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Narrative skills in adolescents with a history of SLI in relation to non verbal IQ scores

Danielle Wetherell, Nicola Botting and Gina Conti-Ramsden

Abstract

Background: There is a debate about whether children with primary language disorders and normal cognitive levels are qualitatively different from those with language impairments who have low or borderline nonverbal IQ (NVIQ). As children reach adolescence, this distinction may be even harder to ascertain especially in naturalistic settings. Narrative may provide a useful, ecologically valid way in which to assess the language ability of adolescents with specific language impairment (SLI) who have intact or lowered NVIQ and to determine whether there is any discernable difference in every day language. **Method:** 19 adolescents with a history of SLI completed two narrative tasks: a story telling condition and a conversational condition. Just under half the group (n=8) had non-verbal IQs of <85. The remaining 11 had NVIQs in the normal range or above. Four areas of narrative (productivity, syntax, cohesion and performance) were assessed. **Results:** There were no differences between the groups on standardised tests of language. However, the group with low NVIQ were poorer on most aspects of narrative suggesting that cognitive level is important even when language is the primary disorder. The groups showed similar pattern of differences between story telling and conversational narrative. **Conclusion:** Adolescents with a history of SLI and poor cognitive levels have poorer narrative skills than those with normal range NVIQ even though these may not be detected by standardised assessment. Their difficulties present as qualitatively similar to those with normal range NVIQ and narratives appear impoverished rather than inaccurate.

Introduction

The diagnosis of SLI is based partly on the presence of low language scores and in part through the absence of poor cognitive ability. However, in recent years this picture has been complicated by the fact that a number of studies have found increased cognitive difficulties in this group. For example children with SLI have been shown to be poorer than their peers on tasks measuring phonological memory (Gathercole & Baddeley, 1990); verbal memory (Ellis Weismer, Evans & Hesketh, 1999) as well as visuo-spatial memory span (Hick, Botting and Conti-Ramsden, 2005a), symbolic play (Roth & Clark, 1987) and spatial rotation (Johnston & Ellis-Weismer, 1983; see Leonard, 1998, for a full discussion).

There is currently a debate about whether a qualitative difference exists between children with SLI and those with primary language impairments whose NVIQ's fall below the normal range. Recently, there have been some interesting investigations into the theoretical divide between those with specific- and non-specific-language impairment (NLI). In a genetic twin study, Hayiou-Thomas, Oliver and Plomin (2005) examined both MZ and DZ pairs of which one twin had SLI and the other NLI. They found that although multiple genetic and environmental factors were likely to underlie both disorders, only some genetic overlap existed between the groups suggesting that there may be some valid reasons for treating the groups separately. Interestingly this was particularly true when the cognitive impairments were more severe, perhaps suggesting that degree of cognitive difficulty might also represent qualitative rather than quantitative differences. Thus there is a school of thought emerging that performance IQ may not necessarily affect severity of language problems (Van der Lely, 2003; Bishop, 1997). Rice, Tomblin, Hoffman, Richman, & Marquis (2004) found that whilst general cognitive delay did not necessarily lead to poor syntactic development, low cognitive ability and language difficulties in combination led to the poorest performance on syntactic tasks. Nevertheless, both

NLI and SLI groups showed difficulty with grammatical marking and could be clinically identified on these grounds.

Along side these studies, others suggest that there may also be a relative decline in general non-verbal IQ (Botting, 2005) or at least in certain skills tested by some IQ measures (Matrices appear to give a more stable picture over time, e.g., Dockrell et al, 2005). As well as falling NVIQ as measured by standardised assessments (see also, Tomblin et al, 1992; Mawhood et al, 1989), other studies have showed that children with SLI matched on non verbal ability with a Down Syndrome group developed more slowly over a year on a non-verbal memory measure (Hick, Botting and Conti-Ramsden, 2005b).

Partly because of these data, there is a more general ongoing debate about how to define SLI and which criteria are most useful. Tomblin and colleagues (1996) set a ‘gold standard’ for language test thresholds of below 1.25 SD. However this was based on a large epidemiological study. In clinical samples and when investigating unstandardised assessments of language skills such as narrative (as in the present study) more relaxed cut-offs such as 1SD may be more helpful as this increases sensitivity and minimises the risk of excluding children who are indeed language impaired but are nevertheless able to perform reasonably on highly structured tests. Many clinicians prefer to use a ‘discrepancy’ criterion in which language skills must be significantly below cognitive ability. This has also been questioned by some (see Bishop, 1997 for a discussion) and is one of the motivations for the current investigation.

