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Constraints in the Production of Written Text in Children With Specific Language Impairments

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ABSTRACT: *The writing performance of 64 elementary school children with a history of specific language impairment was examined to evaluate both the nature of the children: difficulties with writing and the relationship between oral Language, reading, and writing. Children were assessed at age 8 on a range of language, literacy, and cognitive measures and reassessed at age 10 when they completed a standardized writing measure. At age 10 the children continued to experience problems with oral language and language levels were significantly poorer than nonverbal skills. Writing was characterized by short texts with poor sentence structure and little evidence of ideas and organization. Both concurrent measures of receptive vocabulary and reading skill were significant factors in explaining levels of written language.*

Children with specific language impairment (SLI) are a vulnerable population. Practitioners, policy makers and researchers use a range of different terms to describe this population (see Lindsay, Dockrell, Mackie & Letchford, 2002). Moreover, a range of terms are used in Europe (dysphagia) and North America **(USA:** SLI, or in parts of Canada: dysphagia) and more recently primary language disorder (Tomblin, Buckwalter, & O'Brien, 2003). The population is heterogeneous with the specific nature of their problems residing with one or more subcomponents of the language system. We use the term specific language impairment to reflect the most common usage in the literature.)

These children experience problems with the acquisition and processing of oral language **skills.** The most commonly used core criterion to iden-

tify children with SLI is that their language problems cannot be explained in terms of other cognitive, neurological, or perceptual deficits. Problems are characterized by a protracted rate of language development as well as particular difficulties with subcomponents of the language system (Leonard, 1998). Cognitive levels of explanations of SLI have yet to reach a consensus on whether language abilities exhibit a particularly salient impairment arising from a domain-general deficit such as processing capacity or speed (Miller, Kail, Leonard, & Tomblin, 2001) or whether the disorder represents a language-specific deficit (van der Lely, 2005). There is more agreement that the disorder is heterogeneous in terms of language profiles (Conti-Ramsden & Botting, 1999) and in the severity of expressive and receptive language impairment (Bishop, 2002).

Recently progress has been made in identifying the core linguistic deficits of SLI. Measurements that tap into children's proficiencies with phonological processing, sentence recall, nonword repetition, and tense marking have all demonstrated high levels of specificity and sensitivity in differentiating children with SLI from their typically developing peers (Bishop et al., 1999; Bishop, North, & Donlan, 1996; Briscoe, Bishop, & Norbury, 2001; Conti-Ramsden, Botting, & Faragher, 2001; Ellis Weismer et al., 2000; Rice, 2000). Although conventionally identified by discrepancy criteria, children with SLI are also heterogeneous in terms of nonverbal skills (Botting, Faragher, Simkin, Knox, & Conti-Ramsden, 2001). Patterns of performance vary over time both in terms of linguistic skills (Law, Boyle, Harris, Harkness, & Nye, 2000) and nonverbal ability (Botting, 2005).

Children's linguistic deficits have marked effects on the processing of written text (Bishop & Snowling, 2004). Difficulties are evident in both word reading and comprehension (Catts, Fey, Tomblin, & Zhang, 2002; Stothard, Snowling, Bishop, Chipchase, & Kaplan, 1998). These reading problems are not explained by phonological awareness problems alone (Bashir & Scavuzzo, 1992; Bishop & Snowling). As with linguistic performance there is considerable variability within the population on these measures, only some of which is explained by variance in language competence and cognitive skills (Young et al., 2002). Such difficulties further compromise the children's developmental trajectories.

Children; Linguistic deficits have marked effects on the processing of written text.

Surprisingly, and in marked contrast to the extensive work on the written language of children with learning disabilities (Graham, Harris, MacArthur, & Schwartz, 1991; Li & Hamel, 2003), few studies have considered the written language skills of children with SLI and the cognitive mechanisms that support writing for these children. The nature and extent of the combination of language and literacy difficulties that are associated with SLI would suggest that these children should also have severe limitations in the generation of written text.

WRITTEN LANGUAGE IN CHILDREN WITH SLI

There are a number of reasons to predict that children with SLI would experience difficulties with writing. These reasons can be considered across three domains: language, literacy, and working memory. The difficulties that children with SLI experience at the word (Leonard, Eyer, Bedore, & Grela, 1997; Messer & Dockrell, 2006), and sentence level (van der Lely & Ullman, 2001) will impact on the infrastructure of the written text and may result in shorter texts with reduced content, the production of simple rather than complex sentences, and the omission of prepositions, articles, and inflectional morphology (Leonard, McGregor, & Allen, 1992; Rice & Oetting, 1993). Associated problems with phonological awareness may affect writing through increased numbers of spelling errors (Clarke-Klein, 1994; Lewis & Freebairn, 1992; Treiman, 1991). In addition, the high cognitive demands placed on the individual in creating written text may overload a working memory system that is, arguably, reduced in processing capacity in children with SLI (Ellis Weismer, Evans, & Hesketh, 1999; Gathercole & Baddeley, 1990; Montgomery, 2000; Windsor & Hwang, 1999). Thus vulnerabilities with language should lead to limitations in the production of

written text. However, literacy skills could also serve as a moderating factor where children with more competent reading and spelling levels compensate for limited language skills. In sum, children with SLI should experience difficulties in producing coherent and grammatical text. The extent of the problems with writing should be related to language levels, but text production may be further moderated by literacy and phonological working memory.

