The Role of Morphosyntax and Oral Narrative in the Differential Diagnosis of Specific Language Impairment

Submitted for the degree of Doctor of Philosophy

by

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ABSTRACT

Many researchers and clinicians describe a broad range of language features as characteristic of specific language impairment (SLI), while some researchers have attempted to define a narrower set of language features as clinical markers of SLI. However, how SLI is distinguished from other language impairments that fall outside the psychometric diagnostic criteria for SLI, based on language features is not clear. This thesis is concerned with determining which language features, if any, are capable of differentiating children with SLI from children with non-specific language impairment (NLI). Children with NLI, differ psychometrically from SLI only on their non-verbal cognitive abilities.

Conversation and oral narrative language samples, and verbal responses to probes, were collected from seventy five children aged 2 ½ to 6 years comprising four research groups: 21 participants with SLI, 13 participants with NLI, 21 age-matched participants with typically developing language and 20 younger language-matched participants with typically developing language. Matching for group comparisons required that the SLI and NLI groups had similar levels of language ability on a standardised assessment and mean length of utterance (MLU), which reduced the SLI group to 15 participants for these comparisons. The language-matched group was also matched to the SLI and NLI groups on MLU. A wide range of language variables from the conversation and narrative samples were analysed, covering the domains of general sample measures, morphosyntactic accuracy and complexity, narrative structure, information and cohesion.

The SLI and NLI groups performed similarly in all domains and could not be differentiated diagnostically on the measures examined. The most consistent group differences were for comparisons between the age-matched and language-matched groups, which demonstrated the effects of maturation and development. The language impairment (LI) and language-matched groups could not be differentiated on the majority of general language sample or morphosyntactic measures but the SLI group produced narratives that were structurally more complex and cohesive than the language-matched group.

Language tasks varied in their effectiveness in differentiating groups. More consistent group differences for the grammatical accuracy measures were obtained from the conversations than the narratives, and from composite measures compared to individual measures. Targeted elicitation tasks were more effective than the conversations or narratives in producing consistent group differences for accuracy of individual verb tense morphemes. More consistent group differences for the narrative features were obtained from a wordless picture book than a single scene picture. A discriminant function analysis showed that LI was most effectively identified using a combination of key morphosyntactic measures from the conversations and key narrative feature measures from the two narratives.

The results have implications for diagnostic practices, intervention practices and theoretical constructs and explanations of SLI and NLI. In particular, a broad, holistic view of LI is supported, as an impairment that impacts on all domains of language which interact with each other and must be considered collectively, rather than as individual, splintered skills.

DECLARATION

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed: ________________________________ Date: _____________

Wendy M. Pearce

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GLOSSARY

Abbreviation / Term	*Definition*
3S	Third person singular morpheme; e.g., run**s**
AM	Age-matched control group
ART	Article; e.g., a, the
AUX	Auxiliary; e.g., He **is** running.
BE	Verb 'to be', including copula and auxiliary forms; e.g., am, is, are, was, were (excludes auxiliary DO and HAVE)
CAT	Narratives produced for the single scene picture depicting two children and a cat in a tree.
CELF-P	Clinical Evaluation of Language Fundamentals – Preschool (Wiig et al., 1993)
CON	Conversation samples
COP	Copula; e.g., He **is** funny.
DO	Verb auxiliary 'do' and its forms; e.g., **Do** you want it? He **does**n't want to.
ED	Regular past tense morpheme; e.g., He jump**ed**.
EOI	Extended optional infinitive
ERRCOH	Percentage of erroneous cohesive ties
ESL	English as a second language
FRAG	Percentage of fragments (as percentage of all verbal utterances)
FROG	Narratives produced for the wordless picture book "Frog where are you?"
FTC	Finite tense composite – accuracy (percentage correct use) measure for the total of all finite tense morphemes; i.e., ED + 3S + AUX + COP
FTIC	Finite tense inflection composite; accuracy measure for finite tense inflections i.e., ED + 3S
GD	Goal directed
GEN	Possessive or genitive; e.g., John**'s** bike
HSLI	High specific language impairment; expressive percentile > 5
INFO	Narrative information score percentage
ING	Continuous aspect morpheme 'ing'; e.g., He is jump**ing**.
IQ	Intelligence quotient
IQR	Interquartile range, a non-parametric measure of variance, describing the middle 50% of distribution, from the 25^{th} to 75^{th} percentiles
LC	Low non-verbal cognition, and normally developing language
LI	Language impairment
LM	Language-matched control group
MLU	Mean length of utterance
MOD	Modal; e.g., can, might, should
NAR	Narrative samples
NDW	Number of different words
NGD	Non-goal directed
NLI	Non-specific language impairment
NPC	Noun phrase composite – accuracy measure for the total of targeted noun phrase morphemes; i.e., ART + PLS + GEN

NPIC	Noun phrase inflection composite – accuracy measure for noun inflections; i.e., PLS + GEN
NTVC	Non-tense verb composite – accuracy measure for the total of targeted non-finite verb morphemes; i.e., ING + MOD
NVCA	Non-verbal cognitive ability
OC	Obligatory contexts
ORG	Narrative organisation level: non-goal directed, goal directed or elaborated
RCPM	Raven's Coloured Progressive Matrices (Raven et al., 1995)
RDLS	Reynell Developmental Scales 3 (Edwards et al., 1997)
SALT	Systematic Analysis of Language Transcripts (computer software, Miller et al.)
SES	Socio-economic status
SLI	Specific language impairment
TDL	Typically developing language
TNW	Total number of words
WPB	Wordless picture book

CHAPTER 1: DIAGNOSTIC ISSUES FOR SPECIFIC AND NON-SPECIFIC LANGUAGE IMPAIRMENT

INTRODUCTION

Specific language impairment (SLI) in children has received considerable attention in the literature and been the focus of considerable research in recent years (Bishop, 2004; Botting & Conti-Ramsden, 2004; Eadie, Parsons, & Douglas, 1997; Fey, Catts, Proctor-Williams, Tomblin, & Zhang, 2004; Leonard, 1998; Watkins, 1994). Traditionally, SLI is defined as the presence of significant difficulties with language acquisition in the absence of any known cause or other identifiable disorders such as hearing impairments, intellectual disability, neurological disorders or chromosomal syndromes (Fey, Long, & Cleave, 1994; Leonard, 1991b, 1998; Plante, 1998; Tomblin & Buckwalter, 1994; Watkins, 1994). Recent research has attempted to both define the characteristics of SLI and to examine possible causal explanations, but with inconsistent results and differing conclusions.

Research has predominantly compared the characteristics of children with SLI to the characteristics of children with typically developing language (TDL). While this is an appropriate and useful methodology, the lack of comparisons with other language impairments in children that fall outside the diagnostic category of SLI means that the full diagnostic picture is incomplete. Such language impairments have concomitant disorders that exclude a diagnosis of SLI, such as a hearing impairment, intellectual disability or Down syndrome. Comparisons with other types of language impairment (LI) are needed to determine whether the identified characteristics of SLI are unique to SLI or also found in other LIs.

One group of children with language impairments, that does not fit the SLI diagnostic category, is of particular interest: children with ‘non-specific language impairment’ (NLI) (Bishop, 1994b; Ellis Weismer, Tomblin, Zhang, Buckwalter, Chynoweth, & Jones, 2000; Fey et al., 2004; Rice, Tomblin, Hoffman, Richman, & Marquis, 2004). Children with NLI also have a language impairment (LI) that cannot be explained or attributed to a cause, but they differ from SLI in one important feature: their non-verbal cognitive abilities (NVCA). Children with SLI, by definition, have NVCA in the normal range or above. This relates to the exclusion of intellectual disability as a possible cause for the LI (Craig & Evans, 1993). However, poor NVCA may also exist in children in the absence of any identifiable cause and in the absence of any other identifiable disorders. A group that differs from SLI on only one diagnostic feature is an ideal group to compare with SLI in order to clarify whether the linguistic characteristics attributed to SLI are unique to it or are universal to a broader range of LIs. This will have implications for the diagnostic category of SLI and how it is used.

Comparisons between SLI and NLI were sparse when this thesis was formed in 1997, with literature during the 1990s largely raising the issue and calling for investigation. Two studies (Cole, Dale, & Mills, 1990; Fey et al., 1994) found that children with SLI and NLI responded similarly to intervention and challenged the practice of offering higher levels of service to children with SLI than for children with NLI. Fey et al., in questioning the criteria for defining SLI, emphasised that it was important for researchers to determine if linguistic deficits identified in SLI are unique to that group alone, and in particular, whether the deficits varied according to level of non-verbal cognitive abilities.

Bishop (1994b) measured performance on several standardised language assessments in 90 twins where one or both twins had a language impairment. Bishop concluded that "there is no fundamental difference between children with language impairments who have a large discrepancy between IQ and verbal functioning, and those who do not." (p. 108). More recent research has emphasised similarities in memory and morphosyntax (Ellis Weismer et al., 2000; Rice et al., 2004). A meeting of eminent researchers recommended more detailed investigation of "the similarities and differences among children at different levels of IQ" (Tager-Flusberg & Cooper, 1999, p. 1277). A comprehensive comparison of linguistic characteristics between children with SLI and NLI is therefore the subject of this thesis, reported in recent publications by this author (Pearce, 2000; Pearce, McCormack, & James, 2003) .

This chapter discusses the diagnostic construct of SLI and associated issues. This is necessary to develop a full understanding of SLI and the implications of a comparison between SLI and NLI. The focus is placed on SLI because there is a substantial body of literature devoted to the construct of SLI, but little comparative literature on the construct of NLI. The two subsequent chapters discuss the linguistic characteristics of SLI, NLI and other LI: morphosyntactic deficits are discussed in chapter 2, and oral narrative deficits are discussed in chapter 3. The remainder of this thesis is devoted to a description and discussion of the investigation and its results.

SLI AS A DIAGNOSTIC CATEGORY

Purpose for a Differential Diagnosis of SLI

Multiple purposes for diagnostic processes in relation to SLI, and to LI in general, are described in the literature (Bishop, 2004; Johnson, Darley, & Spriestersbach, 1963; Nation & Aram, 1977; Paul, 1995; Peterson & Marquardt, 1981). Primarily, a diagnosis serves to categorise and differentiate among impairments, particularly among impairments that may present similarly and involves an accurate description of the characteristics of the LI and a determination of aetiology or underlying causal relationships. This enables appropriate assessment and intervention, and suggests a possible or likely prognosis. SLI and NLI clearly differ in NVCA, but it is not clear whether or not they can be differentiated based on their language characteristics or whether they hold common or different underlying causes.

Bishop (2004) emphasised distinctions between diagnostic criteria for SLI that are used for research and clinical purposes and argued that research is primarily concerned with such matters as determining underlying impairments or exploring genetic relatedness (i.e., aetiology). On the other hand, clinicians were primarily concerned with diagnosis for assessment and intervention purposes and therefore focussed on diagnostic parameters that identified functional language difficulties affecting the ability to communicate in daily activities at home, school, and work and in the community. This view, however, seems overly restrictive. The placement of clinical diagnostic issues outside the main business of research, in a sense, denies the application of research to the real world of daily activity and life participation. The validity of the clinical diagnosis of SLI needs to be upheld by sound research and thus argues for the inclusion of functional communication measures in research exploring the differential diagnosis of SLI and NLI. It is also important to determine whether the linguistic performance of children with SLI and NLI differs on functional as well as structured tasks. Likewise, causal explanations need to account for functional communication impairments that may present differently from performance on specific, highly controlled linguistic tasks.

If SLI and NLI are undistinguishable from each other in terms of linguistic characteristics and causal factors, then little purpose is served by attempting to maintain the terms as diagnostic categories. Research exploring the criteria for defining SLI has examined three main areas: the use of cognitive referencing (measuring and comparing language ability to NVCA); identification and description of the primary characteristics and underlying deficits of SLI and; explanations for SLI. Each of these will be discussed, to varying degrees in this and subsequent chapters, with reference to their relevance for NLI.

A Psychometric Model

The conventional approach to defining SLI is psychometric (Rice, 2000). This approach uses the normal distribution curve and standardised assessment to define SLI as language performance at the low end of the normal distribution of language abilities (Leonard, 1991b). That is, the child with SLI has poorer language ability than their peers with normally developing language.

SLI is frequently defined as language abilities that fall below a standard deviation of -1.0 on a standardised assessment (Aram, Morris, & Hall, 1993; Cole et al., 1990; Lahey, 1990; Lahey & Edwards, 1995; McCauley & Swisher, 1984; Restrepo, Swisher, Plante, & Vance, 1992; van der Lely & Howard, 1993). The study of more severe forms of SLI (standard deviations of greater than -1.5 or - 2.0) is uncommon in the literature.

