scale regarding a number of aspects of communication skill rated by the teacher or speech-language. The scale was designed to distinguish children with pragmatic difficulties from other children with more typical language impairments. Nine scales are included comprising speech, syntax, inappropriate initiation*, making sense in conversation*, stereotyped conversation*, context*, rapport*, social relationships and interests. The middle five scales (marked *) make up a pragmatic composite scale which showed positive results in discriminating groups with PLI, ASD and SLI using a threshold of 132 to indicate pragmatic difficulties (Bishop, 1998; Bishop and Baird, 2001, Botting, 2004). Bishop and Norbury (2002) also produced an important study that begins to 'tease out' some of the differences between those with language based pragmatic difficulties (PLI) and those with more pervasive developmental disorders such as autism, and showed that the two could occur independently. The present study therefore examines these groups both combined and as separate groups.

Although studies have been conducted that examine differences in semantic and inferencing abilities between children with and without PD (Bishop & Adams, 1992; Vance & Wells, 1994; Letts & Leionenen, 2001) the clinically observed differences have been very difficult to isolate in research contexts. In all of these studies, children with language impairments of both subtypes have experienced similar difficulties with the tasks. There may be a number of reasons for this apparent lack of sensitivity of standardised tests. Clinicians may describe children with PD as having a semantic or inferencing difficulty when in fact impairment is due to other complex factors present in online conversation (such as lack of awareness about

the listener's needs). This would mean that when skills are examined in a more controlled way, no added deficit is evident in this group compared to those with SLI. Alternatively, large verbal processing loads inherent in many tasks might cause children with SLI (who are now known to have processing difficulties, Montgomery, 2003) considerable difficulties in experimental conditions which are minimised in naturalistic settings by other available strategies (such as the use of visual cues). Thus a second aspect addressed by this study is to reduce the amount of processing required by the assessment measures.

The present study aimed to focus on the assessment of semantic and inferencing skill using two new measures designed with minimal processing demands in mind, through the use of visual prompts and limited non-verbal responses. Two clinical groups of children aged 11, those with typical SLI and those with PD, were compared on these tasks in relation to typically developing peers and two younger comparison groups aged 9 and 7 years (similar language levels, see table 1 later). Because of reported communicative behaviour in different groups with language impairment, the predictions were that: a) Clinical groups would perform more poorly than age matched peers on both tasks; that b) For the PD group, performance would be lower than that of even the younger controls and thus that c) Inferencing and semantic difficulty will prove to be significantly more marked for those in the PD group than for SLI peers. Finally we hypothesised that d) On qualitative analysis, the small group of children with autism would perform more poorly on both tasks than peers with either SLI or PD.

Method

Design

This study used a cross-sectional, controlled design in which 2 clinical groups were compared to 3 typically developing groups. One of these control groups represented an age-match, whilst the others were intended to provide younger comparisons with less advanced language skills (see table 1 later).

In the design, uniformity of age of participants with language impairments was a primary consideration in order to obtain a meaningful picture of comprehension and semantic abilities of a large group of children with communication difficulties. First it was thought that children at this age would be old enough to show PD (pragmatic language difficulties are often only evident as being clinically significant once language development has reached a sufficiently advanced level). Second a cross-sectional sample at one age would minimise factors within the group involving changes in ability due to maturation. Children participating in the study were allocated to groups a priori as described below.

Participants

Clinical groups

All children participating in the study were recruited via language units (special high teacher-child ratio classes with speech-language therapy input) and mainstream schools. In total 3 children whose teachers felt they had pragmatic difficulties were tested but did not meet our CCC criteria below (with CCC scores of 139, 140, 141). Because of the strong positive clinical history of pragmatic impairment, we did not deem it appropriate to include these children in the typical SLI group and they were excluded from the study.

Children with SLI (n=25)

These children all had a clinical history of SLI and at least one language test below 1sd from the published mean for age. However, they also had no current status or history of pragmatic impairments as measured by scores over 132 on the CCC pragmatic composite scale (Bishop, 1998). All children had short form performance IQ's of 70 or above (17 children >85 IQ). Mean age was 10;11 (sd=4m) and 4 (16%) were girls. Just over half of this group had persistent expressive and receptive language problems (n=14). The remainder had expressive difficulties but four of these were also described as having a history of receptive difficulties. Three children (2 expressive and 1 mixed E/R) had concurrent articulation difficulties.