Thus it appears that SLI cannot be used to argue convincingly for a pure dissociation between language and cognition. Furthermore, in many of the studies above children with SLI have performed below the level of younger, language matched controls as well as peers. Some

authors have even suggested that the ‘cause’ of SLI lies in slower generalised processing. Miller, Kail, Leonard & Tomblin (2001) obtained reaction time data from one sample of children with SLI on a range of linguistic and non-linguistic tasks with the specific aim of assessing the general slowing hypothesis. The non-linguistic tasks involved either simple motor responses and others required the use of visual-spatial abilities. The results supported the general slowing hypothesis as children with SLI responded more slowly on both linguistic and non-linguistic tasks and between 14% and 21% slower than typically developing children matched for performance IQ. Children with non-specific language impairment (with nonverbal IQ and language scores below mean for age) were also compared on the measures and were slower than the children with SLI. In contrast, Bavin and colleagues (2005) recently found children with SLI to be less accurate but not slower on non-verbal tasks, when compared to peers. Any model of cognitive deficit in SLI needs to be able to explain why individuals with the disorder do not present with the same behaviours as those with more general learning impairments and need also to take into account developmental change in non-verbal skill.

Narrative as a measure in young people with Language Impairment (LI)

Narrative requires the successful integration of a multitude of elements including cognitive skills, the use of world knowledge and an awareness of the listener in order to successfully convey both the message and additional information about the characters involved. Narrative ability is often assessed by therapists in the UK using the Bus Story (Renfrew, 1991) but this is less useful with children of older ages. Furthermore, although there have been a number of studies showing that children with LI have difficulties with producing sophisticated narrative including linguistic markers such as past tense ‘ed’ through to poor ‘story grammar’ (see Liles, 1993 for a review), to the authors’ knowledge no studies have examined the relationship between narrative and non-verbal IQ in children with language impairments. In a study

comparing different diagnostic groups, however, Reilly et al. (2003) found that their Williams syndrome and SLI groups were similar with respect to syntactic abilities using narrative regardless of a clear difference between groups on full scale IQ score. At the same time, children with poor narrative ability at preschool age have been shown to be at risk of poor reading development (Boudreau & Hedberg, 1999; Westby, 1989) and poor academic achievement (Bishop & Edmundson, 1987). The relationship between narrative and non-verbal IQ is therefore of interest.

The present study

The aim of this study was to explore the narrative abilities of two groups of children with a history of specific language impairment: those with normal range NVIQ and those who now have low NVIQ. A range of linguistic and wider narrative measures were examined using two different narrative genres, story telling and conversational narrative. The analyses use a mix of quantitative and qualitative methods. The aim was to investigate i) whether any differences were identifiable between the two groups and ii) whether either of the two groups was more sensitive to differing narrative genre.

Method

Participants

Adolescents with Specific Language Impairment

The participant group consisted of 19 adolescents recruited from a wider study (Conti-Ramsden et al., 1997, Conti-Ramsden & Botting, 1999, Conti-Ramsden et al., 2001). All adolescents had a history of SLI at least at one time point in the study (7, 8 or 11-years-old: i.e. a nonverbal IQ of ≥ 85 and scores of at least one standard deviation below the normative mean on one or more standard language assessment tests; See also Wetherell et al, submitted). However at the point of testing, 8 children had a non-verbal IQ below this threshold. Participants were therefore split into two IQ based subgroups: those with a history of SLI and a performance IQ within the normal range at 14 years of age (NIQ; n=11) and those with a history of SLI and a low performance IQ at 14 years of age (LIQ; n=8). Both groups had a mean age of 14.3 years. No participant had primary pragmatic language impairment (as measured by scores of >132 on the Children's Communication Checklist pragmatic composite; Bishop, 1998). Table 1 presents the age, gender distribution, mean CELF language scores and performance IQ for each of these subgroups.