The psychometric approach can work well in identifying language impairment and suggest a prognosis but Rice (2000) described three major limitations. The first major limitation is the arbitrariness of where to draw the line between normal and impaired language ability (which standard deviation). Secondly, an overall result on a language assessment does not always provide easy identification of specific areas of deficit for intervention, (and some areas of deficit may be more disabling than others). Thirdly, the psychometric model does not provide a measure of how a child's language skills are progressing relative to an adult language system. For example, a typical 5-year-old's ability to use finite verb tense markers is very close to adult language use, whereas their vocabulary would be much less developed than an adult's vocabulary.

Causal factors that could contribute to language impairment have shaped the exclusionary criteria for SLI and include: neurological dysfunction, intellectual disability, genetic or chromosomal syndromes, physical or sensory impairments, identifiable socio-emotional disorders and autism spectrum disorders. The use of exclusionary criteria for SLI means that this group of children with language impairments is largely defined by what it is not rather than what it is.

The exclusion of children with low NVCA from the diagnosis of SLI is also an essential component of its psychometric construct with NLI defined as cognitive performance at the low end of the normal distribution of cognitive abilities. Similar limitations, to those described by Rice for identifying language impairment, may apply to the identification of NVCA. To exclude intellectual disability from a diagnosis of SLI, NVCA needs to lie above a standard deviation of -1.0 on a standardised assessment (which corresponds to a standard score of 85 and to the 16th percentile) (Anastasi, 1988; Sattler, 1990). In addition, some researchers stipulate that language abilities need to fall one standard deviation or more below performance IQ, a practice is known as 'cognitive referencing' (Casby, 1992).

ASSUMPTIONS ABOUT SLI AND THEIR IMPACT ON DIAGNOSIS AND INTERVENTION

Several assumptions about the nature of SLI inform or arise from the current diagnostic construct of SLI. The first assumption is that general cognitive development influences language development (Casby, 1992; Miller & Chapman, 1981). The second assumption, arising from the first is that general cognitive functioning, as measured by nonverbal or performance measures, determines a ceiling or potential for language development (Casby, 1992). A third assumption is that the linguistic characteristics of SLI are a unique clinical marker of SLI (Rice, 2000). Related to this is a fourth assumption, that the language abilities of children with SLI are qualitatively different from the language abilities of children with NLI (Aram, 1991; Restrepo et al., 1992; Rice, 2000; Rice, Warren, & Betz, 2005).

However, none of these assumptions has yet been empirically proven. Aram, Morris & Hall (1993) stated that "many persons involved with children with language impairments have accepted the concept of specific language impairment as an established fact, rather than recognizing that it more accurately represents an hypothesis in need of testing and validation" (p 582). Each of these assumptions will be discussed in relation to their impact on service delivery practices and in relation to differential diagnosis of SLI from NLI.

The Relationship between Cognition and Language (Assumption 1)

The exclusion of intellectual impairment as a potential causal factor from the diagnosis of SLI implies that non-verbal intelligence and cognitive functioning influences language development. However, views of the relationship between non-verbal and verbal abilities are varied, and often conflicting. Considerable debate exists over the degree of independence of language ability from non-verbal cognition (Johnston, 1994). Theories about the relationship between cognition and language still await conclusive and consistent evidence.

Intelligence as a Single Property or Multiple Competencies

One formative theory of intelligence proposes the existence of a general overriding form of intelligence (g) (Gelfer, 1996). Theorists vary in their views of the relationships among general intelligence, NVCA and verbal abilities. Many intelligence tests seek to capture the measurement of general intelligence that underlies more specific intelligence factors, often focussing on aspects of intelligence that contribute to academic success (Anastasi, 1988; Sattler, 1990). Gardner (1985), on the other hand, argues that intelligence is not a single property or a general capacity, but a broader range of competencies valued by the cultural context.

Direction of Influence

The cognitive hypothesis proposes that an underlying level of cognition is needed for language to develop (Cromer, 1976; Miller & Chapman, 1981). The relationship between cognition and language is unidirectional, one where cognition influences language but language does not influence cognition. Children's development of concepts and cognitive constructs, and their desire to express meaning precede language development. For example, concepts of time may develop before they are expressed using temporal adverbs and morphosyntactic tense markers. Language development may be equal to or lag behind cognitive development but may not be more advanced than cognitive development, as non-verbal ability sequentially precedes language development. Dale and Cole (1991) stress that this model is based on unproven assumptions. The premise of this theory is also contradicted by the characteristics of William syndrome, where language ability is more advanced than NVCA (Reilly, Losh, Bellugi, & Wulfeck, 2004; Thomas, Grant, Barham, Gsodl, & Lakusta, 2001; Volterra, Capirci, & Caselli, 2001) and by research showing evidence of children with poorer cognition than language ability (Ellis Weismer et al., 2000).

Johnston (1994) argues, similarly to the cognitive hypothesis, that cognitive mechanisms, including NVCA, are required for language to develop. However, this relationship is not permanent, as once language is acquired it becomes "a major mode of mental representation and crucial to many reasoning tasks" and a "tool of cognition" (pp. 108-109). At the other end of the spectrum, the interaction hypothesis (Rice & Kemper, 1984) argues that language and cognition both influence each other.

Other, less uni-directional, theories describe various relationships between language and cognition. A weaker form of the cognitive hypothesis suggests that while cognitive development is necessary for language development to occur, it does not fully account for all aspects of linguistic development (Cromer, 1988a). Some specific and independent linguistic capacity is necessary for language to develop. According to this view, language and cognition are assumed to be essentially separate and distinct, with language development occurring in parallel with cognitive development. Consistent with the stronger cognitive hypothesis, language development cannot be more advanced than cognitive development.

The correlational hypothesis (Brown, 1973 & Bates et al., 1977 in Miller, 1981) argues that common maturational factors underlie development of cognition and language but that variation may occur in the pace of development in either the cognitive or language domains. This hypothesis accounts for variation between cognition and language in any direction, but does not emphasise directions of influence between non-verbal cognition and language.

Similarly, Gardner (1985) argues that an individual's competency in one intelligence does not enable a prediction about their competency in other intelligences as the various intelligences are relatively independent of each other, although they do interact. This model of intelligence supports the independence of language from non-verbal abilities and variation between a range of cognitive abilities in any direction.

Summary

Deficits in NVCA have been excluded from the diagnostic category of SLI without a sound or agreed understanding of the relationship between cognition and language. The cognitive hypothesis predicts that children with NLI should have poorer language skills than children with SLI because of their more extensive cognitive deficits. Clear predictions about NLI in relation to SLI do not arise from other theories, such as the multiple intelligences model, which suggest that language abilities are relatively independent of NVCA.

Potential for Development (Assumption 2)

Use of Cognitive Referencing as a Prognostic Indicator

The cognitive hypothesis has had a profound influence on thinking about language impairments in children (Casby, 1992). Here, the gap between language and NVCA, in the case of SLI, is considered an indicator of the potential for language development. This has led to a belief that children with low NVCA should be excluded from speech pathology services (Cole et al., 1990). This implies, that children with SLI will benefit more from intervention that children with NLI and are thus more worthy recipients of intervention services. Some have determined that a child is not considered to have a LI if their language abilities are equivalent to their NVCA level, even when their language abilities are significantly below those expected of their chronological age (Casby, 1992). The practise of comparing a standardised measure of language ability with a standardised measure of NVCA has been termed "cognitive referencing' (Bishop, 2004; Cole, Schwartz, Notari, Dale, & Mills, 1995). The assumption that the gap between general cognition (or NVCA) and language ability is an indicator of potential for language development in SLI, was challenged, by Lahey (1990) who concluded that "language disorders should not currently be defined by comparing a level of language ability with a measure of mental ability" (p 617).

Use of NVCA as a prognostic indicator is also challenged by evidence that many children with SLI do not attain normal language abilities (Paul, Murray, Clancy, & Andrews, 1997; Stothard, Snowling, Bishop, Chipchase, & Kaplan, 1998). If NVCA were a prognostic indicator then children with SLI should eventually attain normal language abilities, while children with NLI do not. Stothard et al. (1998) followed up 71 children diagnosed with SLI or NLI at four years of age. At 15 years of age close to two thirds of the children with SLI still had impaired speech and language abilities or a general delay in both language and cognition. For the NLI group, more than three quarters had persistent speech and language difficulties.

Paul et al. (1997) followed up children, who were identified as late talkers at 20-34 months old, when they were in their second grade at school. A quarter of the children had persistent language difficulties. However, the results suggested that the children with persistent expressive language problems in second grade were those with nonverbal abilities at the lower end of the normal range. This finding holds some congruency with the notion that non-verbal cognition is an indicator of potential for language development.

Use of Cognitive Referencing for Determining Eligibility for Intervention

Cognitive referencing and a diagnosis of SLI has been used for determining eligibility for allocation of higher levels of service for children internationally (ASHA, 1989; Casby, 1992; DECS, 1996; EDSA, 1992; James, 1996; Pearce, 1998; Stern, Connell, & Greenwood, 1995). This practise was often based on perceived benefits for SLI over NLI, in relation to learning potentials implied by the cognitive hypothesis (Cole, Mills, & Kelley, 1994). The practise of excluding children from intervention services on the basis of the cognitive hypothesis has been questioned as theoretically unsound and empirically unsupported (Bishop, 1994b; Casby, 1992; Cole et al., 1990; Cole et al., 1994; Dale & Cole, 1991; Fey et al., 1994; Lahey, 1990).

Few studies have attempted to compare intervention outcomes between children with SLI and NLI. However, two studies of note determined that children with SLI and NLI responded similarly to intervention (Cole et al., 1990; Fey et al., 1994). Cole et al. compared the effects of an intervention program on a group of 18 children with SLI and a group of 32 children with NLI, while Fey et al. compared a group of ten children with SLI and a group of eight children with NLI in a similar age range (4 to 6 years and 3;8 to 5;10 years, respectively). Both groups of researchers matched the SLI and NLI groups on selected language measures prior to intervention and, evaluated two interventions, with the participants assigned to treatment groups at random. Both studies found that the SLI and NLI groups made similar and significant gains in language abilities. This contrasted with expectations from the cognitive hypothesis that children with SLI can be expected to make greater gains from intervention because their higher non-verbal cognition gives them a higher potential.

Cole et al. (1990) concluded that the practice of limiting services for children with NLI, and providing more services to children with SLI, was unsupported by their findings. Fey, Long and Cleave (1994) reasoned that “if children with below-normal IQs really differ fundamentally from children with classically defined SLI, they may respond differently to intervention” (p 165). Their results showed that both groups made significant gains and that the language abilities of NLI group actually improved more than the SLI group following intervention. They therefore concluded that children with SLI and NLI were diagnostically similar and belong to the same group of “impoverished language learners” (p. 176).

Issues with Variation in Identification of Language Impairment

A wide range of assessment tools have been used by researchers (and clinicians) to assess language abilities and NVCA with no general agreement on which tests of language ability or tests of NVCA are most appropriate for identifying children with SLI (Dunn, Flax, Sliwinski, & Aram, 1996; Krassowski & Plante, 1997; McCauley & Demetras, 1990). Tests differ, sometimes considerably, in the children they will diagnose with SLI (Aram et al., 1993; Merrell & Plante, 1997).

Aram, Morris and Hall (1993) tested 252 children clinically identified with SLI, using a variety of psychometric and language measures and several different cut-off points to investigate congruence in their identification or diagnosis. The identification of children with SLI ranged from 20% to 71.4% depending on the assessments used and the discrepancy formula applied. Thus, an individual child may be identified as SLI on one test battery but not on another. This is highly problematic for comparing research studies, for clinicians determining a diagnosis, and for the practice of determining eligibility for intervention based on standardised test scores. Casby (1992) noted that: “This variability obviously makes it possible for a child to be eligible for services in one state (or district), yet ineligible in another state (or district)” (p. 200).

These problems may arise because both language and non-verbal ability are multifaceted skills. Different language tests often sample different sets of linguistic abilities (e.g., various aspects of receptive or expressive vocabulary, morphology, syntax or memory). Linguistic performance will also vary according contextual or task demands (Bates & MacWhinney, 1989). Even when the same linguistic abilities are tested they may be tested under a different set of contextual or task demands (e.g., morphosyntactic production in a cloze task versus in a narrative generation task), producing different results (Merrell & Plante, 1997).

Standardised test outcomes may also vary in individuals over time, at a level sufficient to result in differing diagnoses between initial and subsequent assessments (Conti-Ramsden, Donlan, & Grove, 1992; Krassowski & Plante, 1997). Krassowski and Plante investigated the variability of Weschler scale IQ scores over three year periods in children with language impairments aged from 3;8 to 11;3 at the time of first test administration. Twenty seven percent had score changes of one standard deviation (15 points) or more for the Verbal Scale, while 17% had score changes of one standard deviation or more for the Performance Scale. Up to three quarters of the children had smaller changes of 5 points.