Children with pragmatic difficulties - PD (n=22)

Children in this group met one of two recognised diagnostic criteria, that of PLI or that of ASD. To qualify as PLI, (n=16) they were required to have Children's Communication Checklist (CCC) pragmatic scale scores of <132 at either 8 years of age (n=3) or 11 years of age (n=19) and short form performance IQs above 70. To qualify as ASD, (n=6) they were required to have Childhood Autism Rating Scale (CARS; Schopler, Reichler, Devellis & Daly, 1980) scores of >30, indicating an autistic spectrum disorder. No IQ threshold was set as this is not a requirement for the diagnosis of autism. In actuality, only 3 children had IQs below 85. All the six children with ASD also had CCC scores (mean=126.8, sd=13.6). Despite wider variance in CCC scores, there was no significant difference between the ASD group and the PLI group (Mann Whitney exact p=0.97). Mean age of the total PD group was 10;10 (sd=6m) and 3 (14%) were girls. Table 1 shows clinical group characteristics in detail.

[Table 1 about here]

Typically developing groups

The typically developing children who helped with this study were all recruited from a selection of schools in urban and suburban areas. The children's families were contacted through the school and asked for written informed consent to take part. The children were recruited from three age groups: 7 year olds, 9 year olds and 11 year olds. These groups were chosen to provide comparisons with similar language ages (see Table 1) and as age matches. Parents were asked whether children had ever had speech and language therapy or special educational support. Of the 120 children who completed the task, 7 were excluded on these grounds. Therefore in total, 113 children participated. In the 7 year age group, there were 37 children, 21 of whom were girls and whose mean age was 7;7 (sd=3mths); in the 9 year group there were 40 children, 21 were girls and their mean age was 9;3 (sd=2mths); in the 11 year age group there were 35 children, 18 were girls and the mean age of this group was 11;6 (sd=4 mths). Data was collected by two postgraduate research assistants with experience of language data collection

Experimental tasks

Two key experimental tasks were used that had been developed and piloted by the second author.

Semantic Choices

The semantic task was devised using words extracted from the MRC Psycholinguistic Database of lexical items. The database was interrogated for sets of nouns, verbs and adjectives grouped according to established rated characteristics of concreteness and age of acquisition. This yielded 4 groups of items for each part of speech (high concrete/early, high

concrete/late, low concrete/early, low concrete/late), giving 12 sets of words in all. Two examples in each subset were used yielding 24 items in total. Foil words and target words of similar meaning were derived by using an English Lexicon and these words also met similar conditions in the database as the stimulus words. The task for the child was to choose a word of similar meaning. Stimuli were typewritten and read aloud to children. No pictorial clues were provided. The list of items are included in Appendix 1.

Inferencing

The inferential comprehension task involved a story based on a popular children's text "The Lighthouse Keeper's Lunch" (Armitage, 1994) The text of the story book was omitted and children were told the story by the researcher whilst looking at the illustrations. The text read out was not the original story text but was modified to provide inferencing opportunities and can be seen in Appendix 2. The pictures were made available to the children after the story, while a series of questions were asked (beginning with 2 practice items) to which they were required to respond "true/yes" or "false/no". Questions could be repeated once if necessary. A randomised list of literal questions or premises and inferential questions (which involve extraction of unstated information) were used. Harley (1995) defines three major types of inference involved in verbal comprehension which were used to design questions:

- logical inferences, where the relationships between words/referents can be deduced (text-connecting)
- bridging inferences, where new information is related to old (gap-filling)
- elaborative inferences, where information from world knowledge is made available to assist in script building.

Children could respond verbally or by gesture. A copy of the text read to children, instructions, and the question items are in Appendix 2.

Children were also assessed using standardised measures of receptive language and cognition as follows, to determine how our original tasks correlated with standardised assessments:

WISC IIIR – short form (Wechsler, 1992)

British Picture Vocabulary Scale (BPVS-II; Dunn, Dunn, Whetton & Burley, 1998)

Test for Reception of Grammar (Bishop, 1983)

Children's Communication Checklist (Bishop, 1998)

Numbers vary on these tasks as not all participants managed to complete all tasks.