[Table 1 about here]

The current language profiles of the group were mixed, but as can be seen from table 2, the majority (n=16) still scored below 1.25sd (following Tomblin et al, 1996) on at least one part (expressive or receptive composite) of the Clinical Evaluation of Language Functions (CELF 3; Semel, Wiig, Secord, 1995). Although some variation on CELF scores can be seen, the variation was no greater in either group than expected in the general population (i.e. not significantly more than 15 points for 1SD). More than half of the 19 adolescents recruited with a history of SLI still fitted the SLI profile (n=10). Information regarding educational placement

was unavailable for 2 adolescents with a history of SLI, however the remaining 17 all attended mainstream schools at the time of the current study. Of the 17 adolescents, 10 adolescents (58.8%) had some educational support within the school environment (varying in degree from 1 hour a week to every lesson). Table 2 presents individual information about each of the participants.

[Table 2 about here]

Tasks

There were two genres of semi-structured naturalistic oral narrative tasks: a story telling task: *Frog where are you?* (Mayer 1969) which is a wordless 24-picture storybook telling the adventures of a boy and his dog who are in search of their frog that has escaped from a jar in the boy's bedroom (see Fig 1 for picture); and a *conversational narrative task*, (Ingham, *personal communication*) which consisted of a conversational prompt used to elicit naturalistic spontaneous narratives about a most annoying person. This format encourages adolescents to use verbal 3rd person singular –s. They represent interesting complementary paradigms in a number of ways: One has picture prompts, while the other does not; one is based on a fictional scenario, while the other is a real-life description; one encourages past tense use, while the other is more likely to elicit present tense structures. Instructions for two tasks are presented in the appendix.

[Fig 1 about here]

Narrative analysis and reliability coding

Narratives were transcribed by the first author using the CHAT transcription system which is part of CHILDES. The CHILDES system (Child Language Data Exchange System, McWhinney, 1991) provides tools for studying conversational interactions. These tools include a database of transcripts (the CHILDES database), a set of conventions and principles for

transcribing conversational interactions (the CHAT transcription system) and programs for computer analysis of transcripts (The CLAN system; for further information see <http://childes.psy.cmu.edu/>). A second transcriber as a measure of reliability checked 25% of the CHAT transcripts and overall agreement exceeded 93% (story telling narratives 93% and conversational narratives 94.28%). A second coder coded 25% of the narratives following the coding scheme detailed below. For all measures agreement exceeded 90%. Where the data were categorical Cohen's Kappa was used to create an index of inter-rater reliability. Values above 0.7 are considered to represent satisfactory agreement. All measures were above this 0.7 cut off (range 0.71-0.98). Four main areas of narrative were examined: Productivity, Syntactic complexity, Syntactic errors, and Performance. These are described below.

For *productivity*, 2 measures were taken: The total **number of morphemes** - this count excluded repetitions, hesitations and unintelligible speech but included all additional morphemes (plural -s, verbal 3rd person singular -s, verbal past tense -ed and present progressive -ing); **number of different words** - this count was included in order to measure lexical diversity.

For *syntax*, 3 measures were recorded: **Total number of syntactic units**. The definition used for this measure was taken from Norbury & Bishop (2003). A single syntactic unit was classed as a full main clause and any subordinate clauses belonging to it. Simple and complex sentences were counted as one syntactic unit (e.g. "while the boy was sleeping, the frog escaped") and compound sentences were counted as two syntactic units (e.g. "the boy went to sleep and the frog escaped"); **Total number of complex sentences** included subordinate clauses, complement clauses, verbal complements and passive constructions. Finally **total number of syntactic errors** were counted. These included tense, agreement and lexical errors as well as omissions (e.g. subject omissions) and additions (e.g. added morphemes).

Cohesion and *informativity* were rated mainly for the story telling task. Cohesion refers to referential use within narratives. For example, how characters and story lines are established and sustained. Four measures were noted: The **total number of nouns** used, the use of **nouns for re-introduction** (rather than pronouns) and a **semantic score**. The scoring system used for this measure was taken from Norbury & Bishop (2003). They listed ‘...51 plausible propositions one could include in a narrative of the frog story’ (2003:297) and awarded two points for a complete and accurate proposition or just one point for a proposition that contained partial or inaccurate information. See table 3 below for the score sheet. **Total number of different annoying/naughty things reported**. This measure was included to provide an indication of the quality of the conversational narrative. Recall that the topic of that narrative was to talk about a very annoying person. As each response to the question was very personal the answers could not be scored in the same way as the story telling narrative task, but this measure quantified the amount of relevant information given in response to the specific question.