Despite the substantial indirect evidence that children with SLI will have difficulties with written language, there have been limited attempts to specify the nature and extent of the children's problems beyond single word spelling. Yet there is a substantial variation in the written narrative skill of children with SLI that is not captured by single word spelling (Bishop & Clarkson, 2003). The few published studies that have examined the written texts of children with SLI provide a mixed picture of the factors that limit the production of written text. Children with SLI do indeed produce a high number of spelling errors (Bishop & Clarkson; Lewis & Freebairn, 1992; Treiman, 1991), particularly phonological errors (Clarke-Klein, 1994; Mackie & Dockrell, 2004), and error patterns can deviate from those of chronological age (CA) but not language matched (LA) peers (Mackie & Dockrell). Children with SLI show an increased level of grammatical errors in the written form (Gillam & Johnston, 1992; Mackie & Dockrell; Scott & Windsor, 2000; Windsor, Scott, & Street, 2000); more verb composite errors (Windsor, Scott, & Street), and the omission of both whole words and of plural inflections (Mackie & Dockrell).

However, Bishop and Clarkson (2003) found that these children's most common associated problems were not grammatical difficulties but problems with spelling and punctuation, and poorer semantic content. They argued that it was the children's phonological processing deficits that were central in causing the children's written language problems and that this was demonstrated by the close link with the children's difficulties in repeating nonwords. Together, these studies would suggest that text production in children with SLI is related, primarily, to poor syntactic and phonological skills. However their explanatory power requires further clarification given the failure to consider (a) concurrent versus predictive causes of writing difficulties, (b) the moderating effect of children's literacy levels, and (c) the importance of working memory limitations for this population.

Current research on the writing skills of children with SLI has been based on concurrent studies, which consider the children's writing skills at a particular point in time and provide a profile of the textual difficulties in comparison to CA and in some cases LA matches. Current deficits may not be indicative of causal mechanisms (Bishop & Snowling, 2004) and, since written language skills are built on competencies in other tasks, examination of both longitudinal and concurrent competencies is an important component in understanding the nature and extent of the children's written language deficits. Reciprocal relationships between language and reading skills (Share & Silva, 1987), for example, point to the importance of examining both reading and language performance over time in relation to writing. A longitudinal study of children with SLI offers the opportunity to examine these developmental relationships.

Second, studies examining the writing skills of children with SLI have not addressed the possibility that limitations in the production of written text may be mediated by reduced levels of reading abilities. Given the frequently reported associations between SLI and difficulties in reading (Gallagher, Frith, & Snowling, 2000; McArthur, Hogben, Edwards, Heath, & Mengler, 2000), both literacy and language measures should be collected to establish the extent to which the writing problems experienced by children with SLI are influenced by their difficulties in reading.

Third, it is important to establish the ways in which other cognitive resources available to the child support the production of written text. Nonverbal ability plays a role in the children's overall language (Bishop & Edmundson, 1987) and literacy progress (Bird, Bishop, & Freeman, 1995). Consequently an important control variable in studies of written text composition is the children's nonverbal ability. This is particularly important given the reported shifting profile of the nonverbal skills of many children with SLI (Botting, 2005). Working memory also contributes to the development of written composition, independently of reading skill (Swanson &

Berninger, 1994). Because phonological short-term memory has been identified as a weakness in children with SLI (Bishop et al., 1996; Conti-Ramsden & Hesketh, *2003;* Gathercole & Baddeley, 1990), limitations in written production may reflect limitations in cognitive efficiency rather than language limitations per se (but see Bishop & Clarkson, *2003).*

PURPOSE

This study aims to address the ways in which concurrent and predictive measures of language, literacy, and processing limitations are related to writing in a sample of children with SLI. It is predicted that, similar to other cohorts of children with learning disabilities, children with SLI will be at an early stage of developing writing competence and their performance will be influenced by limitations in basic skills such as spelling, punctuation, and capitalization. In addition, it is predicted that the children will have specific difficulties with production of text and that these problems will be related to their language and phonological skills, both concurrently and over time. Children's levels of reading and spelling should moderate but not explain writing performance.

To test these predictions a cohort of children who had been selected as having SLI at 8 years, 3 months completed a range of language, reading, and cognitive measures at a mean age of 10 years, 8 months during their final year of elementary school education. A battery of language and literacy tests was identified to assess skills at the two different age points. Language assessments provided measures of the current psycholinguistic markers of SLI (phonology and syntax) and vocabulary. Reading (decoding and comprehension) and single word spelling were also assessed at both time points. Writing skill was assessed at Time 2 through global and subtest scores of the writing measure of the Wechsler Objective Language Dimensions (WOLD; Rust, 1996). In addition, measures of text length were computed. While text length is not generally a good index of text quality, extreme brevity of children's written texts may explain poor writing scores (Scardamalia, Bereiter, & Goelman, 1982). Limited expressive language may reduce text length and thereby reduce the children's overall written language performance.

METHOD

PARTICIPANTS

Sixty-nine children (17 girls and 52 boys) who had been identified as having SLI at Time 1 (T1) when they were of a mean age of 8 years, 3 months (range 7 years, 6 months–8 years, 10 months) were traced 2 years later (Time 2: T2) when the sample had a mean age of 10 years, 8 months (range 10 years, 2 months–11 years, 4 months). At age 8 all children were on their school's special educational needs register thereby documented as requiring additional learning support to access the curriculum, and 54% had a statement of special educational needs under the Education Act 1996. The statement of special educational needs specifies the provision that must by law be made to meet the child's special educational needs. This status is applied to about 3% of school pupils, over half of whom attend mainstream schools.

Initial identification of participants was completed following a survey of educational provision in two English local education authorities (LEAs). Professionals (speech and language therapists, educational psychologists, and special educational needs coordinators) were asked to identify children who had a discrepancy between their level of functioning in the area of speech and language and that which would be expected given the child's functioning in other areas, and who were experiencing significant language-based learning needs. A total of 133 were identified (Dockrell & Lindsay, 2000) from which a subsample from each LEA was derived. Children with any additional complicating factors which would preclude the diagnosis of SLI were excluded. In addition, children of the same age in the three UK special schools for children with SLI were included in the study ($N = 10$). Only the children who at age 8 were experiencing a specific language impairment were included in the longitudinal study.