Procedure

Following informed written consent from families, children were visited at school and assessed individually in a quiet room or area. Data was collected by the first author and three other postgraduate research assistants with experience of language data collection

Testing on the tasks was completed and for the clinical groups a wider battery of language and cognition tests was also administered. The testing took place during a single visit, at the child's own pace and with normal school breaks. Our procedure followed the ethical guidelines provided by the British Psychological Society (1995).

Results

Determining the abilities of children with SLI and PD

Group comparisons

Fig. 1 shows the means and confidence intervals of the clinical groups in relation to the normally developing children's group scores. Both ANOVAs showed significant differences across the 5 groups (Sem. Choices: $F(4,153)=14.7$, $p<0.001$; Inf: $F(4,152)=3.3$, $p=0.01$), and post hoc (independent) t-tests were used to reveal the different patterns.

For the Semantic Choices task, children with SLI performed significantly more poorly than age matched peers ($t=5.4$, $df=57$, $p<0.001$), and 9 year comparison children ($t=2.7$, $df=62$, $p=0.01$), but overlapped somewhat with the youngest children (7yrs, $t=1.5$, $df=62$ $p=0.14$). The PD group showed marked significant differences from all normative groups (compared with 11yr, $t=6.8$, $df=55$, $p<0.001$; with 9yr, $t=4.3$, $df=60$, $p<0.001$; and with 7yr $t=3.0$, $df=57$,$p=0.004$). Although a trend was seen for children with PD to have lower scores than those with SLI this difference did not reach statistical significance in post hoc t-tests ($t =1.5$, $df=44$, $p=0.14$).

For Inferencing the children in both clinical groups scored more poorly than age-matched peers (SLI &11yrs, $t=3.2$, $df=57$, $p=0.003$; PD & 11 years, $t=3.3$, $df=54$, $p=0.003$). Neither group showed significant differences from younger age children (SLI & 7yrs, $t=1.0$, $df=59$, $p=0.33$; SLI & 9 yrs, $t=0.94$, $df=62$, $p=0.35$; PD & 7yr, $t=1.1$, $df=56$, $p=0.27$; PD & 9yr, $t=1.1$, $df=59$, $p=0.29$). SLI and PD groups also scored very similarly ($t=0.2$, $df=43$, $p=0.88$). Table 2 details these results.

[Fig. 1 & Table 2 about here]

ASD subgroup

When the small group (n=6) of children who had clinical diagnoses of autism (as reported by teachers/speech language therapists in children's notes) were examined separately, they appeared to be performing more poorly on both tasks with mean scores of 15.3 (sd=3.9) for Semantic Choices and 14.0 (sd=2.8) for Inferencing. However, this group was very small and when statistical comparison was performed using Mann-Whitney exact, neither task revealed significant differences (Semantic Choices, p=0.18; Inferencing, p=0.29). Furthermore, the ASD group were not excluded on the basis of low IQ, and a significant difference in PIQ was found between the groups (PLI mean=116.2, ASD mean=76.5; Mann Whitney exact p=0.007). In a larger sample, statistically adjusting for this would likely make PLI and ASD even more similar. Finally, with the ASD children removed from analysis, a significant difference remained between the PLI group and the 7 year old comparison children on the Semantic Choices task (t=2.5; df=51, p=0.02) and on Inferencing between those with. PLI and 11 year peers (t=2.4, df=48,p=0.03). Thus further analyses include both these groups of children as part of the PD group.

Using a different PIQ threshold

Because there is ongoing debate about appropriate IQ cut-off's for those described as having specific language impairment, all children with PIQs below 85 (1sd) were then excluded from the analysis. This left 17 children with SLI and 19 children with PD. Analyses were redone with these smaller, more able groups. Semantic choices ANOVA was significant ($F(4,142)=11.3$, $p<0.001$). For inferencing the ANOVA fell short of significance ($F(4,142)=2.00$, $p=0.10$) although post-hoc t-tests revealed the same patterns as previously for both tasks. Unlike previously, the new groups resulted in a significant difference in IQ scores with the SLI group mean at 101.9 (sd=11.5) and the PLI group at 113.6 (sd=19.5;

F(1,27) =4.3,p=0.049). Thus comparisons between SLI and PD groups (no IQ data was available for the typically developing groups) were recalculated using ANCOVA with PIQ as the covariate, but results followed the same pattern as previous analyses. SLI and PD groups were still not different on Semantic Choices (F(1,27)=0.94, p=0.34) or Inferencing (F(1,27)=0.02, p=0.89).