This high degree of variation argues against the strict use of IQ criteria (cognitive referencing) for the diagnosis of SLI or NLI, or for determining eligibility for services. Anastasi (1988) argued that an IQ score represents the ability level of a person “at any given point in time” rather than representing a potential for learning (p. 362). If IQ scores (and standardised language test scores) are highly variable, then it is inappropriate for a child to be ineligible for a service because their scores miss the criteria by a few points. A child may be ineligible for a service one year, but then be eligible for the same service a year later, or visa versa.

Summary

The practice of differentiating eligibility for intervention based on a diagnosis of SLI or NLI is fraught on two fronts. Firstly, the belief that children with SLI gain more benefit from intervention than children with NLI is, so far unsubstantiated by intervention studies. Secondly, the diagnostic process lacks consistency both across test batteries and over time. The methods currently available for diagnosing SLI and NLI are likely to produce distinctions that are rather fluid, murky and muddled. SLI and NLI are not stable diagnoses if a child can be diagnosed with SLI one year on a particular assessment battery under the criteria for a particular state or country, but be diagnosed with NLI another year, or on a different assessment battery or under the criteria for a different state or country.

Characteristics of SLI (Assumption 3)

Standardised language tests and language sampling assessment approaches both seek to diagnose LI, and to determine specific areas of deficit in the receptive or expressive modalities, or in the domains of morphosyntax, semantics, pragmatics or phonology (Paul, 2001). There is no evidence provided in the literature, however, that language assessments for children can differentiate between LIs of differing aetiologies, or differentiate between SLI and NLI.

More recently, the need to define phenotypes for genetic research and the search for explanations for SLI has contributed to the quest to define the linguistic characteristics of SLI more narrowly (Fey et al., 1994; Rice & Wexler, 1996a, 1996b). Surprisingly, many attempts to define the characteristics of SLI have not sought to determine whether these characteristics are also present in LIs that fall outside the diagnostic category of SLI, such as NLI. Research exploring the question of differences between SLI and NLI has only emerged in recent years, finding much in common between the two groups (Ellis Weismer et al., 2000; Fey et al., 2004; Rice et al., 2004). The linguistic characteristics of SLI and NLI will be discussed in chapters two and three.

Qualitative Differences (Assumption 4)

One view argues that SLI results from a disorder (or defect) in the language processing system of the brain and that the characteristics of SLI are qualitatively and categorically different from those of children with mild delays, NLI and TDL

(Aram, 1991; Bishop, Bright, James, Bishop, & van der Lely, 2000; Restrepo et al., 1992; Rice, 2000; Tomblin, 1991). Restrepo et al. described the qualitative differences model of SLI thus: “The qualitative-differences model characterizes these children as a clinical population; that is, one with unique biological and behavioral characteristics” (p. 206). For example, the existence of extreme disorders (e.g., a 5-year-old child with normal comprehension and no expressive language) may be considered evidence for qualitative differences from the norm. The qualitative differences model expects that SLI will differ from NLI, and seeks clinical markers to differentiate SLI, from TDL and other LIs.

An alternative view argues that the linguistic deficits and characteristics of SLI differ from normal development only as a matter of degree, reflecting similar patterns to younger children with TDL. SLI is thus a statistical or psychometric construct, regarding SLI as ability at the low end of the normal population distribution, rather than a diagnostic category with a discrete conceptual basis (ASHA, 1989; Fey et al., 1994; Gavin, Klee, & Membrino, 1993; Leonard, 1991a, 1991b; Tomblin & Zhang, 1999). Leonard (1987) stated that “it is my view that the ‘cause’ of these children’s language limitations is simply the product of the same types of variations in genetic and environmental factors that lead some children to be clumsy, others to be amusical, and still others to have little insight into their own feelings” (p. 31). This notion holds congruency with the model of multiple intelligences (Gardner, 1985). As verbal ability is critical for social interaction, community participation, educational achievement and employment the consequences of poor language abilities are more devastating than the consequences of poor ability in other areas such as musical or sporting abilities (Friel-Patti, 1992).

Leonard (1987) wrote that children with SLI differ “in degree of language limitation and in degree of discrepancy among individual features of language, but not in the language characteristics themselves” (p. 34). Leonard also argues that discrepancies in ability levels among a range of language characteristics and between language and NVCA are not unique to SLI. They also occur in children with superior language abilities. Support for the low abilities model comes more recently from Dollaghan (2004) who used a taxometric statistical method to investigate whether SLI was a discrete categorical disorder that differed in nature as well as degree, or whether it was based on a continuum of abilities. This was done by investigating measures of receptive vocabulary, expressive vocabulary, MLU and NDW in a large sample of 3 and 4-year-old children. Dollaghan (2004) found no evidence of a discrete diagnostic category, but found evidence for a dimensional continuum of abilities. In a similar vein, it could be questioned whether NVCA varies along a continuum.

As a psychometric construct, the criteria for SLI require a cut off score for verbal abilities (to differentiate it from TDL) and for NVCA (to differentiate it from NLI). However, Fey et al. (1994) argued that the rationale for the non-verbal ability cut-off point for SLI is less clear that the rationale for excluding other known causes of language impairment. Often there is no identified cause for either SLI or NLI (i.e., for poor language abilities or for poor NVCA) and it may be that these 'unidentified causes' are the same for each diagnostic group. Fey et al. distinguish between the borderline range of intelligence (i.e., IQs of 70 - 85) and severe intellectual disability that may have an identifiable organic cause. They also argued that if a lower cut-off point for non-verbal cognition was used for the purpose of limiting variance in research, then use of an upper cut-off point (i.e., to exclude high non-verbal cognitive skills) was just as important. Crago and Gopnik (1994) also urge "proceeding beyond the current clinical wisdom about what possible phenotypes might be or what the necessary cut-off points are for inclusion in a phenotype" (p. 40).

Perceiving SLI as a statistical construct interferes with the notion of SLI as a discrete diagnostic category with unique characteristics and an underlying pathology. However, Rice (2000), using a statistical approach, determined that children with SLI and children with TDL were distributed bimodally on the basis of their mastery of verb tenses and argued that this suggested some qualitative differences between SLI and TDL.

HETEROGENEITY

Researchers have often dealt with children with SLI as a homogenous group although they form a heterogeneous group with many individual differences in the presenting characteristics. Aram, Morris and Hall (1993) found a lack of congruency among children classified as SLI by different clinicians and concluded that SLI was not a single entity but a group of children with differing ability profiles. This heterogeneity frustrates the development of a definition for SLI that is based on clinical characteristics of the disorder, rather than on exclusionary criteria.

Dale and Cole (1991) argued that SLI should be viewed from a perspective of individual differences within a developmental and educational model, rather than seeking collective characteristics. An alternative approach to the issue of heterogeneity is to seek evidence for subgroups or subtypes of SLI. The difficulty here is a lack of agreement on subtypes. For example, van der Lely (1993) described three domain-based subgroups: grammatical, phonological and semantic-pragmatic, whereas Rapin (1996) described three modality-based subtypes: 'mixed receptive/expressive disorders', 'expressive disorders' and 'higher order processing disorders'. Conti-Ramsden and colleagues (Botting & Conti-Ramsden, 2004; Conti-Ramsden & Botting, 1999; Conti-Ramsden, Crutchley, & Botting, 1997) supported Rapin and Allen's subgroups, finding congruency in their classification of 242 children with SLI and the subgroups. SLI may also be sub-divided into 'resolved' and 'persistent' but these types may only been distinguishable by the time a child is six or eight years of age, the diagnosis being a retrospective one (Paul, 1993; Paul et al., 1997; Paul & Smith, 1993).

An exploration of subtypes requires large numbers of subjects, which is beyond the scope of this research. However, it needs to be acknowledged that NLI, like SLI, may also form a heterogeneous group and just as there are subtypes of SLI, there may be subtypes of NLI. Similarities and differences between SLI and NLI may depend on which subtypes are being compared.

EXPLANATIONS OF SLI

The search for a cause for SLI is a common theme in the literature as it is considered highly relevant to developing an understanding of SLI (Aram, 1991; Johnston, 1991; Tomblin, 1991). Generally, the exploration of cause has focussed on genetics, neurology, linguistic accounts and processing accounts.

Genetics

Genetic studies of SLI attempt to identify biological causes of SLI and how children with SLI may be distinct from children with TDL. They also attempt to determine relative influences and interactions between environmental and hereditary factors (Bishop, 1994b; Bishop, North, & Donlan, 1996; Crago & Gopnik, 1994; Gopnik & Crago, 1991; Kamhi & Johnston, 1982; Kjelgaard & Tager-Flusberg, 2001; Plomin & Dale, 2000; Rice, 1997; Rice, Haney, & Wexler, 1998; Rice & Wexler, 1996a; Tomblin & Buckwalter, 1994; Viding, Price, Spinath, Bishop, Dale, & Plomin, 2003; Wexler, 1996). For example, in a study of 3000 pairs of twins, Plomin and Dale found high heritability for SLI (78%) but low heritability for low NVCA, in the absence of low vocabulary (22%). Heritability for low vocabulary in combination with low NVCA was quite high (94%), consistent with understandings of a strong genetic contribution to cognitive disability. Genetic correlations among the language measures were higher (.53 to .65) than correlations between each language measure and NVCA (.29 to .40). Plomin and Dale suggested that the role of genetics and DNA testing in the identification of language impairments is certain to develop and will change the future of research and clinical approaches to assessment and intervention for language impairments.

A full review of research into the genetics of SLI and NLI is beyond the scope of this thesis because it is primarily concerned with the identification and diagnosis of LI based on observable language behaviours. Identification and description of the language characteristics, or phenotypes, of SLI and NLI is important for genetic research as a clearer picture of sound, identifiable linguistic characteristics enables better matching between symptoms and genetic features.

Neurological Accounts

A finding of greater recovery of language abilities in young children with focal brain lesions, than in children with SLI, suggests that a limitation in neuroplasticity is a feature or causal factor in SLI (Reilly, Weckerly, & Wulfeck, 2004). Children with SLI have more difficulties with morphosyntax than children with focal brain lesions (left or right hemisphere), particularly at younger ages (4 years) and still lag behind by 12 years of age (Reilly, Losh et al., 2004). Brain imaging and electricocortical measures have provided evidence of differences in the brains of children with SLI, from children with TDL, particularly in the presylvian, Wernickes', and Broca's areas (Leppanen, Lyytinen, Choudhury, & Benasich, 2004). However, matching of specific neurological anomalies to specific language characteristics is not yet possible due to the more diffuse nature of neurological differences in SLI, limitations in neurological knowledge and measurement; and to a lack of consistency in the description and classification of language impairments in children.

Ullman and Pierpont (2005) argued that SLI can be explained as a deficit in the brain structures comprising the procedural memory system, particularly Broca's area and the caudate nucleus within the basal ganglia. Deficits may occur in any part of the neurological network subserving the grammar and procedural memory systems that are interlinked. Declarative memory where the lexicon is stored, in this hypothesis, is relatively spared. This provides explanation for, differences in the language domains or modalities affected and for the extent to which the language impairment seems to reflect a greater problem with processing capacity than with knowledge capacity. Comorbidity with other developmental disorders that rely on the procedural system, such as attention deficit disorder, is also explained in this account. Ullman and Pierpont suggest that in the future, early identification of SLI may be facilitated by neurological examinations (e.g., MRI scans) and that intervention may even include pharmacological remedies to improve neurological function.

In summary, while there is some evidence of neurological deficits in children with SLI, the deficits are more diffuse and less definable than those found in children with brain injuries, and less responsive to change. This picture of the neurological aspects of SLI is not supportive of a discrete modular account of LI, but suggests that LI in children arises from a more complex and dynamic interplay of parameters and neurological processes. Evidence for neurological deficits in children with NLI is not addressed in the literature, but would contribute to identification of similarities and differences with SLI.

Linguistic Deficit Accounts

Linguistic deficit accounts generally attribute the characteristics of SLI to a fault in the child's ability to acquire the morphosyntactic rules and features of the language, such that the child fails to generate and develop adult grammar in the same way as a child with normally developing language (Leonard, 1998). The locus of the fault or deficit is considered to lie in a 'grammatical acquisition device' within the language areas of the brain. The proposal that SLI is due to a linguistic deficit accommodates the fact that more general cognitive abilities are intact in these children (Adams & Gathercole, 2000). If the language impairments in children with NLI are connected to an underlying cognitive deficit that is somehow different from a linguistic deficit, then children with NLI are likely to have different language characteristics from children with SLI. Alternatively, if both children with SLI and NLI have the same type of underlying linguistic deficit then their language characteristics are likely to be the same. Further discussion of linguistic explanations for SLI will follow in chapter 2 because they relate closely to morphosyntactic evidence.