All children were contacted at the point of follow-up but two families with male children did not want their children to complete any standardized assessments. Sixty-seven children completed formal assessments but only 64 children (16 girls and 48 boys) agreed to complete the writing task. Three children refused to write saying they could not do it or it was "too difficult." The children

who completed writing assessments were being educated, at this point, in a wide range of provisions: (a) 41 in mainstream classes, (b) 5 in special units within mainstream schools, and (c) 18 in special schools including residential special schools for children with SLI. All children in England follow a national curriculum (Department for Education and Skills; DfES, 1989) with prescribed instruction for reading and writing. This instruction occurs within a daily session, called the "Literacy hour."

Materials

Measures were identified to tap both receptive and expressive oral language slulls, literacy, nonverbal ability, and written language. Language assessments previously identified as clinical markers of SLI were included in the assessment battery. Reading was assessed for both accuracy and comprehension. Tests were identified to be age and culturally appropriate, standardized, and used with children with SLI. Measures of reliability and validity derived from the technical manuals are reported for each scale on first mention. Details of the measures used and their psychometric properties are presented in Table 1.

PROCEDURE

All children were assessed individually in a quiet room at school. Informed consent from schools, parents, and children was provided prior to any testing. Testing occurred over 3 days. The first session involved a familiarization with the researcher and an introduction to the project. Children were allowed to terminate the session or opt out of a test if they wished. All tests were administered using the standard procedures in the manuals. Writing fluency was measured from the time the child started to write. Children were asked to read back their written texts to prevent penalizing children who were poor spellers and the tester noted the unclear words on a separate sheet. Reliability checks were performed for the analytical scoring on 10% of writing samples by the two researchers. In the case of an interrater disagreement the scores were further discussed with the research team. Mean reliability for the total score agreement was 92%.

RESULTS

Data available from age 8 years (T1) were used to inform and help predict writing scores at age 10 years (T2). Only data for children completing the writing measure are reported ($N = 64$). To normalize performance on the test each standard score, centile or T score was transformed to a Z score to provide a standard common base of analysis. All test scores for Time 1 are presented in Table 2 and Time 2 in Table 3.

The results are presented in three parts. Part 1 describes the profile of the children's language and literacy skills and nonverbal ability at T1 and T2 and writing at T2. Part 2 describes the children's performance on the written language measure and Part 3 describes the relationships between language and literacy and different aspects of the WOLD and children's writing productivity.

Language Skills and Nonverbal Ability at Time 1 and Time 2

The children had substantially delayed development on a number of language and educational measures as shown in Table 2. To validate the clinical diagnoses of SLI a series of repeated measures ANOVAs confirmed that vocabulary scores, grammar scores, and expressive narrative scores were significantly below measures of nonverbal ability (BAS naming vocabulary), F (1, 63) = 4.78, $p = .03$, $\eta^2 = .07$; BPVS, F (1, 63) = 16.32, $p < .0005$, $\eta^2 = .21$; TROG, F (1, 63) = 35.68, $p < .0005$, $\eta^2 = .35$; Bus Story information, F (1, 63) = 32.01, $p < .0005$, $\eta^2 = .34$. Phonological awareness scores produced a similar trend (PhaB), F (1, 63) = 3.31, $p = .07$. To investigate further the pattern of language performance at T1 a factor analysis was computed. This and subsequent factor analyses met all the necessary statistical assumptions and only those factors with eigenvalues greater than 1.0 were considered. The analysis generated a single factor solution that accounted for 60% of the variance in performance across the language measures. Thus at T1 the children fell within the category of SLI.

As shown in Table 3, at T2 participants continued to show a depressed performance on language measures. To identify developmental changes in performance we compared children's performance over the two time points when the

TABLE 1

Assessment Measures

Measures Taken at Time 1	
Nonverbal Ability	British Abilities Scales II (BAS 11) Matrices subtest (Elliot, Murray, & Pearson, 1997). Children are presented with a set of patterns where one pattern is incomplete. There is a choice of six responses and children are required to point to the missing piece: reliability .85; validity with the WISC-III performance scale .47.
Vocabulary	British Picture Vocabulary Scale (BPVS; Dunn, Dunn, Whetton, & Burley, 1997). Children are shown four line drawings and asked to choose the one that best illustrates a word spoken by the assessor: reliabiliry .89; validity with the expressive one-word vocabulary test .72.
	British Abilities Scales II (BAS 11) Naming subtest (Elliot et al., 1997). Children are shown a series of familiar items and asked to name them: reliability .75; validity with the Weschler Preschool Primary Scale of Intelligence Performance scale .68.
Grammar	Test of Reception of Grammar (TROG; Bishop, 1983). A multiple-choice test designed to assess understanding of grammatical constructions. Children are shown four pictures and the assessor reads a sentence. The child is required to select a picture that matches the sentence: reliability .88; validity with the Clinical Evaluation of Language Fundamentals: Revised UK Edition (CELF-R^{UK}; Peers, Lloyd, & Foster, 1999).53.
Expressive Narrative	Bus Story: Information Store (Renfrew, 1997). The assessor tells the child a short story about a naughty bus. The narrative is supported by pictures. The child is asked to retell the story as accurately as possible using the pictures as cues. A score for information reported is computed: reliability .70; validity for British and American versions of the test as .98.
Phonological Awareness	Phonological Assessment Battery (PhAB; Frederickson, Frith, & Reason, 1997) rhyme and alliteration measures. For the rhyme test children choose two words that rhyme out of a choice of three (one irrelevant word and two that rhyme). The alliteration test is similar with the exception that the chosen words have the same beginning sound.
Fluency Measures	The fluency test involves children generating as many words as they can in each of the following areas: semantic, e.g., food and animals; alliteration, e.g., words beginning with 'm' and 'b'; and rhyme, e.g., words that sound like 'whip' and 'more'. Scores on these separate measures are combined to form a composite phonology measure: reliability $\geq$ .80; validity with the Neale Analysis of Reading Ability (NARA; Neale, Christophers, & Whetton, 1997) reading accuracy .24–.56.
Reading	Individual Reading Analysis (IRA, Accuracy and Comprehension; Vincent & de la Mare, 1990). The pupil reads aloud a series of graded passages and responds to a series of questions about the passage: reliability accuracy .97, comprehension .89; no validity reported.
Spelling	British Abilities Scales II (BAS 11); Spelling Scale. This scale provides a number of phonetically regular and irregular words to assess the child's ability to produce correct spellings. Each item is first presented in isolatioh, then within the context of a sentence, and finally in isolation. The child has to respond by writing the word: reliability .91; validity with Weschler Objective Reading Dimension (WORD: Weschler, 1993) spelling .63.