[Table 3 about here]

There were 4 measures of *performance*: **Amount of support required from investigator** and **amount of prompts required from investigator**: Utterances made by the investigator were assessed. If they were conversational, empathetic, reassuring or agreeing without questioning or being essential to the continuation of narrative then the utterance was counted as a support. For example <uh-huh> or <oh dear!>. If an utterance took the form of a question or the intonation of a question it was counted as a prompt. For example <what happened then?> or <and?>. Where the investigator replied to a question from the participant they were counted as prompts if the answer was essential to continue or as supports if no direct information was given. **Total number of fillers**. This measure counted the number of fillers present and was used to assess

the fluency of the narratives provided by the participants. The main fillers that were counted were <um>, <er>, <you know>, <sort of> and <like>. The latter two were only counted when they were not the main verb or were not being used to make a comparison or simile. Usually the latter two were used in conjunction with <um> or <er> and were then counted as two separate occurrences of a filler; **Total number of corrections** this measure counted the total number of disfluencies in the narratives. False starts and retracing both with and without corrections (all coded separately in CHAT) were included in this measure.

General Procedure

The adolescents were visited individually either at school or at home after school (depending on school access policy and personal preference). The tasks took approximately 15 minutes in total to complete and both tasks were tape recorded. The adolescents with SLI also completed a battery of other standardised language tests to assess their current language profile and other skills related to the wider study. The first author completed all the narrative assessments. However, other research assistants completed psychometric testing, therefore the narrative assessments were conducted blind to IQ status. British Psychological Society (1995) ethical guidelines were followed throughout and participants could choose to opt out of the study at any time.

Results

Due to the differences in numbers of participants across these smaller groups and the exploratory nature of this analysis, non parametric analyses were used.

CELF scores

Interestingly, the NIQ and LIQ groups did not differ on their overall CELF scores (means 74.2 and 78.1 respectively; Mann Whitney $U=38.0$; $p=0.66$) or on the expressive composite (means 67.7 and 73.3 respectively; Mann Whitney $U=34.0$; $p=0.44$) and receptive composite (means 83.6 and 86.4 respectively; Mann Whitney $U=38.5$; $p=0.66$). Indeed scores slightly favoured the LIQ group.

Comparison of subgroups on combined narrative measures

Table 4 shows the means (and standard deviations) for the NIQ and LIQ subgroups on both the narrative measures combined.

[Table 4 about here]

Despite the fact that language scores on standardised tests did not differ between the groups, narrative analysis identified a number of differences (see table 4). Both measures of productivity were greater for the group with normal NVIQ as were, the total number of syntactic units and the number of nouns used overall.

In addition, the groups differed on their inclusion of semantic information on the story telling task, with the normal NVIQ group producing many more pieces of semantically relevant text.

Finally those with normal range NVIQ used many more corrections during the narrative tasks. Recall that the NIQ subgroup had greater number of syntactic units (longer narratives) and nouns. These data taken together with the performance data, suggest that the NIQ subgroup are producing longer narratives but that this is effortful with more disfluencies including fillers and corrections.

Furthermore, although other statistical comparisons did not reach significance, the trend was for those with lower NVIQ to perform less favourably than NIQ peers. This is interesting for two reasons. Firstly, the effects may represent a cumulative effect of non-verbal IQ on narrative or a general trend that would reach significance with more statistical power (that is larger groups). Secondly, the direction is the opposite to that found on standardised tests of language suggesting perhaps that those with LIQ are supported somewhat by the testing situation or that those with NIQ can compensate more easily in naturalistic settings than on formal measures. It may also be worth noting that children with lowered NVIQ did not make significantly more *syntactic errors* but instead showed limited use of positive narrative devices such as inclusion of appropriate semantic information.

Comparison of groups across genres

Table 5 shows the narrative measures for each genre for both the NIQ and LIQ subgroups separately. Cohesion and semantic scores are not presented here as they were each only taken from one task. As can be seen from the Wilcoxon tests, both groups showed narrative differences between the different genres to the effect that the conversational tasks produced shorter and more limited narratives but also contained significantly fewer errors. Although the differences between genre are less marked for the LIQ group, this may be due to smaller ranges of scores, and overall the pattern of differences between genres is strikingly similar for both

groups. Thus it is not that the LIQ group has ‘added’ difficulty with one genre compared to those with normal NVIQ.