Limited Processing Capacity Accounts

Some researchers attribute the source of SLI to a limited ability or capacity to process information (Adams & Gathercole, 2000; Bishop et al., 1996; Dollaghan & Campbell, 1998; Eadie & Douglas, 2005; Ellis Weismer, Evans, & Hesketh, 1999; Ellis Weismer et al., 2000; Johnston, 1994). The capacity to process information is considered to be a central cognitive function that is distinct from the linguistic mechanism that generates language (Adams & Gathercole, 2000; Bishop et al., 1996). However, debate is unresolved as to whether the limitation is specific to the capacity to process linguistic information or is of a general and central executive nature (Gillam & Hoffman, 2004; Johnston, 1994). Debate is also unresolved regarding whether a limited processing capacity in children with LI is a causal factor or another area of difficulty.

A 'working memory' is a form of processing capacity, with phonological working memory often measured using non-word repetition tasks. Children with SLI have significantly more difficulties with processing than AM groups (Adams & Gathercole, 2000; Bishop et al., 1996; Dollaghan & Campbell, 1998; Ellis Weismer et al., 2000). On the other hand, van der Lely and Howard (1993) concluded that children with SLI have a linguistic rather than a processing capacity deficit because children with SLI performed similarly to LM groups on a range of verbal memory tasks.

It is possible that children with NLI have processing capacity limitations of a more general nature while children with SLI have processing capacity limitations more in the linguistic domain. Differences in the locus of the processing capacity limitation are likely to result in differences in the language characteristics of children with SLI from children with NLI. However, an investigation by Ellis Weismer et al. (2000) found that children with SLI and NLI had similar difficulties with non-word repetition; and concluded that non-word repetition was dissociated from non-verbal cognition. Children with SLI and language-matched children with Down syndrome also have similar levels of difficulty with short-term verbal memory (Eadie, 1999; Eadie, Fey, Douglas, & Parsons, 2002; Laws & Bishop, 2003). These findings suggest that children with SLI and NLI may have common language characteristics and a common locus for their limited processing capacity.

Other researchers emphasise the perceptual aspect of a processing capacity. The surface account (Leonard, 1989; Leonard, Eyer, Bedore, & Grela, 1997) assumes that children with SLI have a limited processing capacity that causes them to have difficulties processing grammatical morphemes of brief duration. Input frequency is reduced because of the limited processing capacity, so that children have fewer opportunities to build the appropriate categories of meaning attached to grammatical morphemes. Lexical items are maintained while grammatical morphemes with less perceptual saliency are omitted. Children with NLI may also have a limitation in their ability to process grammatical morphemes of brief duration, a theory still to be tested.

A Dynamic Interactional Model

Many current theories seeking to explain or identify causes for SLI have a narrow focus and do not explain all aspects of LI. Grammatical accounts may explain specific grammatical deficits but they do not explain deficits that may occur in vocabulary or discourse structure. On the other hand, a limited processing account may be too broad as an explanation because it fails to account for the specific nature of many deficits and may overlook the unique nature of the linguistic system. A good explanation of SLI would account for the broad range of deficits identified (e.g., morphosyntax, semantic and pragmatic), the narrow focus of deficits that are more frequently identified (e.g., grammatical impairments) and individual differences among children with SLI (i.e., heterogeneity) (Tomblin & Zhang, 1999).

In addressing the issue of heterogeneity, Weismer, Evans and Hesketh (1999) stated that “it is unlikely that any single factor will be found to account for the language difficulties of these children; there may be subtypes of SLI in which working memory limitations play a role and others in which they do not.” (p. 1258). Bishop (2004) also suggested that “A multidimensional model appears to do a better job in capturing clinical reality than a diagnostic system with sharp divisions between discrete disorders” (p. 317). Likewise, theories accounting for SLI might explain some types of SLI or NLI, but not others.

Rybárová (2002) proposed a *weak modularity* approach to describing SLI that was both dynamic and interactional. In this approach, language is construed to have domain specific modules that may be a) innate or acquired; and b) processing devices or knowledge bases. The parameters for Rybárová’s approach form the basis for development of a dynamic interactional model, shown in Figure 1.1. This model recognises that language is not static, but develops and changes over time. A dynamic interactional model accommodates evidence for both linguistic and processing explanations for LI as well as providing an explanatory basis for heterogeneity and a range of LI subtypes. In the words of Rybárová, “This model allows both linguistic and non-linguistic accounts to converge on one understanding of SLI” (p. 214). The model also acknowledges the role of social and communicative contexts that provide the learning experiences which shape language ability and performance (Hoff & Tian, 2005). Interactions between parameters may be hypothesised: ‘learning experiences’ interact with an individual’s ‘innate capacity’, while the ‘processing device’ also interacts with an individual’s ‘knowledge data base’. This model highlights a way of accommodating differing accounts and interpreting research results, so the implications of this model will be explored further in this thesis.

Parameters	*Innate Capacity*		*Learning Experiences (Acquired)*	
Knowledge Data-Base:	Narrow impairment Independent of environment Linguistic deficits	Language impairment	Narrow impairment Influenced by environment Limited provision of linguistic models	Language deprivation; Socio-cultural, Educationald and Age differences
Processing Device	Broad impairment Independent of environment Limited processing capacity		Broad impairment Influenced by environment Limited provision of contexts for using language	

Note. Based on modules described by Rybárová (2002)

Figure 1.1. Dynamic interactional model of explanations for language impairment

Explanations for SLI need to account for any similarities with or differences from NLI, but actually fail to explicitly address this issue. Similarities between the linguistic characteristics identified for SLI and NLI will suggest that both groups have a common explanation. Conversely, differences will suggest that SLI and NLI have different explanations and underlying causes. Since there is evidence for both linguistic and broader deficits in children with NLI, the explanations for SLI are expected to apply to NLI. Explanations for NLI, as opposed to SLI are lacking in the literature. However, it is expected that children with NLI, who have non-verbal cognitive deficits in addition to language deficits, will have a broader range of processing deficits and thus a broader range of LI characteristics.

Summary

Theories accounting for SLI are varied, but fail to address the issue of how SLI may be distinct from, or similar to, NLI. A dynamic interactional approach offers promise as a framework for understanding and comparing explanations for LI in both SLI and NLI. It acknowledges the roles of both innate capacity and learning from social and environmental contexts, and incorporates both knowledge and processing systems. In this way, the important contributions from linguistic accounts and processing capacity accounts are incorporated into a holistic model rather than positioned against each other.

LEVEL OF ANALYSIS

Descriptive and structural approaches to language often focus on the grammatical structure of language, primarily in relation to the sentence (Fromkin, Rodman, & Hyams, 2003; Leech & Svartvik, 1994; Lyons, 1970). These approaches primarily influence linguistic explanations of LI. Chomsky's modular view of language (Lyons, 1970) proposed that humans have an innate capacity to generate syntax and morphology. Under this perspective, morphosyntactic deficits are perceived to form the crux of a child's developmental LI. Such approaches have contributed much to diagnosis of LI by defining areas of linguistic deficit at the word and sentence level. Vocabulary and pragmatics are considered by some theorists to lie outside this innate linguistic capacity (van der Lely, 1997). The emphasis on innate aspects of language has fostered a drive to determine the genetic and neurological bases of language impairments. How this innate linguistic capacity is influenced, or not influenced, by underlying cognition or NVCA is unclear.

On the other hand, functional approaches argue that innate perspectives do not provide full explanation. The role of culture, the environment and social context in shaping communicative functions and language development must also be considered (Armstrong, 2000; Armstrong, 2005; Armstrong, 1991; Bates & MacWhinney, 1989; Butt, Fahey, Feez, Spinks, & Yallop, 2000; Emmitt, Pollock, & Komesaroff, 2003; Gardner, 1985; Halliday, 1985, 1994, 2005; Hoff & Tian, 2005; Togher, 2001; Tomasello, 2000). Consideration must also be given to how non-verbal cognitive abilities (NVCA) may influence the way in which context can be used to shape language use as well as structural aspects of language. Some processing capacity accounts more readily accommodate functional approaches, as they consider the effects of task demands on processing capacity.

Functional approaches have made significant contributions to the analysis of language discourse, as structural linguistics has been limited in its ability to describe and analyse language processes that operate beyond the level of the individual sentence. Structuralist approaches view discourse as a language level above the sentence, but do not always consider the highly influential role of context (Togher, 2001).

Researchers need to investigate language with full consideration of the communicative context and the demands and allowances that the particular context places on language use. Togher (2001) explained that “the context in which a discourse appears directly realizes the resulting language structures across many levels” (p. 133). The relationship between NVCA and the ability to make linguistic adaptations based on context is unclear as research in this area is lacking. It is possible that children with SLI and NLI will differ in their ability to adapt their language to the situational context.

Standardised assessments used for diagnosis and measurement of language impairments are largely based on structural linguistic approaches (Paul, 2001). They explore the child’s ability to understand and use words and sentences in tasks that are often removed from daily language use in context. Functional approaches are rarely standardised, yet have contributed significantly to the identification of language impairments that form the basis of social and academic difficulties that are missed by available standardised language assessments (Damico, 1985; Fey et al., 2004). Observation of communicative functioning in the child’s natural environment and descriptive approaches to assessment are perceived as critical adjuncts in the process of determining whether a language impairment exists and the need for intervention. A functional assessment may also serve to validate or question standardised assessment results. The evidence suggests that decisions about eligibility for intervention are best based on assessment of the child’s communicative performance in their environment, together with standardised assessment (Fey et al., 2004; Paul, 2001). The use of one or two tests as the only measure of language ability, in order to provide a diagnosis of LI, has been criticised as inadequate and inappropriate (Anastasi, 1988; ASHA, 1989).

An investigation of differences between SLI and NLI needs to evaluate linguistic performance in both structured and more functional tasks. Some tasks may be more problematic than others for one or both LI groups. For example, a more complex discourse context may elicit more complex language because they demand that the speaker address more complex relationships and verbal reasoning between events and ideas conversation (Abbeduto, Benson, Short, & Dolish, 1995; Leadholm & Miller, 1992; MacLachlan & Chapman, 1988; Wagner, Nettelbladt, Sahlen, & Nilholm, 2000; Westerveld, Gillon, & Miller, 2005). On the other hand, a more complex discourse context may elicit more linguistic deficits (Westerveld et al., 2005), because they are more demanding of processing capacity.

RESEARCH AIMS

While recent research has sought to distinguish the linguistic characteristics of SLI from those of children with normally developing language, very few studies have sought to compare the linguistic characteristics of SLI with those of children who have language impairments that do not fit the SLI criteria. The purpose of this research is to determine whether SLI can be distinguished from NLI based on their structural and functional oral language characteristics. The findings will broaden understanding of SLI and test the validity of SLI as a diagnostic category. The findings will also contribute to understandings of interactive effects between language, cognition and communicative context; and will contribute to theoretical understandings of language impairment.

This research is important in determining whether there are characteristics of language impairment that are universal in nature across diagnostic categories or whether they are specific to certain diagnostic categories. It will also make an important contribution to understandings about interrelationships between language and NVCA. It will have significant implications for diagnosis and intervention. In essence, this research will explore two diagnostic issues for SLI: the role of cognitive referencing, and the concept of unique linguistic characteristics.

The existence of qualitative differences between SLI and NLI will imply that SLI is a valid diagnostic category that can be clinically defined by a description of unique linguistic features. It will suggest that SLI is not an arbitrary statistical or psychometric construct and that the exclusion of children with low NVCA is valid. On the other hand, the absence of differences between the two groups will question the usefulness and validity of SLI as a diagnostic category of language impairment and will challenge the practise of limiting access to intervention services for children with NLI.

The linguistic characteristics of SLI that will form the focus of this research will be selected on the basis of evidence from prior research findings. The structural characteristics of morphology and syntax have received considerable attention in the literature as common areas of deficit in children with LI (Leonard, 1998; Rice et al., 2005). Oral narrative deficits have frequently been presented in the literature as evidence of functional discourse difficulties in children with LI (Fey et al., 2004; Norbury & Bishop, 2003). Evidence for morphosyntactic and oral narrative deficits in children with SLI and NLI will be discussed in the next two chapters, together with development of the hypotheses for this research.

CHAPTER 2: THE ROLE OF MORPHOSYNTAX IN THE DIAGNOSIS OF LANGUAGE IMPAIRMENT

INTRODUCTION

A comprehensive literature review by Leonard (1998) shows that children with SLI have more difficulties with a range of grammatical morphemes than their age peers with normally developing language (TDL). Morphosyntactic difficulties typically manifest as shorter, simpler utterances and inconsistent omissions of inflections in verb and noun phrases. These features may be evident in children as young as 2-years-old and into the teenage years (Bishop, 1994a; Gavin et al., 1993).

A decade ago, Rice, Wexler and Cleave (1995) proposed that a specific set of morphosyntactic clinical features were unique to the language of children with SLI. However, later research suggests that the same set of morphosyntactic difficulties are also evident in children with language impairments that fall outside the diagnostic boundaries of SLI, including Down syndrome (Eadie, 1999, 2001; Eadie et al., 2002) and NLI (Rice et al., 2004). These findings suggest that such features are not unique indicators of SLI, but rather, are indicators of a broader range of LI. Specific evidence for morphosyntactic deficits in NLI is limited to a few studies (Bishop, 1994b; Fey et al., 2004; Rice et al., 2004; Stothard et al., 1998; Tomblin & Zhang, 1999).