continues

TABLE 1 *(Continued)*

Measures Taken at Time 2

Where possible we maintained the same measures at T2 that were given at T1. Repeated measures at T2 included the BAS II Matrices subtest, BPVS, TROG, PhAB and BAS II Spelling Scale. The following measures were used where the originals were no longer age appropriate or new measures were required.

Working Memory	Children's Nonword Repetition (CNRep; Gathercole & Baddeley, 1990) involves the child hearing a single novel word-like item, such as "barrazon," and being required to repeat it immediately. The test contains 40 items: reliability .77; validity with measure of digit span .45 to .51.
Grammar	CELF^{UK} (Peers et al., 1999)—recalling sentences and listening to paragraphs. In the recalling sentences task children are asked to imitate orally presented sentences: reliability .82; validity with other expressive subscales .43–.49. Listening to paragraphs requires the child to attend to a short paragraph and answer specific questions related to the content: reliability *74;* validity with other receptive scales .30–.43
Reading	BAS II Word Reading Scale. This scale assesses recognition and oral reading of single words. The principal aim is to test single word decoding ability using a sample ranging from common words found in children's books to less common words: qliability .93; validity with WORD reading scale .71. Neale Analysis of Reading Ability (NARA). The NARA is a standardized reading test containing *six* passages of prose of gradually increasing difficulty. The test measures reading speed and accuracy in text reading, and comprehension. Comprehensiqn ability is measured by asking the child several questions after they have finished reading each passage. Speed and accuracy of reading are measured simultaneously: reliability accuracy .86, comprehension .94; validity with Schonell graded word reading accuracy .95, comprehension .88 and rate .76.
Written Language.	The Wechsler Objective Language Dimensions (WOLD): writing expression (Rust, 1996). The child is asked to write a letter outlining his or her ideal house. Children are allowed 15 minutes to complete the task. This free writing task addresses the development of ideas and organization, as well as punctuation and use of capitals. The written output *can* either be scored holistically or analytically: reliability .89, correlation with Woodcock-Johnson Psychoeducational Battery-Revised (Woodcock & Johnson, 1989), Dictation = *0.72*. The analytic scale was used to assess the children's written text. This comprises *six* dimensions, each rated on a four-point scale, which are scored independently of each other: Ideas and development; Organization, unity and coherence; Vocabulary, Sentence structure and variety; Grammar and usage; Capitalization and punctuation.

same measures were available. Children's performance improved significantly over time for both the TROG, F (1, *63)* = *4.34*, p = *.04* η^2 = .07, and the nonverbal measure, F (1, *63)* = *4.47*, p = .04 η^2 = *.07* but not phonological awareness, F (1, 63) = 0.02, *ns*, or BPVS, F (1, *63)* = *1.18, ns.*

To substantiate the continued diagnosis of SLI we performed a series of repeated measures ANOVAs comparing language measures with nonverbal ability. Vocabulary scores, grammar scores, listening to paragraphs, recalling sentences and phonology were all significantly below the measure of nonverbal ability, BPVS *T2*, F (1, *63)* = *35.87*, p < .0005, η^2 = .36; TROG T2, F (1, *63)* = *24.23*, p < .0005, η^2 = .28; listening to paragraphs, F *(1, 63)* = *34.30*, p < .0005, η^2 = .35; and recalling sentences, F (1, *63)* = *83.94*, p < .0005, η^2 = .58; PhaB T2, F (1, *63)* = *15.78*, p < .0005, η^2 = .20. To investigate further the pattern of language performance at *T2* a factor

TABLE 2

Means and SDs for Time 1 Measures for Children Who Produced Written Text at Time 2 (N = 64)

Time 1 Measures	*Assessment*	*Mean Z score*	SD
Nonverbal Ability	Nonverbal cognitive ability (BAS Matrices)	–.76	.80
Language Measures	Naming vocabulary (BAS)	–1.04	.89
	British Picture Vocabulary Scale (BPVS)	–1.13	.60
	Test of Reception of Grammar (TROG)	–1.44	.92
	Bus Story information	–1.55	1.14
Phonology	PhAB	–.94	.66
Literacy Measures	Reading accuracy (IRA)	–.98	1.01
	Reading comprehension (IRA)	–1.24	.81
	Spelling (BAS)	–1.38	1.03

analysis was computed. The analysis generated a single factor solution that accounted for *58%* of the variance. Thus at T2 the children continued to meet the criteria of SLI.

The children were also experiencing difficulties with reading and spelling (Table *3).* **A** series of repeated measures ANOVAs compared the children's *Z* scores on the nonverbal cognitive ability test (BAS Matrices T2) with the measures of single word decoding, text reading, text comprehension, rate of reading, and spelling. In all cases, children's performance on the literacy measures was significantly lower than their scores on the nonverbal measure: Single word decoding (BAS word reading), F (1, *63)* = *44.83, p* < .0005, η^2 = .42; text reading (NARA), *F*(1, *63)* = *46.558, p* < .0005, η^2 = .43; text comprehension (NARA), *F* (1, *63)* = 108.59, *p* < .0005, η^2 = .63; and spelling (BAS spelling) F (1, 63) = *25.42, p* < .0005, η^2 = .29.