Relationship between Semantic Choices and Inferencing task by group

Pearson product moment correlations between the two tasks were performed for each group separately. Children with SLI showed an unexpected lack of association between these types of skill (r(21)=0.19, r^2=0.04, p=0.39), whilst the other two groups showed evidence of a moderate relationship (typically developing children – all ages combined: r(110)=0.48, r^2=0.23, p<0.001; and PD: r(18)=0.63, r^2=0.40, p=0.003).

Examining relationships between other skills and semantic and inferencing ability

Cognitive ability and standard receptive task performance were examined in relation to Semantic and Inferencing skill for each of the clinical groups separately, using Pearson product moment correlations. The aim was to examine how the original tasks compared to recognised tasks of cognitive understanding and language comprehension.

Children with SLI

Cognitive ability as measured by short form PIQ was not found to relate to Semantic Choices (r(22)=0.04,p=0.85). However, receptive vocabulary skill (BPVS r(22)=0.63, p=0.001), and language comprehension (TROG, r(22)=0.53, p=0.008) were found to have significant associations with this task. For Inferencing in this group, all three tasks correlated significantly: PIQ r(22)=0.47 (p=0.02); BPVS: r(22)=0.50 (p=0.01) and TROG, r(22)=0.44

(p=0.03). CCC scores showed little significant association with Semantic Choices (r(16)=0.24) and a borderline (non-significant) relationship to Inferencing (r(16)=0.45).

Children with PD

Analyses in this group showed a similar pattern although PIQ was found to relate strongly to Semantic Choices score (as well as to Inferencing, see below) at r(14)=0.66 (p=0.006). Receptive language tasks showed borderline significant relationships with Semantic Choices in this group (BPVS r(15)=0.46, p=0.07; TROG (15) r=0.43, p=0.09). Inferencing in the PD group also related to PIQ (r(13)=0.65, p=0.008) and also to both comprehension tasks (BPVS, r(14)=0.63, p=0.009; TROG, r(13)=0.64, p=0.008). CCC scores showed no significant associations with Semantic Choices (r(16)=-0.18) or Inferencing (r(15)=0.01).

Discussion

The current study aimed to explore the semantic and inferential skills of two groups of children with communication impairment and peers of different ages. Our first prediction, that children in both clinical groups would perform more poorly than age peers, was borne out, with significantly lower scores on the Semantic Choices task and the Inferencing Task. We further suggested that the PD group would have particular difficulty in these areas of communication. This indirectly held true for the Semantic Choices task, in which children with SLI performed at the level of younger children, whilst the PD group showed significantly poorer scores than all comparison children. However, following on from this result, our prediction that the PD group would perform more poorly than those with SLI was not strongly supported by the data, although for Semantic Choices there was a trend for this group to score lower than the children with SLI. Similarly, although the mean of the small group of children with ASD was lower for both tasks, they were not significantly poorer on either.

Semantic ability and communication impairment

In some ways, the findings of this study are surprising given the recent observations of a dissociation between pragmatic and semantic impairments (Botting & Conti-Ramsden, 1999; Bishop, 1998). The data suggest that the PD group do indeed have semantic difficulties and that these may not be in line with receptive language age. This may give some insight into the different pattern of language development that is reported clinically of this group. Moreover, when tasks were examined in relation to each other, it was the SLI group who showed little association between the skills (unlike typically developing or those with PD), suggesting that the strategies underlying performance on the tests for both groups warrant further

exploration. It is of interest that tests of semantic ability often tend to focus on naming tasks or word finding, which require relatively superficial semantic knowledge. It is plausible that this task is more sensitive to the semantic impairments experienced by children with language impairment. Another possible explanation may be the presence of several children with ASD in our pragmatic language group, however even with these children removed, a significant difference between the PLI group and 7 year old comparison children was maintained.

On the other hand, the results reported here support previous studies in that no reliable differences were found between those with typical SLI and those thought to have pragmatic difficulties. In this sense, they reflect the position that semantic difficulties are not a defining characteristic of PD.