This literature review will focus firstly on the morphosyntactic characteristics of SLI, NLI and other language impairments, followed by a discussion of methodological issues in morphosyntactic research, before examining explanations for morphosyntactic deficits and research hypotheses. Abbreviations for grammatical morphemes that are discussed in this chapter are provided in the Glossary.

MORPHOSYNTACTIC ACCURACY IN SLI

Age or MLU Referencing

Investigations of morphosyntactic impairments in children have typically used one or both of two types of control groups: 1) an age-matched group of children with TDL (AM); and 2) a younger group of children with TDL, matched on at least one language variable (LM). Each of these points of comparison, or reference, provides different insights into the nature of LI. Age-matched comparisons are useful for determining the presence and extent of the impairment, and commonly used in both research and clinical contexts. For example, clinicians typically diagnose impairment in terms of how far abilities deviate from age expectations (Sattler, 1990; Wiig, Secord, & Semel, 1993).

Mean length of utterance (MLU) is the most frequently used language matching (LM) variable in the literature, followed by the matching of raw scores or language age on a standardised language assessment (Montogomery & Leonard, 1998; Scott & Windsor, 2000). The use of MLU for language matching is an accepted standard for the establishment of control groups for research into language impairment (Leonard, 1998). A variable such as MLU serves as a fixed point for comparing variability in other linguistic features. Investigations that compared children with SLI to LM groups, have strengthened knowledge about which particular grammatical morphemes pose the greatest difficulty for children with SLI, relative to their overall level of language development.

Language-matched comparisons can be an effective way of demonstrating differences among the morphosyntactic patterns of children with SLI, NLI and normal developmental patterns. They may be indicative of discrete diagnostic features in comparison to a delayed pattern of development as "…any differences that remain when groups with similar MLU values are compared can be seen as departures from an even profile of delay – that is, they point to specific symptoms of SLI" (de Jong, 2004, p. 263). Different findings for NLI-LM comparisons, from SLI-LM comparisons, would suggest different patterns of development.

Evidence from Age Peer Comparisons

In comparison to AM groups, children with SLI show significant difficulties in the production of both verb and noun phrase elements, but more particularly with verbs. Morphosyntactic difficulties with verb and noun phrases typically contribute to diagnosis of LI (Leonard, 1998; Miller, 1981; Wiig et al., 1993).

Verb phrase errors

Verb phrase difficulties in children with SLI are typically located in the inflectional system, and in unbound grammatical morphemes. The most common type of error is omission of the tense morphemes, namely, regular past tense (ED), third person singular (3S), auxiliaries (AUX) and the copula (COP) (Bishop, 1994a; Gavin et al., 1993; Leonard, 1989; Leonard, Bortolini, Caselli, & McGregor, 1992; Oetting, Horohov, & Costanza, 1996). Errors of comission or substitution (e.g., "The boy*s* *is* running.") in these studies were rare. A summary of accuracy results for verb phrase morphemes from a range of studies is presented in Table 2.1. A summary of participant details for these studies in provided in Table A-1 in Appendix A. Higher variance in accuracy for most morphemes was evident for the SLI groups than for the TDL groups and reflects considerable heterogeneity among the children with SLI.

Young children[1] with TDL typically achieve high levels of accuracy (88% to 98%) for finite tense morphemes, while young children with SLI achieve much lower and more varied levels of accuracy (21% to 78%) (Bedore & Leonard, 1998; Leonard et al., 1992; Leonard et al., 1997; Rice & Wexler, 1996b; Rice, Wexler, & Hershberger, 1998; Rice, Wexler, Marquis, & Hershberger, 2000). These results are also reflected in finite tense composite measures (FTC) (Bedore & Leonard, 1998; Eadie et al., 2002; Rice et al., 2004; Rice, Wexler et al., 1998). While error rates for irregular past tense (IP) were similar between SLI and AM groups (Leonard et al., 1992; Leonard et al., 1997; Rice et al., 2004), significant differences emerged when substitution with regular past tense (IPFinite) was taken into account (Rice et al., 2004; Rice et al., 2000). Smaller, yet significant differences in accuracy were also evident for the infinitive morpheme *to* (TO) (Leonard et al., 1997). Accuracy differences between SLI and AM groups for the non-tense verb morpheme for continuous aspect (ING) were small (99% for children with TDL, and 92% for children with SLI) (Rice & Wexler, 1996b).

Noun phrase errors

Noun phrase difficulties in children with SLI predominantly involve poor use of determiners and articles (ART), pronouns (PRO), regular plurals (PLS) and the possessive inflection (GEN) (Bishop, 1994a; Bliss, 1989; Gavin et al., 1993; Leonard, 1989; Loeb & Leonard, 1991; Oetting & Horohov, 1997; Rice & Wexler, 1996b). A summary of accuracy results for noun phrase morphemes, from a range of studies is presented in Table 2.2. A summary of participant details for these studies in provided in Table A-1 in Appendix A. Accuracy did not differ between the SLI and AM (age-matched control) groups as much as it did for the verb phrase morphemes. Young children with TDL achieve high accuracy levels for noun phrase morphemes (90% to 98%), while SLI groups achieve lower accuracy levels (41% to 88%) (Bedore & Leonard, 1998; Leonard et al., 1992; Leonard et al., 1997; Rice & Wexler, 1996b; Rice, Wexler et al., 1998; Rice et al., 2000).

[1] The term *young* children will generally be used to refer to children ≤ 5 years; *school-aged* children for 5 to 13 year olds; *older* children for 10 to 13 year olds; and *adolescents* for ≥ 12 year olds.

Table 2.1. Summary of studies investigating accuracy of verb phrase morphemes

GM	*Researcher(s)*	*AM*	*LM*	*SLI*	*NLI/ DS*
ING	(Ingram & Morehead, 2002)		28%	69%	
	(Rice & Wexler, 1996b)	99%	90%	92%	
	(Steckol & Leonard, 1979)		95% – 100%	84%	
MOD	(Eadie et al., 2002)		92%	83%	80%[3]
COP	(Eadie et al., 2002)		89%	85%	88%
	(Leonard et al., 1992)	97%	71%	41%[1]	
	(Leonard et al., 1997)	96% - 97%	67% - 80%	39% - 64%[1]	
	(Steckol & Leonard, 1979)		81% – 95%	57% – 82%	
AUX	(Eadie et al., 2002)		85%	65%	75%
	(Steckol & Leonard, 1979)		57% – 74%	40% – 41%	
BE	(Beverly & Williams, 2004)		27%	46%	
	(Rice & Wexler, 1996b)	95% - 96%	64% – 70%	47% – 50%[1]	
DO	(Rice & Wexler, 1996b)	90%	48%	29%[1]	
3S	(Eadie et al., 2002)		89%	29%[1]	40%[3]
	(Ingram & Morehead, 2002)		53%	50%	
	(Leonard et al., 1992)	91%	59%	34%[1]	
	(Leonard et al., 1997)	98%	48% - 51%	21% - 34%[1]	
	(Rice & Wexler, 1996b)	88% – 92%	44% - 61%	23% - 36%[1]	
	(Rice et al., 2004)	94%		77%[2,5]	67%[4,5]
	Longitudinal			72%/98%	62%/97%
ED	(Eadie et al., 2002)		100%	76%	38%[3]
	(Leonard et al., 1992)	98%	65%	32%[1]	
	(Rice & Wexler, 1996b)	92%	44% - 48%	22% – 27%[1]	
	(Rice et al., 2000)	92%/100%	47%/98%	32%/88%[1]*	
	(Rice et al., 2004)	93%		84%[2,5]	78%[4,5]
	Longitudinal			80%/97%	74%/96%
IP	(Eadie et al., 2002)		87%	79%	89%
	(Leonard et al., 1992)	64%	77%	65%	
	(Leonard et al., 1997)	89%	73%	72%	
	(Rice et al., 2004)	37%		23%	25%
	Longitudinal			21%/70%	21%/63%
	(Rice et al., 2000)	43%/86%	24%/48%	13%/48%[2]	
IP	(Rice et al., 2004)	83%		73%[2]	69%[4]
Finite	(Rice et al., 2000)			65% - 97%	64% - 93%
TO	(Leonard et al., 1997)	88%	88%	45%[1]	
FTC	(Bedore & Leonard, 1998)	98%		46%[2]	
	(Eadie et al., 2002)		85%	65%[1]	76%
	(Rice et al., 2004)	90%		78%[2,5]	71%[4,5]
	Longitudinal			72%/97%[5]*	67%/95%[5]*
	(Rice, Wexler et al., 1998)	91%/100%	56%/98%	33%/89%[1]	

Note: GM = grammatical morpheme;
[1] Significant statistical difference between SLI and MLU-matched controls (and also SLI and age-matched controls, if compared);
[2] Significant statistical difference between SLI and Age-matched controls (but not SLI and MLU-matched controls, if compared);
[3] Significant statistical difference between NLI and MLU-matched controls (and also NLI and age-matched controls) or between Down syndrome (DS) and MLU-matched controls, whichever is applicable;
[4] Significant statistical difference between NLI and Age-matched controls (but not NLI and MLU-matched controls, if compared) or between DS and Age-matched controls, whichever is applicable;
[5] Significant statistical difference between NLI and SLI or between DS and SLI, whichever is applicable;
* for older age groups only.

Table 2.2. Summary of studies investigating accuracy of noun phrase morphemes

GM	*Researcher(s)*	*AM*	*LM*	*SLI*
ART	(Steckol & Leonard, 1979)		78% – 85%	74% – 85%
	(Leonard et al., 1992)	95%	62%	52%
	(Leonard et al., 1997)	95% - 98%	86% - 87%	69% - 80%[1]
	(Rice & Wexler, 1996b)	90%	75%	62%[1]
PLS	(Ingram & Morehead, 2002)		92%	79%
	(Leonard et al., 1992)	97%	96%	69% [1]
	(Leonard et al., 1997)	99%	92% - 96%	73% - 81%[1]
	(Rice & Wexler, 1996b)	97%	97%	88%
GEN	(Ingram & Morehead, 2002)		14%	42%
	(Leonard et al., 1997)	96%	87%	41%[1]
NPC	(Bedore & Leonard, 1998)	97%		70%[2]
PREP	(Rice & Wexler, 1996b)	98%	97%	96%

Note: GM = grammatical morpheme;
[1] Significant statistical difference between SLI and MLU-matched controls (and also SLI and age-matched controls, if compared);
[2] Significant statistical difference between SLI and Age-matched controls (but not SLI and MLU-matched controls, if compared).

Pronoun difficulties are an exception to the predominant error pattern of omission found in children with SLI. Difficulties are typified by case marking errors where nominal pronouns are inconsistently replaced by accusative pronouns (e.g. *him* for *he*) (Bishop, 1994a; Bliss, 1989; Loeb & Leonard, 1991). The grammatical nature and function of pronouns differs from the other morphemes under discussion. Determiners, plural inflections and tense inflections are obligatory in certain contexts whereas pronouns replace a noun. They are not obligatory in the grammatical sense and the frequency of pronoun use is often determined by the nature of the pragmatic or discourse context (Campbell, Brooks, & Tomasello, 2000). For example, pronouns may be used frequently when a referent is known or lexical forms may be used when more explicit communication is required.

Children with SLI experienced more difficulties with accuracy for articles (ART) than pronouns (PRO). Bliss (1989) postulated that this was because pronouns have a more concrete reference than articles. The role of articles is more subtle, serving to help listeners to distinguish between given and new information. Rice and Wexler (1996b) also hypothesised that difficulties evident with verb tenses and articles may indicate an underlying problem with syntactic reference (temporal and nominal), but did not elaborate this idea.

Evidence from Language-matched Comparisons

Significant differences between young children with SLI and a language-matched control group (LM) demonstrate areas of particular difficulty for children with SLI. However, an examination of Table 2.1 and Table 2.2 shows that results varied across studies for SLI and LM comparisons of accuracy in using a wide range of finite tense morphemes and non-tense morphemes. Many researchers found no significant differences between the groups for the same morphemes that other researchers found significant differences for (Beverly & Williams, 2004; Eadie et al., 2002; Ingram & Morehead, 2002; Leonard et al., 1992; Leonard et al., 1997; Rice & Wexler, 1996b; Rice, Wexler et al., 1998; Rice et al., 2000; Steckol & Leonard, 1979). Researchers concurred, however, in finding no significant differences between SLI and LM groups for the ING non-tense morpheme (Ingram & Morehead, 2002; Rice & Wexler, 1996b; Steckol & Leonard, 1979). One researcher examined modals (MOD) and found no significant difficulties between the SLI and LM groups (Eadie et al., 2002).