WRITING AT TIME 2

As a group the children performed poorly on the total analytic scale of the WOLD; examples of two texts are provided in Figure *1.* Children's performance on the written language measure was significantly poorer than their nonverbal cognitive ability scores, F *(1,* 63) = *41.12,* p < .0005, h2 = .40. There were no significant differences in standard scores between children's educational placements (mainstream M = *–1.18, SD* = .71; unit M = –1.26, *SD* = .79; special school M = *-1.22, SD* = .53; F *(2, 63)* = .052, ns) or in the performance of the girls and boys (girls M = *–1.41, SD* = .58; boys M = *–1.13, SD* = .66; F *(1, 63)* = *2.23,* ns).

TABLE 3

Means and SDs for Time 2 Measures for Children Who Produced Written Text (N = 64)

Time 2 Measures	*Assessment*	*Mean Z score*	SD
Nonverbal Ability	Nonverbal cognitive ability (BAS Matrices)	–.50	.95
Language Measures	BPVS T2	–1.19	.72
	TROG T2	–1.19	1.00
	Listening to paragraphs (CELF)	–1.27	.74
	Recalling sentences (CELF)	–1.74	.74
Phonology	PhAB T2	–.92	.72
	Nonword repetition	–1.97	.97
Literacy Measures	Reading accuracy single word (BAS)	–1.34	.87
	Reading accuracy text (NARA)	–1.42	1.01
	Reading comprehension (NARA)	–1.71	.84
	Spelling (BAS)	–1.18	1.02
Writing Measure	WOLD	–1.20	.66

FIGURE 1

Examples of Text Produced Maintaining Original Spelling and Punctuation

Participant 23 *Z* score Matrices –.41, BPVS –1.88, Reading –1.48

Dear Matthew,

I want to live in a house. I want it to be a love house.

Participant 69 *Z* score Matrices –.31, BPVS –1.23, Reading –.92

Dear Jason; I want to live in a flat Where I can play Basketball; snooker pool; tennis and play in the swimming pool and Where I *can* play on the Playstation with the game of Star Wars Episode 1. I Want a kitchen; a bathroom and a bedroom with star wars; Episode 1 posters. I want to live in France Love From

. . . . . .

And I Want a barbeque and a sitting room Where I can watch T.V. and I Want a bowling game and I need a T.V. screen which shows your name and your score and

As such, all further analyses treat the participants as one group.

Children's written texts were examined in terms of length and patterns of performance across the WOLD subscales. In general children were producing short texts. The total numbers of words (excluding written numerals) were tallied for each piece of writing; separate measures of nouns (excluding proper nouns) and verbs produced were also calculated. The children produced a mean of *52.61* words (range 6–194), a mean of *10.61* nouns *(SD = 7.80)* and a mean of *5.43* verbs *(SD = 4.37)*. Thus children were producing an average of *3.5* words per min *(SD = 2.63)* compared to an average of *9* words per min for an age matched sample on the same test (Buck, *2004)* and word production significantly correlated with WOLD *Z* score, $r = .34$ $p = .003$. The same patterns of relationships were evident when nouns ($r = .35$, $p < .0005$), and verbs ($r = .39$, $p = .002$) were considered separately.

The WOLD *Z* score provides an overall measure of text quality to identify whether children were experiencing specific patterns of difficulties. We examined performance on the subscale scores that are combined to provide the overall score for the WOLD. The children's best performances were on measures of grammar *(M = 1.73, SD = .88)* and capitalization *(M* =1.72, *SD* = .74), although both means were still at the lower end of the scale. These scores are indicative of text that includes some errors of grammar that may interfere with meaning and errors of capitalization and punctuation that do not seriously interfere with meaning (WOLD manual; Rust, *1996,* p. *44).* The poorest performance was evident on the measure of sentence structure *(M = 1.44, SD = .59)*, a score that is indicative of many errors that inhibit clarity or fluency. Measures of ideas and development *(M =1.53, SD = .67)*, vocabulary *(M = 1.55, SD = .62)*, and organization and coherence *(M = 1S0, SD = .67)* were also in the low range. A Freidman's Analysis indicated that the scores across the subtests differed statistically significantly ($X^2 = 12.02$, $df = 5$, $p = .034$). There were significant differences between sentence structure and grammar ($z = -2.31$, $p = .021$), and sentence structure and capitalization ($z = -2.63$, $p = .008$). This differential pattern of performance was also evident in the relationships between subscales on the WOLD and word production. Pearson correlations controlled for age revealed that there were statistically significant relationships between word production and ideas ($r = .70$, $p < .0005$), vocabulary ($r = .37$, $p = .003$), and organization ($r = .29$, $p = .021$) but not capitalization ($r = .04$, *ns*), grammar ($r = -.03$, *ns),* and sentence structure ($r = .04$, *ns*).

To investigate this pattern of subtest differences a factor analysis was computed. Results of the factor analysis by varimax rotation are presented in Table *4.* The analysis generated a two-factor solution, with factors accounting for *38.53%* and *18.54%* of the variance respectively.

TABLE 4

Factor Analysis of WOLD

Subtest	*Factor 1*	*Factor 2*
Ideas and Development	.858	.003
Organization and Coherence	.804	.153
Vocabulary	.783	.175
Sentence Structure	.260	.687
Grammar	.009	.592
Capitalization	.157	.671

The first factor was interpreted as relating to semantic or meaning dimensions of written language including ideas and vocabulary, while the second factor was interpreted as relating to rule based factors including grammatical morphology and punctuation. The factor analysis indicates that the ratings of the children's writing output reflected two independent dimensions. These two dimensions held different relationships between the numbers of words produced. The more the children wrote the higher their scores on the semantic factor ($r = .48, p < .0005$) but the lower their scores on the rule factor ($r = -.29, p = .01$).