Inferential ability and communication difficulties

Despite clinical opinion to the contrary, other studies examining inferential ability have also struggled to measure any difference between those known to have pragmatic language difficulties and those with more typical SLI. Norbury and Bishop (2002) and Bishop and Adams (1992) found like the present study that children with pragmatic impairment were no different on tasks to SLI peers. Letts and Leionenen (2001) also reported similar results (although they have been able to report poorer performance in single case studies, see Leionenen and Letts, 1997). A study examining inferencing ability in children with a so-called non-verbal learning disability also could not find differences between this group and a group with language impairment (Worling et al, 1999). Why might this be the case? It could be that children with pragmatic difficulties do not in fact have a deficit in inferencing per se. That is, they may be able to make such judgements in the context of formal and

fictional situations, but have difficulty *applying* such knowledge in actual conversation. For instance,. Norbury and Bishop (2002) found that children with communication impairments could all make inferences, but not all were relevant to the story. Secondly, there may be a timing factor. Children with PD might indeed have problems with the task but may be able to "work out" correct solutions given enough time perhaps drawing on different resources to the other clinical groups. Researchers helping with data collection reported that this group seemed slower at reaching their answers. This advantage may not be available in conversation when timing is crucial for cohesion , coherence and turn taking and thus this group may become much less competent in real-life communication.

Limitations and further research

Although this study points to some interesting findings semantic and inferential ability in different clinical subgroups, these data provide only a first step in providing adequate information about typical and atypical development as children get older. No measures of linguistic skill or cognitive ability were available on the typically developing groups of children and it has therefore not been possible to assess the relationship between the target tasks and other factors which is needed in future studies. Furthermore, it is evident that the children in even the youngest of our typically developing groups were very able at the tasks and were performing near ceiling. It would be interesting to examine performance on this task at even younger ages. One reason for the near ceiling performance may be the high probability of answering correctly by chance created by offering only two response choices. This was done to minimise processing load (especially with special populations in mind), but future assessments would ideally have an additional foil response to allow more variation in scores. It was also noted during testing that children with PD and some younger typically developing children seemed to take more time over answering the questions, and thus the

measurement of reaction time on higher-level language tasks such as these might also be an interesting line of research in the future.

It might have been helpful for children to have given a justification for answers after completing the main task, especially where inferencing is concerned. In future studies, this might enable us to tease out any underlying differences between groups, work out why the PD and SLI groups did not differ and also why both groups with communication difficulty find this task harder than age-match peers. It might also have helped explain some of the failures on more ambiguous semantic items such as item 6: 'scratch – scrape or mark'. However, Letts and Leionenen (2001) did not find a qualitative analysis of inferencing responses useful in discriminating those with pragmatic difficulties, nor was any effect on overall results found when individual semantic items (such as that above) were removed. Finally, the numbers of participants here did not allow for in depth analysis such as separating skilled and less skilled subgroups, so future studies need larger group sizes to examine these areas of communication fully.

Concluding remarks and clinical implications

In summary, this study showed that semantic and inferential skill is poorer for those with communication difficulties than comparison children matched for age. This will not come as a surprise to most clinicians, but the measurement of these impairments has previously been difficult and the deficits hard to quantify. Furthermore, data presented here suggest that different clinical subgroups might perform differently on such tasks, and may be completing items using different strategies or underlying mechanisms. The difficulties seen here in a narrative task mean that problems with inferencing may not be confined to purely social paradigms which is especially interesting in relation to those with ASD. It is also interesting

that neither task related strongly to CCC pragmatic composite scale in either clinical group and we may need to examine more closely the online abilities of both groups in order to pin point the exact sources of pragmatic difficulty. This may in turn help remediation along with techniques such as Laing & Kahmi 's (2002) "think-aloud" strategy that enabled better inferencing performance in poor readers.

The tasks presented here have shown that clear differences can be identified between age-matched peers and different subgroups of children with communication impairments using short assessment tasks. However the tasks did not adequately distinguish between those with and without marked pragmatic difficulties. We hope that this study might encourage more interest in the assessment of higher-level comprehension abilities within clinical settings and the skills and strategies that underlie them.