Children with SLI use irregular past tense (IP) forms at a similar level of accuracy to LM groups (Leonard et al., 1992; Leonard et al., 1997; Rice et al., 2000). However, children with SLI produce more bare verb stems, while the LM groups produce more over-regularisation errors (IPFinite) (Leonard et al., 1992; Rice et al., 2000). The use of the ED inflection in place of the irregular past form, showed an awareness of the need to mark verb finiteness in the LM group. That is, children with SLI displayed greater difficulty with the production of finite tense forms than MLU-matched controls.

Variation in results among researchers may reflect the heterogeneity, variability and overlap which are typical of grammatical development in children with TDL, and children with SLI (Lahey, Liebergott, Chesnick, Menyuk, & Adams, 1992). Group sizes for most researchers were frequently small (ranging from 6 to 45), increasing the risk of measurement error. Small group sizes in combination with high variability in the SLI population means that each researcher may have examined groups of children that differed in their language profiles.

Evidence for Verb Tense Omission as a Clinical Marker of SLI

Rice and colleagues proposed that the omission of finite verb tenses is a clinical marker of SLI (Rice, 1997, 2000; Rice, Haney et al., 1998; Rice, Noll, & Grimm, 1997; Rice et al., 2004; Rice & Wexler, 1996a, 1996b; Rice et al., 1995; Rice, Wexler et al., 1998; Rice et al., 2000; Rice, Wexler, & Redmond, 1999). In English, finite verbs carry tense morpheme inflections (e.g., “He skipp*ed*.”, “He *is* skipping.” & “He skip*s*.”), while non-finite verbs are unmarked by inflections (e.g., “He likes to *skip*.”). Hence, the lack of overt marking of finiteness may be interpreted as the replacement of a finite verb with its non-finite form. While the results of studies by Rice and colleagues were summarised earlier, their interpretation is described here in more detail.

Rice and colleagues (Rice & Wexler, 1996b; Rice et al., 1995) studied the use of tense morphemes and determiners in the language samples of 122 young children including SLI AM and LM groups. The children with SLI differed significantly in their pattern of morpheme usage from LM group, with less correct use of ART, individual finite tense morphemes and a FTC (Rice, Wexler et al., 1998). Most morpheme errors for the SLI children were errors of omission and when they did use a tense morpheme, it was usually used accurately. Conversely, the SLI group produced targeted non-tense related morphemes (PLS, prepositions *in* and *on* (PREP) and ING) with similar levels of accuracy as the two control groups. The researchers concluded that children with SLI used articles and finite verb tense markers on an optional basis for an extended period. Since optional use of finite verb tenses is a normal stage of development in younger children, Rice and colleagues described this characteristic in SLI as a period of extended optional infinitive (EOI).

The optional infinitive stage is significantly protracted in children with SLI, shown in a 4-year longitudinal study of 21 young children with SLI, and similarly sized AM and LM control groups (Rice, Wexler et al., 1998). The AM group had close mastery of finite tense morphemes at five years of age and full mastery (100%) at eight years of age, while the SLI group was still well below expected levels at eight years of age. Although the children with SLI followed a similar pattern of developmental change to the LM group, they did not show a catch-up period. An extension of longitudinal research beyond the age of eight years would be needed to be conclusive about whether or not the SLI group eventually caught up. Rice et al. also found that differences between the SLI and LM groups were not significant in the earlier ages, but became significant from 6 years of age onwards.

The poor use of finite verb tense was proposed as a clinical marker of SLI in two ways. Firstly, the difference between the SLI and LM groups showed that SLI did not mirror the morphosyntactic development patterns of younger children (i.e., they do not conform to a delay model of language impairment) (Rice & Wexler, 1996b; Rice et al., 1995). Secondly, children with SLI were distinguished from age-matched peers because their tense marking abilities were distributed bimodally (Rice, 2000). This statistical characteristic marked SLI and TDL as mutually exclusive groups.

Cautions against Verb Tense as a Unique Clinical Marker of SLI

Difficulties beyond verb tense

While support is widespread for difficulties with finite tense morphemes as a strong linguistic feature of SLI, there is no agreement that this difficulty constitutes the whole of SLI. The available evidence shows that difficulties for children with SLI extend into other areas of morphosyntax and into other language domains. For example, Bishop, Bright, James, Bishop and van der Lely (2000) examined a range of language and cognitive characteristics in 37 same-sex twin pairs with SLI and 104 twin pairs with TDL (7 to 13 years old). They determined that children with a cluster of syntactic difficulties also tended to have difficulties with vocabulary. Pure cases of grammatical SLI were not identified in their sample. Even Rice and Wexler (1996b) stated that "there may be subgroups of children with SLI who may not demonstrate this clinical marker" (p. 1254).

Leonard and colleagues did not give full support to finite tense difficulties as a clinical marker of SLI (Bedore & Leonard, 1998; Leonard et al., 1992; Leonard et al., 1997). Their evidence demonstrated that children with SLI had greater difficulties with a range of grammatical morphemes than AM groups across three studies. The children with SLI had higher accuracy for a noun phrase composite (NPC) than a finite tense composite (FTC), while the AM group had little difference between accuracy levels for NPC and FTC. This pattern of greater difficulties with finite tense is congruent with tense difficulties as a clinical marker, but instead, they supported the notion that it was the stronger of a range of morphosyntactic features in SLI, including noun phrase deficits.

A clinical marker that does not identify all cases of SLI is problematic, and of limited use diagnostically. An effective clinical marker of SLI "should identify all individuals with a history of language impairments" (Conti-Ramsden, Botting, & Faragher, 2001, p. 745) (p. 745).

Effective indicators of SLI

Accurate diagnosis or discrimination of LI from TDL in children is important both socially and educationally, as an inaccurate diagnosis may have significant long-term consequences (Plante & Vance, 1994). Plante and Vance argued that accurate identification of LI and TDL is the best indicator of the validity of a language test. A discriminant function analysis provides information on the percentage of cases that are classified correctly using a specified variable or set of variables. High rates of correct classification for LI indicate that a measure has high *sensitivity* because it correctly identifies children with LI. High rates of correct classification for TDL indicate that a measure has high *specificity* because it excludes children with TDL from a misdiagnosis of LI. Plante and Vance regarded correct classification rates of 80% or higher as a *fair* result, and correct classification rates of 90% or higher as a *good* result. Correct classifications below 80% were considered *poor* with an unacceptably high rate of misdiagnosis.

Several studies used discriminant function analysis to determine effective identifiers of LI and TDL from a range of oral language sample variables (Bedore & Leonard, 1998; Conti-Ramsden et al., 2001; Gavin et al., 1993). These discriminant function analyses showed that morphosyntactic measures were not always effective at discriminating between children with SLI and AM groups (79% to 95%). Evidently, some children with SLI did not have verb tense difficulties. These measures often had better specificity than sensitivity. If finite verb tense omission were the only test for SLI, a number of children with SLI would be misdiagnosed with TDL. Other linguistic characteristics may also be moderate or strong identifiers of SLI.

The three studies considered here compared different linguistic measures. Firstly, Gavin et al. (1993) created composite variables from a grammatical analysis (LARSP by Crystal, 1979) and determined that verb phrase errors, single word utterances and limited production of three-element noun phrases were the primary identifiers of SLI (in 2;0 to 4;2 year olds). This combination of factors, together with age, accurately identified 86% of participants in relation to their clinical diagnosis (a fair result).

Bedore and Leonard (1998) determined that FTC was better at discriminating between SLI and TDL than NPC (in 3;7 to 5;9 year olds). Both FTC and NPC had excellent specificity (correct identification of TDL of 100%), but FTC had fair sensitivity (correct identification of SLI of 84 %.), while NPC had poor sensitivity (79%). The addition of MLU to FTC decreased specificity (to 95%), but increased sensitivity (to 95%). FTC in combination with NPC resulted in decreased specificity and sensitivity. The higher specificity measures for FTC indicate that children with TDL do not have difficulties with finite tense, while the lower sensitivity measures indicate that children with SLI usually, but not always, have difficulties with finite tense morphemes.

Finally, Conti-Ramsden et al. (2001) determined that sentence repetition was the most accurate marker of SLI (sensitivity of 90% and specificity of 85%) followed by non-word repetition (sensitivity of 78% and specificity of 87%) in a large group of older children (260 children aged 10 to 11 years). The finite tense morphemes of ED and 3S were the least accurate with fair to good specificity but poor sensitivity.

Alternative view of developmental patterns

Two alternative views exist to account for the difference in frequency between verb and noun phrase errors in children with SLI (Beverly & Williams, 2004; Rescorla & Roberts, 2002). Rescorla and Roberts showed that 3- to 4-year-old children with TDL typically develop noun morphology earlier than verb morphology. They argued that the verb and noun phrase difference evident in SLI reflected protracted verb morpheme acquisition, rather than a qualitative difference. Children with SLI remain in the stage of verb-noun phrase difference for a longer period than children with TDL.

Beverley and Williams (2004) proposed that early grammatical learning patterns differed from later learning patterns. Developmental patterns at the earlier stages of language development (MLU below three morphemes) were found to be different to the later stages of development that were more frequently examined by researchers. The young SLI group (3 & 4-year-olds) in this study used correct forms of BE significantly more often than the very young LM group (1;10 to 2;7 years) an opposite finding to other researchers, discussed earlier. Young children with SLI were therefore advantaged in the formation of early verb tense morphology in comparison to the LM group. The authors explained this apparent paradox, referred to as the *less is more* hypothesis, in terms of processing constraints that actually serve to optimise learning of early grammatical forms. The limitation, which ultimately hinders the ability to process the full scope of English morphology, serves to simplify the task in the early development stages.

GENERAL LANGUAGE MEASURES AND SLI

Many general language measures have been investigated as potential indicators of SLI. Measures of verbal productivity and complexity are typically derived from language samples and considered singly or in conjunction with other measures to distinguish children with SLI from age-matched children with TDL.

Verbal Productivity

Verbal productivity, often measured by the total number of utterances or total number of words (TNW) in a timed or constrained sample, varies in its ability to distinguish LI from TDL. Klee (1992) determined that the TNW from a timed play language sample was a useful diagnostic measure for 2 to 4-year-old children, while the total number of utterances was not. In oral narratives, utterances may be measured using various methods including the total number of syntactic units (t-units, c-units), number of ideational units (propositions) or number of words (TNW). While the ability to produce longer oral narratives increases with age (Strong & Shaver, 1991), researchers vary in their findings for the effect of LI on narrative length.

Some have determined that the number of c-units or utterances in oral narratives distinguished children with LI from AM groups (Kaderavek & Sulzby, 2000; Scott & Windsor, 2000; Strong & Shaver, 1991), while others determined that measures of length did not distinguish LI and TDL (Boudreau & Hedberg, 1999; Fey et al., 2004; Norbury & Bishop, 2003). The measure of TNW often distinguished children with LI from children with TDL in narratives (Boudreau & Hedberg, 1999; Gillam & Carlile, 1997; Scott & Windsor, 2000; Strong & Shaver, 1991; Westerveld et al., 2005), but not always (van der Lely, 1997).

Complexity

Only a few studies have looked at complexity measures other than MLU, as potential identifiers or characteristic features of LI. Children with SLI, across a range of ages (from 4 to 10 years), produce significantly less phrasal expansions, complex utterances and types of complex utterances than AM groups for a range of oral discourse tasks (Greenhalgh & Strong, 2001; Manhardt & Rescorla, 2002; Marinellie, 2004; Reilly, Losh et al., 2004; Scott & Windsor, 2000).

MORPHOSYNTACTIC FEATURES OF NLI AND OTHER LANGUAGE IMPAIRMENTS

Non-specific Language Impairment

The few available studies that compare children with SLI and NLI have mostly found similarities in morphosyntactic features rather than differences between the two diagnostic groups (Bishop, 1994b; Fey et al., 2004; Rice et al., 2004; Stothard et al., 1998; Tomblin & Zhang, 1999). A longitudinal study found that adolescents with persistent SLI did not differ significantly from children with NLI on a range of language measures including vocabulary, comprehension, and sentence and non-word repetition tasks (Stothard et al., 1998). Bishop (1994b) examined a range of language characteristics in 90 same-sex twins (mostly 7 to 10 years old), one or both of whom were diagnosed with a LI. Based on their test concordance results Bishop concluded that there was no difference in the language profiles of children with SLI and NLI.

Tomblin and Zhang (1999) found that 996 children with SLI and NLI, recruited from a large epidemiological sample, performed similarly to each other on range of measures from a standardised language test and a narrative assessment. Both LI groups had significantly greater difficulties with morphosyntactic tasks than with vocabulary or narrative tasks in comparison to an AM group. Tomblin and Zhang concluded that SLI did not have a unique profile, but was simply a case of poorer language ability, at the low end of the normal range.