The children's limitations in language and literacy were mirrored in the poor writing skills of the current cohort. Particular weaknesses were evident in the areas of sentence structure, organization and coherence, and vocabulary. Moreover, it was possible to identify two different factors influencing writing: semantics and rules. The following section considers to what extent children's language and literacy measures were predictive of their performance on the WOLD.

RELATIONSHIPS BETWEEN LANGUAGE AND LITERACY AND WRITING

In order to evaluate the relationship between the children's oral language and literacy with their written language performance, scores on test measures were correlated with the WOLD. These data are presented in Table 5. A Bonferonni correction to control for multiple correlations was set at .002. The table highlights the significant and substantial correlations between all the language, literacy, phonology, and cognitive measures both concurrently and over time.

There were large (> .7) and statistically significant correlations between all measures of reading accuracy, reading comprehension and spelling both concurrently and over time (T1 variables 8, 9, and 10; T2 variables 16, 17, 18 and 19). Language measures also show moderate (> .4) and statistically significant correlations both concurrently and over time (T1 variables 3, 4, 5, and 6; T2 variables 12, 13, 14, and 15). Of particular importance to the current questions is the extent to which writing (variable 1) is associated with measures of language and literacy. At both time points reading is statistically significantly related to writing, as are vocabulary, spelling, phonology and nonverbal ability. Oral narrative text production (Bus Story) is also significantly associated with the production of written text. In contrast nonword repetition (CNRep), receptive grammar (TROG T1, TROG T2), recalling sentences, and listening to paragraphs do not correlate significantly with writing.

The data were analysed by three multiple regressions to test in sequence the role of concurrent measures of language and reading and predictive measures of language from T1 on writing. Following Cain, Oakhill, and Bryant *(2004)* we use a minimum of 10 data points per predictor. In all cases residuals were normally distributed about the predicted variable. We predicted that current, as opposed to earlier, measures of language and literacy performance would be better indicators of writing. In the first analysis the initial predictions were tested by entering as regressors nonverbal ability and all four language measures and text reading at T2. A significant model emerged, $F(6,63) = 10.33$, $p < .0005$, $R^2_{adj} = .470$. Significant variables for Model 1 are shown in Table 6. For Model 1 both concurrent measures of reading accuracy and receptive vocabulary are significant.

For the second regression we retained the significant predictors for Model 1 and nonverbal ability and included concurrent measures of spelling and phonology as regressors given their key role in producing written text. A significant model emerged, $F(5,63) = 12.89$, $p < .0005$, $R^2_{adj} = .485$. Significant variables for Model 2 are shown in Table 6. For Model 2 only the concurrent measure of receptive vocabulary is significant. For the third regression we again retained

TABLE 5

Correlations Between Language, Literacy, Cognitive Measures, and Writing at Time 1 and Time 2

Variable	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
1. WOLD	—																			
2. Nonverbal T1	.41[a]	—																		
3. BPVS T1	.41[a]	.57[a]	—																	
4. TROG T1	.36	.50[a]	.55[a]	—																
5. Bus *Story* T1	.48[a]	.43[a]	.52[a]	.49[a]	—															
6. Naming Vocabulary T1	.49[a]	.37[a]	.57[a]	.44[a]	.49[a]	—														
7. Phonology T1	.52[a]	.56[a]	.44[a]	.54[a]	.50[a]	.40[a]	—													
8. IRA accuracy T1	.56[a]	.38[a]	.42[a]	.35	.39[a]	.36	.60[a]	—												
9. IRA comp T1	.58[a]	.40[a]	.51[a]	.41[a]	.52[a]	.50[a]	.63[a]	.87[a]	—											
10. Spelling T1	.54[a]	.41[a]	.34	.35	.39[a]	.24	.58[a]	.86[a]	.73[a]	—										
11. Nonverbal T2	.48[a]	.42[a]	.27	.42[a]	.40[a]	.37[a]	.53[a]	.45[a]	.45[a]	.43[a]	—									
12. BPVS T2	.55[a]	.55[a]	.77[a]	.52[a]	.53[a]	.53[a]	.45[a]	.38[a]	.50[a]	.30	.40[a]	—								
13. TROG T2	.35	.38[a]	.48[a]	.52[a]	.57[a]	.43[a]	.50[a]	.42[a]	.51[a]	.38[a]	.33	.50[a]	—							
14. Recalling Sentences T2	.21	.33	.49[a]	.40[a]	.40[a]	.44[a]	.39[a]	.32	.52[a]	.15	.20	.50[a]	.58[a]	—						
15. Listening to Paragraphs T2	.33	.33	.55[a]	.29	.43[a]	.32	.29	.24	.44[a]	.23	.23	.58[a]	.36	.35	—					
16. Word Reading T2	.57[a]	.36	.32	.26	.26	.34	.51[a]	.85[a]	.78[a]	.79[a]	.34	.34	.40[a]	.28	.20	—				
17. Reading Accuracy T2	.58[a]	.32	.31	.24	.31	.25	.55[a]	.85[a]	.72[a]	.82[a]	.39[a]	.32	.36	.20	.19	.90[a]	—			
18. Reading Comprehension T2	.51[a]	.40[a]	.48[a]	.39[a]	.50[a]	.45[a]	.49[a]	.71[a]	.74[a]	.69[a]	.47[a]	.50[a]	.59[a]	.41[a]	.40[a]	.72[a]	.72[a]	—		
19. Spelling T2	.57[a]	.40[a]	.24	.28	.29	.27	.54[a]	.83[a]	.70[a]	.81[a]	.38[a]	.30	.36	.20	.21	.90[a]	.84[a]	.64[a]	—	
20. Phonology T2	.51[a]	.55[a]	.36	.43[a]	.43[a]	.34	.69[a]	.62[a]	.55[a]	.63[a]	.51[a]	.50[a]	.53[a]	.38[a]	.29	.61[a]	.60[a]	.56[a]	.66	
21. CNrep T2	.37	.24	.40[a]	.36	.41[a]	.25	.52[a]	.42[a]	.40[a]	.34	.16	.36	.39[a]	.41[a]	.19	.42[a]	.43[a]	.29	.44[a]	.59[a]