[Table 5 about here]

Discussion

This study has presented a number of interesting findings. First, the scores on standardised tests of language did not differentiate the NIQ and LIQ groups. However, both narrative genres revealed more subtle differences in the use of everyday language for those with lowered NVIQ. These two groups did not differ on mean number of errors, but instead showed narratives that were more limited in length, as well as syntactically and semantically. Finally, although the genres produced significant differences on many of the narrative measures, this occurred equally for both groups and the groups did not show a markedly different pattern of response across genre.

In general, the group with normal range NVIQ performed above their LIQ peers on a variety of narrative measures. However, further examination suggests that narratives were still effortful - for example, the additional length of narratives and increased noun use is at least partly explained by the increased number of corrections used by the NIQ subgroup and there was an increased use of fillers by the NIQ subgroup. In other analyses, the SLI group as a whole were found to perform significantly more poorly on these tasks than typically developing peers (Wetherell, et al. submitted).

These findings extend the debate about the use of IQ as a criterion in SLI. This debate is particularly relevant to clinical practice and policy in which children with language impairments and low IQ are often excluded from specialist language provision (Conti-Ramsden and Botting, 2000). The present study suggests that in many respects children with lower NVIQ perform in qualitatively similar ways on both standardised tests and on different genres of narrative. This is in line with evidence gathered in intervention contexts. Fey, Long & Cleave (1994) noted that children with SLI and children with low nonverbal IQ scores

(who would have otherwise have been classed as having SLI) made comparable gains in a treatment study focused on improving grammatical skills. At the same time, the results of the present investigation may indicate a difference in the severity of every day language difficulties and the limitations this may place on communication, that are not always identifiable using formal assessments.

However it is worth noting here that the group of children with LIQ participating in this study, were originally identified as having normal range NVIQ. Thus the differences seen in this group may not be the same as for children who present with limited NVIQ at an earlier age. Indeed the narrative difficulties experienced by this group may be as much related to the *decrease* in nonverbal IQ with age rather than low IQ per se. For example, Reilly et al. (2003) also evaluated the different types of complex syntax used in narrative across three clinical groups – those with SLI, William’s syndrome and Down Syndrome and found that even in the oldest age group children with SLI used a more restricted range of complex syntax than their typically developing peers. This is in stark contrast to the children in the other two clinical groups who performed at the same level as the children with typically developing language at 10 to 12 years old. As described earlier, Hick et al (2005b) also found that development of verbal and non-verbal skills over time was different for those with Down Syndrome and SLI despite matching initially for non verbal ability. These investigations suggest perhaps that the narrative differences found in the present study are not merely a simple factor of low NVIQ per se but may have more to do with ‘why’ the LIQ group showed a decline in NVIQ over time whilst the remainder maintained good cognitive function. It may be that a general lowering of NVIQ reflects the specific difficulties with certain cognitive functions, such as memory seen in other studies (e.g., Bavin et al, 2005; Ellis-Weismer et al, 1995) which in turn affect narrative performance and language in naturalistic settings.

Narrative investigations are rarely conducted longitudinally (Reilly et al, 2003 being a notable exception) or using participants who are in adolescence. It is plausible that the long-term effect of poorer cognitive skills lead to increasingly more limited functional language (when compared to the development of peers). Further research is needed to investigate narrative abilities in different groups of children with LI over time and in relation to change in NVIQ, especially since other studies have found that any decline in nonverbal IQ may be relatively temporary for those with SLI with some gains noted in adulthood (Clegg et al., 2005). In addition, it is important to note that this group of children did not show pragmatic difficulties and the role of these added impairments is not fully understood. For example, Botting (2002) suggested that individuals with primary pragmatic language impairment may show more qualitatively different patterns of narrative and everyday language, than those with LIQ. Further research exploring the possible interactions of factors such as these would be of interest.

Concluding remarks and clinical implications

This study suggests that assessing children who have LI with low NVIQ on standardised assessments may not adequately tap into additional limitations they experience in everyday communication. Impoverished narrative ability has implications for adolescents in the mainstream classroom (where the majority of children with SLI are placed by age 14) and for social interaction. Conti-Ramsden and Botting (2004) have previously reported social difficulties in the wider group of children from which this sample was recruited at a younger age. Difficulties with conversational narrative in particular may be an important skill for interaction and later for successful relationships (Brinton, Robinson & Fujiki, 2004). It appears that children with a history of SLI who also show a pattern of declining NVIQ may be particularly at risk and thus may benefit from continued specialist language provision.