Two other studies have drawn from the epidemiological sample of Tomblin and Zhang (Fey et al., 2004; Rice et al., 2004). These studies focussed on different aspects of language utilising differing methodologies but both studies compared children with SLI, NLI, low cognition but normally developing language (LC) and an AM group. Fey et al. (2004) investigated oral and written narrative production in 538 children. The SLI group produced significantly more complex utterances (c-units) than the NLI group, but the two groups did not differ in grammatical accuracy. The NLI and LC groups were also similar for syntactic complexity.

The findings of Rice et al. (2004) from a longitudinal study of 130 school-aged children differed from the previous studies. The AM and LC groups were similar in their use of finite tense, while both the SLI and NLI groups had significantly more difficulties with finite tense than both the TDL and LC groups. Notably, the NLI group had significantly more difficulties with finite tense than the SLI group. The finite tense growth curves for SLI and NLI varied, with the NLI growth curve slower from seven to nine years, then accelerating from nine to ten years of age. Outcomes for the SLI and NLI groups, however, were similar by ten years of age.

It is important to note that no information was provided on the language or non-verbal cognitive abilities of the groups examined by Rice et al. (2004), apart from the group inclusion or exclusion criteria. Thus, it is not known whether the SLI and NLI groups were matched for the severity of their language impairment, or whether the two TDL groups were matched for their level of language ability. Fey et al. (2004) reported that their SLI group had significantly better language abilities than the NLI group, as measured by their composite of standardised language assessments. Differences reported between the SLI and NLI groups by both groups of researchers may be due to differences in the severity of the LI. In conclusion, the research evidence available suggests that children with SLI and NLI have common language features.

Language Impairments associated with Identified Aetiologies

Comparisons between SLI and other language impairments in the literature suggest that the morphosyntactic characteristics of SLI are also characteristics of impairments associated with a range of identified aetiologies. Similar morphosyntactic features to those identified in SLI (i.e., difficulties with verb tenses, articles, complex sentences, verbal productivity, lexical diversity) are identified in children with Down syndrome (Bol & Kuiken, 1990; Chapman, 1997; Chapman, Seung, Schwartz, & Bird, 1998; Eadie, 1999, 2001; Eadie et al., 2002; Laws & Bishop, 2003), Williams syndrome (Reilly, Losh et al., 2004), autism (Kjelgaard & Tager-Flusberg, 2001; Norbury & Bishop, 2003), intellectual disability (Hemphill, Picardi, & Tager-Flusberg, 1991) and brain injury (Reilly, Losh et al., 2004; Reilly, Weckerly et al., 2004; Reilly, Bates, & Marchman, 1998). In particular, both children with SLI and children with Down syndrome demonstrate significant difficulties with finite verb tenses (Eadie et al., 2002; Laws & Bishop, 2003). Children with Down syndrome also demonstrated poorer language compared to NVCA, but not to the same degree found in SLI.

Some differences between SLI and other LIs are demonstrated in the developmental progression of the LI. While children with injuries to the language areas of the brain often demonstrate similar language characteristics to SLI, they differ significantly from children with SLI in the progression and resolution of their difficulties. Children with focal brain injury, who may be similar to children with SLI in their younger years, recover from their morphosyntactic deficits by middle childhood, while children with SLI still show evidence of more significant difficulties (Reilly, Losh et al., 2004; Reilly, Weckerly et al., 2004).

Matching on cognitive measures has highlighted some differences between SLI and other LI groups. Kamhi and Johnston (1982) found that syntactically, children with intellectual disability and SLI were qualitatively and quantitatively different in their use of linguistic structures. The SLI group produced a higher frequency of morphosyntactic errors than an older group with intellectual disability and an AM group, all matched for cognitive ability. The errors were particularly evident when attempting verbs, negatives and interrogative reversals. The children with intellectual disability asked less questions, used early developing conjunctions (*and*) more frequently, and produced progressive tense sentences more frequently than the SLI and AM groups. This finding suggests that children with NLI may also attempt less complex language and make less grammatical errors than children with SLI.

However, the groups in the Kamhi and Johnston (1982) study were not matched on any index of language ability. The children with intellectual disability had significantly longer MLUs than both other groups so it is possible that different results could occur if the groups were matched for MLU. Without a common language variable to anchor the comparisons, differences between the children with SLI and intellectual disability may simply reflect different levels of language impairment. The finding that children with SLI have poorer language skills than children with intellectual disability, relative to their non-verbal cognitive skills, is a feature already inherent in the diagnostic criteria.

Similarities are also evident between children with SLI and children with Down syndrome using matches on the basis of non-verbal cognitive ability (Chapman, Seung et al., 1998; Laws & Bishop, 2003). Verb tense morphology and working memory were identified as problematic, while vocabulary was identified as an area of strength relative to other language skills, for both children with SLI and children with Down syndrome (Laws & Bishop, 2003). Chapman et al. (1998) found that children and adolescents with Down syndrome produced shorter utterances than children matched for mental age.

A discriminant function analysis by Laws and Bishop (2003) compared three groups that were matched for non-verbal cognition: 19 children and adolescents with Down syndrome (10 to 19 year olds), 17 children with SLI (4 to 7 year olds) and 19 children with TDL (4 to 7 year olds). Combined measures for a range of language characteristics (receptive grammar, expressive and receptive vocabulary, memory for sentences, non-word repetition, MLU, and the morphemes 3S and ED) showed good classification of TDL (94%), fair classification of Down syndrome (84%) and extremely poor classification of SLI (17.6%). The majority of children with SLI were erroneously classified as Down syndrome (70.6%), due to the similarities between the two groups.

In summary, many similarities in morphosyntactic characteristics were identified between SLI and LIs associated with differing aetiologies. This suggests that a dysfunctional language system may result in a similar range of linguistic features whatever the cause or concomitant disorders.

EXPLANATIONS FOR MORPHOSYNTACTIC DEFICITS IN LANGUAGE IMPAIRMENT

Theoretical approaches that attempt to explain SLI were introduced in Chapter 1. Evidence from studies of morphosyntactic deficits provide varied support for linguistic and processing deficits as explanations of SLI. This will be demonstrated through consideration of several specific theories encompassed by these approaches. Explanations for NLI are not evident in the literature. However, common morphosyntactic deficits for SLI and NLI suggest common explanations.

Linguistic Deficit Accounts

Grammatical rule deficits

Gopnik and Crago (1991) proposed that children (and adults) with SLI possess a genetically-based deficit in the linguistic mechanism for constructing morphological inflections. This account, has been referred to as *feature blindness*, the *missing feature hypothesis*, and more recently the *implicit rule deficit account* (Leonard et al., 1997). The implicit rule deficit account predicted errors in the use of a wide range of grammatical morphemes because their underlying representations of morphosyntactic features were impaired. That is, children with SLI were unable to understand or acquire the implicit rules for marking tense, number or person, but produced grammatical morphemes at random or not at all.

However, the predominant error pattern of omission, rather than interchangeable or inappropriate use of grammatical morphemes, has been interpreted as evidence that children with SLI do have knowledge of how to apply grammatical rules, albeit inconsistently (Bishop, 1994a; Leonard et al., 1992; Leonard et al., 1997). When children with SLI apply a grammatical rule, they usually do this correctly. In addition, a deficit in the ability to acquire grammatical rules has not been supported by those who argue that the difficulties of children with SLI focus on a narrow, rather than broad, range of grammatical morpheme errors (Leonard et al., 1997; Rice & Wexler, 1996b).

Extended optional infinitive (EOI) account

Rice and colleagues (Rice, Haney et al., 1998; Rice et al., 2004; Rice & Wexler, 1996b; Rice, Wexler et al., 1998) argued that children with SLI have an innate linguistic deficit that is very specific in its nature. The deficit is not a generalised one because there is little evidence that children with SLI apply grammatical rules randomly or inappropriately. The EOI account attempted to explain why children with SLI use some grammatical morphemes relatively well (e.g., prepositions, plurals) but have great difficulty using verb tenses. Children with SLI rarely used verb tenses inappropriately (e.g., "the boy *am* sitting") as their problem was one of omitting verb tenses inconsistently, or optionally with an extended acquisition period for this select and vulnerable aspect of grammar. The EOI account perceives that growth in use of finite tense is due to maturational effects as Rice et al. (1998) determined that other variables such as maternal education, receptive vocabulary and MLU contributed little to development of finite tense markers.

Rice et al. (2000) also showed that LM groups produced more expressions of irregular verb forms as finite forms (over-generalisation) than children with SLI. The findings suggest that children with SLI have greater difficulties with rule-based grammatical systems than with memory based language systems such as vocabulary and irregular forms. This conclusion is consistent with the dual mechanism account (Oetting & Horohov, 1997) which proposed two parallel grammatical learning processes: the lexically based learning of irregular grammatical forms (e.g., irregular past tense) that relied on associative memory networks; and rule generated regular inflections (the area of greater difficulty for children with SLI). A comparison of irregular forms between children with SLI and NLI would reveal whether NLI also had greater difficulty with rule based grammatical systems, in comparison to memory-based systems.

Recently, Rice et al. (2004) found evidence that supported operation of the EOI account in children with NLI. This suggests that both SLI and NLI have a common linguistic deficit. Although the children with SLI had more significant difficulties with finite tense morphemes than the children with NLI, finite tense was still the major problem area for NLI. Other researchers have provided qualified support for the EOI account in the sense that finite tense morphemes pose a particularly strong problem for children with LI, but dispute the EOI account as an explanation for the full range of morphosyntactic deficits in children with LI (Eadie, 1999; Leonard et al., 1997).

Processing Capacity Accounts

Working memory accounts

The exact nature of the relationship between verbal working memory (often tested using repetition of nonsense words or sentences) and morphosyntactic deficits is unclear. Available research has not determined whether working memory has a causal role, or whether it is a concomitant feature of LI. The prediction is that problems with working memory will result in a broad range of language characteristics. This is in contrast to grammatical accounts that predict a narrow range of deficits.

Bishop (1994a) suggested that the inconsistent morpheme omissions, characteristic of SLI, were due to a limited processing capacity rather than a specific linguistic deficit. Beverly and Williams (2004) argued that the constraints evident in a limited processing capacity in SLI served to support early morphosyntactic development, but hampered later morphosyntactic development.

Evidence of a broader range of morphosyntactic and other linguistic characteristics in children with LI supports the concept of a limited processing capacity rather than a specific linguistic deficit (Eadie, 1999; Eadie et al., 2002) (Bedore & Leonard, 1998; Bishop et al., 2000; Conti-Ramsden et al., 2001; Gavin et al., 1993; Leonard, 1992; Leonard et al., 1997; Rescorla & Roberts, 2002). Bishop (1994a) argued that the pattern of inconsistent omissions and lack of comission errors indicated a problem with performance (e.g., processing) rather than with linguistic competence. Conti-Ramsden, Botting and Faragher (2001) determined that memory tasks such as sentence repetition and non-word repetition were stronger identifiers of SLI and TDL than tense markers. Yet, they were not convinced of the unique nature of working memory deficits in SLI, suggesting that "difficulties with nonword repetition may be more related to any language impairment and that the specific nature of SLI still remains to be understood fully." (Conti-Ramsden et al., 2001, p. 747).

Children with NLI and with Down syndrome also show evidence of a broader range of deficits in morphosyntax (not restricted to finite tense deficits) and working memory which indicates a commonality of explanation with SLI (Eadie, 1999; Eadie et al., 2002; Ellis Weismer et al., 2000). This implies that difficulties with processing capacity and morphosyntax are not unique to SLI.

Surface (low phonetic substance) account

The surface account, (a limited capacity to process grammatical morphemes of brief duration), is supported by cross linguistic findings which find that children with SLI have less problems with the inflectional system in inflectionally rich languages than they do in English. In English many morphemes are of short duration (e.g., -s, -ed), while other languages possess a richer inflectional system, in which the inflectional morphemes are of longer duration, and thus more salient. This supports the notion that saliency and frequency of inflections are critical factors for language learnability in children with SLI (de Jong, 2004; Leonard, 1998, 2000).

The surface account is also supported by evidence that children with SLI differed from children with TDL in their sensitivity to inflections of different length (Montogomery & Leonard, 1998). Montgomery and Leonard showed that children with SLI were sensitive to inflections of longer duration, but not to inflections of shorter duration; while an AM group, matched for receptive syntax, were sensitive to inflections of both long and short duration. On the other hand, Norbury, Bishop and Briscoe (2001) determined that children with SLI had significantly more difficulties with finite verb tenses than children with hearing impairment. They concluded that difficulties perceiving morphemes of weak phonetic substance was not a sufficient explanation for SLI. However, children with hearing impairments may rely on other modalities in addition to sound perception, such as lip reading.