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Table 1: Clinical group characteristics (means & sds) and **age equivalents**

	PIQ*	EVT	Recalling Sentences	BPVS	TROG	CCC+ a
SLI	93.34 (15.8)	11.1 (19.9) **7;9 – 7;11**	14.2 (20.5) **8;0 – 8;11**	20.7 (19.3) **8:6 – 8:8**	33.4 (33.5) **7;11 – 8;11**	145.7 (7.7)
PD	103.3 (28.6)	20.3 (21.1) **8;3 – 8;5**	13.1 (20.3) **8;0 – 8;11**	29.9 (30.2) **8:9 - 8:11**	34.2 (38.1) **7;0 – 7;11**	128.6 (10.5)

* = standard IQ points, + = raw score, all others in percentile rank for age.

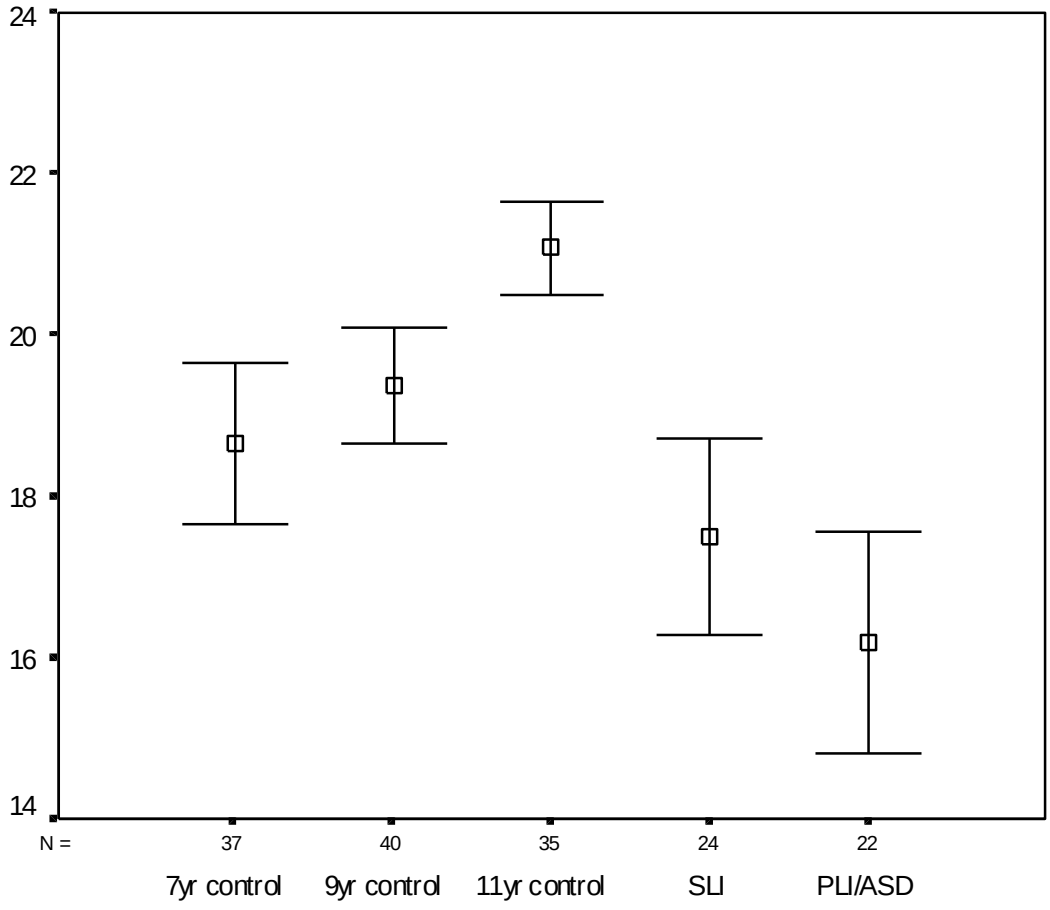
a = significantly different across groups, all others ns.

Table 2: Scores by task and group

	Mean (sd)	Median (IQR)	Minimum	Maximum
Semantic Choices				
	17.4 (3.0)	16.0 (5.0)	13	23
SLI	16.2 (3.2)	15.0 (5.0)	12	23
	21.1 (1.7)	22 (1.0)	16	23
PD	19.4 (2.2)	20.0 (3.0)	13	23
11 year olds	18.6 (3.0)	19.0 (5.0)	12	23
9 year olds				
7 year olds				
Inferencing				
	15.2 (2.6)	16.0 (4.0)	11	20
SLI	15.1 (2.5)	15.0 (4.0)	11	20
	17.0 (1.4)	17.0 (2.0)	14	19
PD	15.8 (2.5)	16.0 (3.8)	10	19
11 year olds	15.9 (2.5)	16.0 (4.0)	10	19
9 year olds				