[a].002 with Bonferonni correction

TABLE 6

Results of Multiple Regressions for Writing Measure

Model	*Predictor Variable*	β	p
Model 1	BPVS vocabulary T2	.398	$p = .003$
	Reading accuracy T2	.398	$p < .0005$
Model 2	BPVS vocabulary T2	.360	$p = .001$
Model 3	BPVS vocabulary T2	.233	$p = .041$
	Reading accuracy T2	.364	$p = .001$

the significant predictors for Model 1 and nonverbal ability and examined the role of language measures from testing at T1. These regressors included Bus Story Information, phonology T1 and single word naming. A significant model emerged, $F(6,63) = 11.33$, $p < .0005$, $R^2_{adj} = .496$. Significant variables for Model 3 are shown in Table 6. As in Model 1 the significant variables were concurrent measures of reading accuracy and receptive vocabulary.

Finally, we considered the relationship between language, literacy, and number of written words produced. We predicted that the pattern of explanatory variables would be similar to those for the WOLD and include reading and vocabulary scores. The data were analysed by multiple regression, using the same regressors as Model 1 above (nonverbal ability, four language measures, and text reading). The regression was a very poor fit ($R^2_{adj} = .147$), but the overall relationship was significant, $F(6,63) = 2.816$, $p = .018$ with the TROG T2 as the only significant effect ($\beta = .464$, $p = .004$). No other model improved the fit and the TROG T2 remained the only significant variable in all other models.

DISCUSSION

The current study has extended the evidence bearing on the written language skills of children with a history of SLI. As a cohort, the children continued to experience difficulties with oral language and literacy and by the age of 10 significant problems in producing written text were evident. Both concurrent and predictor measures of language and literacy provided similar patterns of relationships with the written language measure. However, in contrast to previous research, working memory (as measured by nonword repetition) was not statistically significantly associated with writing at this point in time and nonverbal ability, while significantly associated with writing, did not contribute statistically in the regressions to performance on the writing measure. In contrast lexical knowledge and reading were substantial and significant predictors of the children's writing scores.

No measure of oral grammatical competence was associated with the written language measure. This is surprising given previous research (Mackie & Dockrell, 2004; Scott & Windsor, 2000; Windsor et al., 2000) but is consistent with the data from Bishop and Clarkson (2003). The factor analysis of the WOLD subscales provided evidence that, at this point in development, children's written productions could be captured by *two* different dimensions: semantics and rules. The semantic factor was significantly related to the amount of written text produced. In contrast the scores on the rule-based factor were negatively correlated with text production. This negative correlation can be seen as indicating that as children produce more text there is a greater scope for errors of grammar and punctuation, although genre may be a critical factor of these results (Verhoeven et al., 2002).

The importance of semantic skills in underpinning the writing skills of children with SLI is further substantiated by the significant independent contribution of the vocabulary measure in the regression analyses. Previous studies have provided indicative evidence that vocabulary knowledge may be a relevant dimension in the writing of children with SLI. Lexical diversity was shown to be a factor in the performance of the children studied by Scott and Windsor (2000), and semantic content was associated with writing in the Bishop and Clarkson (2003) study but in both cases the role of semantics as a support for writing

for the children was minimized. The current study challenges this view. Vocabulary was the only language factor to contribute to the resultant model in the regressions. As with oral language, vocabulary appears to provide a building block for written language (see also Green et al., 2003). A range of lexical items allows the child to build a text and provide the basic infrastructure of text meaning. This is consistent with work published by Berninger et al. (1992). They found that text generation skills in normally developing 5- to 9-year-olds were constrained by verbal IQ, including vocabulary development. They also noted that basic oral language skills such as word finding influenced the development of transcription skills in children's writing. The severe delays in writing skill our children displayed corroborates this hypothesis. The extent and nature of children's semantic representations are a central dimension in the texts produced.

Although receptive vocabulary was a significant factor in the overall assessment of the children's productions, the length of the texts was only related to the receptive grammar measure. This measure only accounted for a small proportion of the variance; however, it does suggest that for these children quality and quantity of text are determined by different parameters. Shorter texts have been attributed to children being unable to sustain the writing effort or failing to gain access to the knowledge they may possess, or to problems with the mechanics of writing (slow handwriting and poor spelling; Graham, 1990). These hypotheses have been derived from models of writing development where translation (putting your ideas on paper) consists of both text generation and transcription skills (Berninger, 1999; Swanson & Berninger, 1994). The associations between the idea generation and vocabulary scales of the WOLD support this view. In addition the current data suggest that understanding grammatical distinctions (as measured by the TROG) influences the number of words produced for children with SLI. This was the only variable that contributed to the amount of text produced and suggests that more advanced understanding of oral grammar supports their written output. The children's limited grammatical skills were also evident in their written output in terms of severely limited sentence construction skills. Indeed it appeared that many of the children were reliant on just one or *two* set sentence frames.

Previous studies of the written productions by children with SLI have failed to consider their reading skills. The current study indicates that the production of written text is indeed mediated by the children's reading levels. Thus, studies of children with SLI need to address this factor prior to drawing any conclusions about the role of oral language skills. The influence of reading skills has an impact at a number of levels of writing development including familiarity with books and narrative structure (Juel, 1988) whereas limited knowledge of spellings can constrain the development of low level writing skills such as transcription and text generation (Berninger et al., 1992).

The importance of semantic skills in underpinning the writing skills of children with SLI is further substantiated by the significant independent contribution of the vocabulary measure in the regression analyses.