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Table 1: Descriptive data for the two groups (means and SD unless otherwise specified)

<u>Group</u>	Age (months)	Gender (N and %male)	NVIQ	CELF TLS
NIQ (n=11)	171.8 (8.7)	8 (73%)	96.6 (11.4)	74.2 (11.3)
LIQ (n=8)	171.4 (6.7)	6 (75%)	78.4 (6.2)	78.1 (16.0)

Table 2: Language profile for group of adolescents with a history of SLI

	Gender	Support in school	CELF expressive language score	CELF receptive language score	CELF total language score	WISC Perform. IQ	WISC Verbal IQ	WISC Full IQ
NIQ	F	N	70	91	78	119	75	94
	M	N	50	50	50	86	54	66
	M	N	86	95	90	99	115	108
	M	Y	54	67	59	90	90	88
	F	-	72	103	86	116	82	96
	F	Y	73	83	76	91	90	89
	M	N	62	95	77	99	88	92
	M	Y	76	76	74	85	70	75
	M	N	70	93	80	88	99	93
	M	Y	62	93	76	96	93	94
	M	-	70	74	70	94	79	83
LIQ	M	Y	67	63	63	78	84	79
	F	Y	80	95	86	84	83	81
	M	Y	76	103	89	82	87	82
	M	Y	84	112	98	78	89	82
	F	N	67	65	64	82	75	76
	M	Y	59	63	56	66	58	60
	M	N	86	105	95	84	87	83
	M	Y	67	85	74	73	70	69

Table 3: Semantic items in story-telling task (following Norbury and Bishop 2003)

1. Boy had pet frog and dog	27. Bee swarm (hive) falls / knocked down
2. Frog in jar	28. Boy looks in hole in tree
3. Frog got out / escaped	29. Owl comes out of tree
4. In the night / while boy asleep	30. Bees chase dog
5. Next day / in the morning / when boy awoke	31. Boy falls down
6. Boy finds frog has gone	32. Owl frightens boy
7. Look for frog in boot	33. Boy climbs / looks over rock
8. Look for frog in jar	34. Boy calls for frog
9. Look everywhere	35. Boy holds on to antlers / branches
10. Dog head stuck in jar	36. Boy doesn't realise its a deer
11. Call frog / say "frog where are you?"	37. Deer picks up boy
12. Call / look out of window	38. Deer carries / runs with boy
13. Dog falls out of window	39. Dog runs after
14. Jar broken	40. Deer stops suddenly
15. Boy goes out of house / window	41. Deer ducks / tosses / throws boy
16. Boy picks up / cuddles dog	42. Boy and dog go over cliff / edge
17. Dog licks boy	43. Dog on boy's head
18. Boy angry / says dog is naughty	44. Fall into water / pond / lake
19. Boy (+ dog) calling / looking for frog	45. Boy hears frog sound
20. Boy and dog go into the woods / forest	46. Boy says shh / tells dog to be quiet
21. Boy looks in / shouts in hole	47. Boy + dog look over / climb over log
22. Creature comes out of hole	48. Find his / the frog
23. Creature bites boy's nose	49. Frog family (mum dad + babies)
24. Dog jumps up at tree	50. Take home baby frog / little frogs
25. Dog barks at bees	51. Say goodbye to frogs
26. Bees come out	

Table 4: Group means on combined narrative measures

	NIQ (n=11)	LIQ (n=8)	Mann-Whitney U	p-value – difference between groups
Productivity				
Number of morphemes	574.00 (106.52)	312.75 (85.90)	1.00	<.001
Number of different words	203.27 (24.88)	130.25 (36.85)	7.00	.001
Syntax				
Total number of syntactic units	54.82 (11.77)	35.63 (10.10)	9.00	.002
Total number of complex sentences	9.18 (4.64)	6.13 (4.02)	27.0	.159
Total number of errors	5.91 (5.68)	6.13 (4.19)	44.00	.500
Cohesion and informativity				
Total number of nouns (story telling narrative only)	23.91 (10.32)	15.29 (8.67)	19.50	.043
Reintroduction – number of nouns (story telling narrative only)	20.64 (8.84)	14.29 (8.04)	23.50	.087
Semantic information (story telling narrative only)	54.6 (9.4)	39.1 (11.7)	13.00	.009
Number of characteristics mentioned (conversational narrative only)	5.6 (1.8)	4.9 (1.6)	33.00	.395
Performance scores				
Total number of supports from INV	8.36 (6.62)	7.13 (6.62)	37.50	.295
Total number of prompts from INV	4.82 (3.25)	4.50 (3.74)	42.00	.434
Total number of fillers	13.0 (8.0)	6.25 (5.3)	21.00	.062
Total number of corrections	16.2 (9.6)	5.5 (3.2)	12.00	.007