7 year olds				

Fig. 1: Semantic Choices and Inferencing Task by group Means (95%CIs)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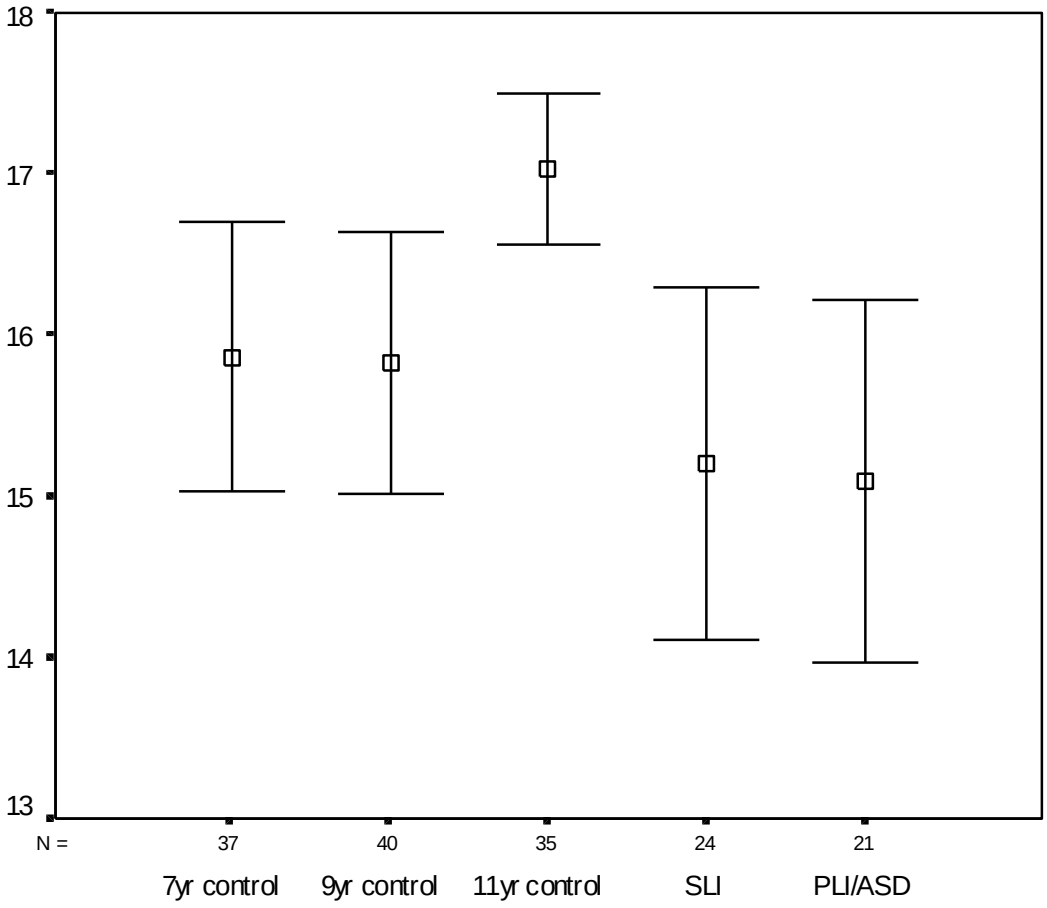
11yr control
SLI
PLI/ASD



Appendix 1 – Semantic Choices

Instructions to child

"We're going to look at some words which go together. I'm going to show you a word and I want you to listen while I read out two other words. You have to choose one of those words which is nearest in meaning to the word I show you. Let's say I show you this word [practice item 1 shown] 'small'. Let's choose which of these words 'little' or 'dirty' is the same or nearly the same in meaning".

"Now we're going to do some more words and I want you to choose them on your own this time. First listen and look at all the words and then point to the one you think goes with the word at the top. Remember that sometimes the words might not mean exactly the same thing, but they will be nearly the same thing."