Investigations of written language are complex and subject to a number of limitations. In the current study the children produced short written pieces providing little opportunity to produce many errors in punctuation or grammar and this may limit the ability to identify deficits in these areas. Moreover, although it provides the benefit of standardization, the WOLD does not permit an analysis of the error patterns produced by the children, nor of the vocabulary items used. There is the added possibility that the children's actual writing abilities may be inflated as a result of the scoring system. The WOLD assessment is intended not to discredit spelling errors yet many pupils in the project had severe spelling difficulties, a problem that is likely to impact on the interpretation of written texts in other contexts. In addition, different writing profiles could result in similar scores for a subtest. For example, in the grammar and word usage scale a child would gain full points for producing no errors whether performance was a single accurate sentence or a list of phrases correctly produced. In both cases the score is independent of the meaning produced.

Further research would need to disaggregate these error patterns to provide a wider range of scores.

Educational Implications

The children in our study were having great difficulty learning to write; the general writing support in schools was not sufficient to meet their needs. Two dimensions, vocabulary and reading, both amenable to direct instruction (Hammill, *2004;* Jitendra, Edwards, Sacks & Jacobson, 2004), accounted for a significant proportion of the variance in the children's written outputs. Studies that aim to improve the writing of children with learning difficulties typically focus on the process of writing itself, including strategies related to such activities as planning, organizing, and revising (Graham, in press). These processes are linked to teaching children *how* to write. Our data suggest that for children with language impairments addressing *what* to write or idea generation is also important.

Vocabulary development has been described as the building block of language (Dockrell & Messer, *2004).* The importance of vocabulary skills in the written output of the children was an unexpected outcome as previous work has focussed on the children's syntactic limitations in writing. Our data suggest that for children with language difficulties vocabulary also plays a significant role in producing written language. Relative strengths in vocabulary served to support the production of written text and discriminated between levels of writing. Limited syntactic skills may lead children to rely more heavily on semantics, as occurs with children in the early stages of writing. Thus, the development of semantic skills may be seen as a compensatory mechanism for weak syntactic skills. Children with poor vocabulary skills will need explicit support with vocabulary to generate ideas; this dimension is particularly important since we identified no changes in the children's relative vocabulary development over the two points of assessment. There is limited understanding regarding the ways in which novel words are introduced during episodes of classroom teaching (Carlisle, Fleming, & Gudbrandsen, 2000) and the types of support teachers offer children about word meanings (Dickinson, 2001). Reliance on implicit learning is unlikely to address these problems as the mean rate of incidental word learning from text calculated for typically developing children is approximately 15% of the potential words to be acquired (Swanborn & de Glopper *1999).* The cognitive limitations of children with SLI are likely to further limit incidental word learning. Teaching will need to be explicitly provided either through prior vocabulary activities or the provision of target words to provide a scaffold to the children's writing endeavours (Jitendra et al., *2004).*

Reading skills also served to support the production of texts for these children. Better readers produced more highly rated texts and reading skill accounted for a significant proportion of the variance in writing. The data do not indicate which aspects of reading mediated their writing performance. However, there is indicative evidence that reading can support writing in a variety of ways. Students can acquire knowledge about writing through reading (Bereiter & Scardamalia, *1984)* and poor reading skills will limit the successful use of revision strategies. Reading also provides a scaffold for developing vocabulary: Good readers develop larger vocabularies than poorer readers (Nagy, Herman, & Anderson, *1985).* Thus children with limited literacy skills are disadvantaged in terms of the texts they read and the vocabulary they encounter. Specific reading instruction has the potential to enhance writing (Fitzgerald & Shanahan, *2000)* and should be considered as an important dimension of the "writing package" for children with language problems. Again there is likely to be a need to make such instruction explicit (Graham, in press) and to include specific exposure to different genre and to the development of comprehension skills.

The negative correlation between the amount of text produced and the children's scores on the rule-based factor raises the question of how a balance is established in teaching contexts between providing children with the opportunities to write and monitoring the grammatical accuracy of their output. Quality and quantity of the text produced by these children were underpinned by different cognitive competencies. Given the children's slow and limited production in writing, supporting the generation of written text will provide the basis for the needed experience and success in writing (Graham, in press). Thus focussing on the content of the writing, that is idea generation with

the necessary vocabulary, will allow teachers to capitalize on the children's strengths in writing (Gersten & Baker, 1999).

The data indicate that for children with SLI teaching should address the correlates of writing that are often assumed to be automatically accessible to typically developing children. Children with language difficulties may have neither the vocabulary nor the experience with written text to produce written language. Research in other domains of writing has implicated the importance of making teaching explicit (Graham, in press). Our data complement this research and suggest that when children experience difficulties with writing it is important to introduce explicit strategies to support vocabulary and reading. Interventions and assessment accommodations need to address these factors separately if the production of written text is to be supported effectively. These data further support the view that writers' instructional needs vary and teachers need to be sensitive to the strengths and weaknesses of the children in these domains.

CONCLUSION

This study has confirmed the close relationship between oral language, reading, and writing in a sample of children with SLI. In contrast to previous studies with this population, the results indicate that the relationships between the key language, literacy, and writing measures parallel patterns found in studies of typically developing children. However, the amount of shared variance between these measures was never more than .50 (See Fitzgerald & Shanahan, 2000, for similar relationships between reading and writing for typical children). An important question remains concerning which factors differentiate the performance in these different cognitive domains. One explanation rests in the dimension of written language assessed. The data provide evidence that vocabulary and reading skills scaffold the development of writing for meaning yet no similar case can be made for the rule-based elements of written language skills of this cohort. Vocabulary may provide a source of semantic bootstrapping that enhances children's abilities to generate ideas. Alternatively the more extensive vocabulary may provide a more flexible representation system to structure their written text. The key role of vocabulary as a feature of these children's success requires further evaluation as does a more precise analysis of the children's written language trajectories.

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