Table 5: Narrative scores by genre for both groups

	NIQ			LIQ		
	Story telling	Conversation	Wilcoxon	Story telling	Conversation	Wilcoxon
Productivity						
Total number of morphemes	450.82 (109.14)	123.18 (75.29)	.004	250.50 (79.70)	62.25 (36.62)	.012
Total number of different words	137.36 (23.58)	65.91 (28.67)	.006	92.00 (27.63)	38.25 (16.40)	.012
Syntactic complexity scores						
Total number of syntactic units	41.73 (10.64)	13.09 (6.35)	.003	27.63 (9.62)	8.00 (2.39)	.012
Total number of complex sentences	5.55 (3.14)	3.64 (3.30)	.098	5.00 (3.42)	1.13 (1.36)	.021
Total number of errors	4.18 (4.58)	1.73 (2.49)	.065	4.38 (3.93)	1.75 (1.98)	.173
Performance scores						
Total number of supports from INV	5.27 (4.76)	3.09 (3.18)	.139	3.75 (4.62)	3.38 (3.29)	.114
Total number of prompts from INV	1.45 (1.81)	3.36 (2.54)	.081	1.88 (2.10)	2.63 (2.62)	.932
Total number of fillers	8.73 (7.34)	4.27 (1.74)	.090	4.13 (4.29)	2.13 (1.25)	.462
Total number of corrections	13.45 (7.92)	2.73 (2.69)	.005	4.13 (2.48)	1.38 (1.41)	.029

Figure 1: Frog Story example page

Frog, where are you?



Appendix: narrative protocols

Story telling

- Before beginning the main task, a conversation with the participant was initiated by the investigator about something that happened to them yesterday or last week (“can you tell me about something you did yesterday/last week?”).
- The materials included four envelopes each containing a copy of the frog story.
- All four envelopes were placed on the table. The investigator instructed the participant as follows: “Each of these envelopes contains a picture book that tells a story about something else that happened yesterday/last week. The four stories are almost the same, but some things that happened are just a little bit different in each story.”
- The investigator then asked the participant to choose an envelope and look at it without showing the investigator.
(“Choose one of the envelopes and then take it over there away from me and have a good look at all the pictures in the book. Then come back and tell me the story. I have to guess which story it is.”)
- When the participant was ready they were invited back to the table where they could use a screen to hide the book from the experimenter. The investigator then instructed the participant: “Now tell me the story of what happened yesterday / last week remember to tell me all the details so I will know exactly what happened and who did what, then I can guess which story you have. I will get you started. Last week...”.
- The investigator listened as they told the story and signalled that she was following by nodding and saying “uh-huh”. She did **not** intervene unless the participant stopped narrating and then encouragement was given to carry on. If the participant was not looking at the book whilst narrating the story they were encouraged to do so.
- The participant was encouraged to tell the story in the past-tense thus if the participant started in the present tense, a prompt like “what happened then?” was used. However, if the participant continued in the present after two prompts, no further prompts were made.

Appendix (cont.)

Conversation

- The investigator instructed the participant as follows: “Think of the most annoying person you know.”
- The investigator then asked the question: “Can you tell me some of the things this person does everyday that annoy you?”
- The investigator listened as they told the narrative and signalled that she was following by nodding and saying “uh-huh” or responding conversationally when necessary (“yes that would be annoying!”). She only intervened if the participant stopped narrating and then encouragement was given to carry on and to speak for as long as they wished on this topic.
- The participant was encouraged to use the verbal 3rd person singular –s thus if their response did not take this form, a prompt like “what other things does he/she do everyday that annoy you?” was used. However if the participant continued to use a different form after two prompts, no further prompts were made.