Semantic questions

1. Meadow - field / wind
2. Laughter – giggle / face
3. Frost - icicle / knife
4. Heavy - hot / fat
5. Sweet - soft / pretty
6. Scratch - scrape / mark
7. Maze - puzzle / hedge
8. Timber - pencil / plank
9. Monsoon - sky / storm
10. Fair - blonde / hairy

Appendix 1 (continued)

11. Polish - spark / shine
12. Produce - display / clean
13. Safety - umbrella / shelter
14. Magic - spell / show
15. Fortune - purse / luck
16. Brave - fearless / kind
17. Wish - hope / hunger

18. Tame - warm / gentle
19. Agony - pain / plaster
20. Illusion - shadow / trick
21. Suspicion - doubt / guess
22. Trust - believe / know
23. Cunning - sharp / sneaky
24. Tempt - persuade / realise

Appendix 2 – Inferencing task

Instructions to child:

"We're going to have a look at a story together. I'll tell you the story and I want you to listen carefully and try to understand it."

[Story is read whilst looking at pictures– see below – then the pictures are put away]

"Now I am going to ask you some things about the story. All you have to do is say 'yes' if you think that's happened or 'no' if you think that didn't happen. Let's start with an easy one."

Text read out with pictures:

Picture1 – Once there was a lighthouse keeper called Mr. Grinling. At night time he lived in a small white cottage perched high on the cliffs. In the day time he rowed out to his lighthouse on the rocks to clean and polish the light.

Picture 2 – Mr. Grinling was a most industrious lighthouse keeper. Come rain or shine he tended his light.

Picture 3 – Sometimes at night, as Mr. Grinling lay sleeping in his warm bed, the ships would toot as they passed.

Picture 4 – Each morning Mrs. Grinling prepared a delicious lunch for Mr. Grinling and packed it into a special basket which she clipped onto a wire that ran from the cottage to the lighthouse on the rocks.

Picture 5 – But the lunch did not arrive. It was spotted by three scavenging seagulls. "Clear off" shouted Mr. Grinling, but the seagulls took not the slightest notice.

Picture 6 – That evening Mr and Mrs Grinling decided on a plan to baffle the seagulls. "Tomorrow I shall tie cloth to the basket" said Mrs. Grinling. "A very sound plan" said Mr. Grinling. But this didn't stop the seagulls.

Appendix 2 (continued)

Picture 7 – On Tuesday evening Mr and Mrs Grinling wracked their brains for another plan. "Hamish is a very good seagull chaser, and tomorrow he can guard the lunch. Hamish spat and hissed as Mrs. Grinling secured him in the basket. "I'll have a tasty piece of herring waiting for you when you arrive home" said Mrs. Grinling.

Picture 8 – Poor Hamish. His fur stood on end when the basket swayed and he felt much too sick to even notice the seagulls.

Picture 9 – The next day Mrs. Grinling came up with her best plan. “I have just the mixture for hungry seagulls!” exclaimed Mrs. Grinling. “ Mustard Sandwiches”, chuckled Mr. Grinling.

Picture 10 – The next day she packed the sandwiches in the same way and put the basket on the wire. And she packed the same sandwiches again the next day until the seagulls had had enough. Then on Saturday she put away the mustard pot and made a tasty lunch for Mr. Grinling.

Picture 11 – While he had his lunch Mr Grinling wondered where the seagulls had gone to now!

Appendix 2 (continued)

Inference Questions

1. Mrs Grinling makes lunch for her husband every day	(true)
2. Mr. Grinling spent every day in the lighthouse	(true)
3. The light was dirty	(true)
4. Mr. Grinling clipped the basket on the wire	(false)
5. The light warns ships of dangerous rocks	(true)

6. Seagulls don’t like spicy food (true)

7. She wanted the basket to slide down the wire to the lighthouse (true)

8. Mrs. Grinling put fish in the basket (false)

9. The ships tooted because they wanted Mr. Grinling to know they were there (false)

10. Mrs Grinling thought that Hamish would frighten the seagulls (true)

11. The cottage was low down on the cliff (false)

12. Seagulls only like ham sandwiches (false)

13. Mr. Grinling used a rowing boat to get to the lighthouse (true)

14. The seagulls knew that the sandwiches were under the cloth (true)

15. The wire was very strong (true)

16. The seagulls stopped eating when Mr. Grinling shouted at them (false)

17. Hamish felt sea sick (true)

18. Hamish liked being in the basket (false)

19. Mr. Grinling was responsible for keeping the light shining (true)

20. Hamish scared the seagulls away (false)