Challenges to the surface account come from evidence that homophonous morphemes with different grammatical functions do not pose similar levels of difficulty for children with SLI (Leonard et al., 1992; Leonard et al., 1997). Children with SLI have greater difficulties with accuracy for 3S than PLS, which suggests that more than perceptual saliency is involved. Leonard and colleagues also determined that children with SLI had significantly greater difficulties with PLS than a LM group; both expressed using the same brief phonemes. However, Rice and Wexler (Rice & Wexler, 1996b) did not find differences between SLI and LM groups. Differences in conceptual saliency may operate, additional to perceptual saliency, (e.g., a child’s ability to understand concepts of quantity as opposed to concepts of time). Grammatical saliency may also be affected by word position and clausal and phrasal contexts. For example, Dalal and Loeb (2005) found that children with SLI produced ED more accurately when the verb was in final sentence position.

Similarities between children with SLI and NLI in their use of brief morphemes would suggest that the surface account could form a common explanation for LI in both these groups. On the other hand, if children with NLI had more difficulties with morphemes of brief duration than children with SLI, then the NLI children's broader cognitive difficulties may be influencing conceptual or perceptual saliency.

Contributions to Explanation from Cross-linguistic, English as a Second Language and Dialectic Studies

Studies of SLI in languages other than English have shown that many diagnostic profiles and theoretical explanations are biased by the properties of the English language (de Jong, 2004). While difficulties with verb morphology are described as a clinical marker of SLI in English, they are not necessarily a feature of SLI in other languages (Leonard, 2000). Dutch-speaking children with SLI make a significant number of substitution errors (as opposed to English errors of omission) for verb tense and number marking (de Jong, 2004). Italian-speaking children show significant difficulties with definite singular articles and third person plural inflections, but not with finite tense morphemes (Bortolini, Caselli, Deevy, & Leonard, 2002). Swedish children with SLI display word order difficulties, that reflect complex word order rules in Swedish (Hansson, Nettelbladt, & Leonard, 2000). Rescorla and Roberts (2002) argued that verb morphology is particularly difficult for English language learners, including young children acquiring English as their first language.

Cross-linguistic studies suggest alternative accounts for SLI. The morphological richness account explains that children with SLI from highly inflectional languages show less difficulties with inflections than in English, which is only partially inflected (Bortolini, Caselli, & Leonard, 1997). A prosodic account is supported by finding that in Italian SLI problematic inflections were those that did not conform to a strong-weak syllable pattern (Bortolini et al., 2002).

One examination of second language learners and speakers of different English dialects showed some interesting parallels with SLI. Paradis and Crago (2000) compared French-speaking children with SLI, French-speaking children with TDL and English-speaking children acquiring French as a second language. Both the French SLI and French second language learners used significantly more non-finite verbs than the French TDL group. Although the EOI effect operated to a lesser extent in French than in English studies, Paradis and Crago suggested that the EOI stage might be “an intermediate process in all language learning contexts” (p. 844). Their evidence indicated that tense marking is not an effective clinical marker for distinguishing between SLI and a second language learner.

Some dialects of English raise relevant issues in relation to a discussion of the linguistic characteristics of SLI, particularly those with Creole or pidgin connections to other languages. Aboriginal English and Singaporean English are two examples of English dialects that differ from Standard Australian English: one arising in Indigenous Australians (Dinos, 2002; Gould, 2004); and the other arising as a common language in multilingual Singapore (Brebner, 2001). In both these dialects finite verb tenses, plurals and articles are often omitted. This suggests that certain grammatical morphemes have high vulnerability in the English language and that “their native language in part determines the problem space with which language-impaired children are faced” (de Jong, 2004, p. 264). Grammatical morphemes, particularly finite verb tenses, are the problem space for the English language, with omission the strategy of choice, whether the cause is SLI or the task of learning or adapting English as a second language learner. Indeed, a meeting of eminent researchers (Tager-Flusberg & Cooper, 1999) called for research to investigate “the differentiation of SLI from bilingual and second-language learning” (p. 1277).

The relationships among learning English as a second language, dialectical differences and LI have not been fully explored. However, evidence of similar morphosyntactic vulnerabilities suggests that the morphosyntactic vulnerabilities or characteristics of SLI may be universal to language learning challenges for English across circumstances. This predicts that children with NLI will have similar linguistic characteristics or areas of language vulnerability to children with SLI.

SUMMARY

While there is general agreement about the areas of morphosyntax that are characteristically problematic for children with SLI, there is a lack of agreement on how these findings should be interpreted. On the one hand, frequent omission of finite verb tense morphemes is perceived as a unique clinical marker of SLI. On the other hand, a wider array of morphosyntactic morphemes is considered problematic for children with SLI, with some morphemes typically more difficult than others. Findings of differences between children with SLI and younger LM children are inconsistent across researchers. Changing patterns of development across different ages also suggest that comparisons between SLI and younger LM children are not straightforward.

Available research suggests that the morphosyntactic characteristics and processing capacities of children with SLI and NLI are similar, and suggests that language impairment cannot be accounted for by variations in non-verbal cognition. Similar morphosyntactic deficits are also identified in LI associated with other aetiologies. These studies support the concept that language is modular, in the sense that language is dissociated from non-verbal cognitive skills. The linguistic characteristics identified in SLI may not be unique to SLI, but common to LI concomitant with a wide range of disorders and differing aetiologies.

Theories of language impairment are varied and lack agreement. There may be no need, however, to dismiss one in favour of another. Evidence for a linguistic deficit, may account for a subgroup of LI, while a limited processing capacity may account for another subgroup of LI. The dynamic interactional model, introduced in Chapter 1, provides a model of how both a linguistic deficit and a limited processing capacity may be considered as causal factors. Heterogeneity in the characteristics of LI, suggests that causal factors may vary among affected children. Each deficit may operate to varying degrees in each individual.

HYPOTHESIS AND QUESTIONS

This thesis is concerned with differential diagnosis of SLI from NLI. The evidence raised in this chapter leads to questions about whether or not SLI can be distinguished from NLI based on their morphosyntactic characteristics. Recent evidence suggests that these two groups are similar, rather than different. However, there is a lack of research that directly compares SLI and NLI with careful matching on appropriate language variables, such as MLU and language test scores.

The first hypothesis examined by the thesis is that: *The morphosyntactic characteristics of children with NLI and those of children with SLI will not differ on like tasks, but the morphosyntactic characteristics of the two LI groups will differ significantly from age-matched (AM) and language-matched (LM) children with TDL.*

More specifically, several questions arise in relation the identification of differences for specific morphosyntactic and general measures:

1) Are there differences in the use of finite verbs: Specifically, accuracy of copulas, auxiliaries, regular past tense and third person singular?

2) Are there differences in the use of non-tense verb morphemes: specifically, accuracy of the progressive verb aspect *ing* and modals?

3) Are there differences in the use of bound and free morphemes in noun and adverbial phrases: specifically, accuracy of plurals genitives, articles and pronouns?

4) Are there differences in clausal complexity: specifically, measured as proportions of fragments, complete and complex clauses, and the subordination index?

5) Are there differences in the proportion of utterance level errors of a syntactic or semantic nature?

6) Are some morphosyntactic variables more discriminating than others for achieving a differential diagnosis of LI?

CHAPTER 3: THE ROLE OF ORAL NARRATIVE IN THE DIFFERENTIAL DIAGNOSIS OF SLI

INTRODUCTION

Some children with language impairments who display minimal difficulties at the single word or sentence level, such as morphosyntactic deficits, will display significant difficulties at the discourse level (Fey et al., 2004; Paul, 2001). Discourse tasks may be more challenging for children with language impairments because they require the integration of knowledge and skills from a number of different domains: linguistic, cognitive, social and pragmatic (Boudreau & Chapman, 2000; Griffith, Ripich, & Dastoli, 1986; Hemphill et al., 1991; Miles & Chapman, 2002; Olley, 1989; Shapiro & Hudson, 1991; Westby, Van Dongen, & Maggart, 1989). As children's morphosyntactic skills, particularly grammatical accuracy, approach mastery at 5 years of age (Crystal, Fletcher, & Garman, 1976; Rice, Wexler et al., 1998) their discourse and oral narrative skills are typically still developing (Berman & Slobin, 1994; James, 1999; Karmiloff-Smith, 1986).

Discourse difficulties interfere with learning and functioning at preschool and school and have detrimental effects on social interactions (Bishop & Edmundson, 1987; Crais & Lorch, 1994; Feagans & Appelbaum, 1986). Performance on discourse tasks is pertinent to the assessment of functional communication that is culturally and contextually centred, and to the determination of intervention goals that are relevant for real-life communication situations (Crais & Lorch, 1994). Therefore, assessment of discourse skills is often recommended as part of the diagnostic process, although standardised formats remain limited or unavailable (Crais & Lorch, 1994; James, 1999; James, 2001; Johnson, 1995). Oral narrative[2] is the area of discourse most explored by researchers in relation to child language development and impairment, and for which there are extensive frameworks for analysis (Hedberg & Westby, 1993; Hughes, McGillivray, & Schmidek, 1997).

Definitions of oral narrative vary and range from minimal descriptions that could be applied to a broad range of discourse genres, to highly specific descriptions of a particular genre. For example, Peterson and McCabe (1994) defined narrative as

[2] The term *narrative* will be used, rather than the term *story*, except in quotes, in reference to specific analysis systems and regularly used terms (e.g., story grammar, story-stem) and in reference to instructions given to children (e.g., "tell me a story").

"an instance of talk about events removed in time and included at least two adjacent utterances on the same topic" (p. 940), while Olley (1989)described narrative as connected text, usually presented as a monologue. A broad view of oral narrative includes events that have been personally experienced or witnessed, events retold by someone removed from the event; scripts that describe recurring everyday events; and eventcasts that describe or direct ongoing events in real time (Hedberg & Westby, 1993; Hughes et al., 1997; Peterson, 1990, 1993).

An alternative view is to focus on narratives as fictional events, created or retold by the narrator or as a set of events with a problem or conflict that requires resolution (Butt et al., 2000; Hedberg & Westby, 1993). A narrative is expected to entertain and presents the narrator's view and interpretation of events, which are expected to be related in an orderly and logical fashion (Olley, 1989). This chapter will focus on evidence for difficulties with problem based, largely fictional, narratives in children with LI.

While the frameworks developed for narrative structure analysis have been used extensively, procedures for eliciting and analysing oral narratives have not been standardised. No robust normative data has been developed for clinicians or researchers to use in the assessment of oral narrative development (James, 1999; James, 2001; Johnson, 1995; Liles, 1993). General guidelines are available for understanding the range of narrative structures expected at each age (Hedberg & Westby, 1993; Hughes et al., 1997), yet caution must be applied in interpreting these in the absence of standardised procedures and norms.

Wide variation in oral narrative skills is reported as a strong feature in young children, particularly around the age of 5 years (Berman & Slobin, 1994; Johnson, 1995; McCabe & Rollins, 1994). Johnson postulated that a wide range of diversity in narrative skill levels would hamper the development of norms. This implies that many contributing factors may be at play in the development of narrative skills in this age group.

NARRATIVE FEATURES OF SLI

Narrative Structure

Framework for analysis

Researchers approach narrative structure from different perspectives and utilise different methodologies. The focus of this chapter will be on the frequently used *story grammar* analysis, based on the early work of Stein and Glenn (1979), and adaptations such as key event analysis (Boudreau & Hedberg, 1999).

Early development of narrative structure focuses on the emergence of description, thematic relationships, temporal sequencing, and cause and effect relationships. A pivotal stage is reached when narratives become goal directed (GD) and focussed on the resolution of a problem (Hedberg & Westby, 1993; Hughes et al., 1997). Most preschoolers have not mastered plot structure, but by early school age, most children are able to produce narratives with simple plots, with the ability to produce more complex plots emerging as children progress through the school years.

The *essential* plot components of a *complete* GD episode[3] are an *initiating event* or *internal response* (as these refer to the motivation or purpose of the character's behaviour); overt *attempts* to solve the problem; and a *consequence* that represents success or failure in attaining the goal (Boudreau & Hedberg, 1999; Liles, 1987; Merritt & Liles, 1987; Stein & Glenn, 1979). A narrative that is missing an essential plot component forms an *incomplete* episode (Liles, 1987). GD narratives may become more complex through the introduction of *obstacles* to goal attainment that lead to repeated attempts to solve the problem (Hedberg & Westby, 1993; Hughes et al., 1997). Narratives may include information about the *internal plans* of the characters (describing how they intend to achieve their goals) and the *reactions* of the characters (emotional, cognitive or behavioural) to the event consequences (Hedberg & Westby, 1993; Hughes et al., 1997).

Later oral narrative development involves the elaboration of GD narratives through the production of more than one episode. These additional episodes may inter-relate as a series of episodes or may be embedded within each other. Elaborated narratives may also include goals, plans, attempts and reactions from different character perspectives that interact with each other (Hedberg & Westby, 1993; Saliba, 2001).

Coherent narratives also provide *setting* information to introduce the characters and provide the temporal, social and physical context for the narrative (Merritt & Liles, 1987; Peterson & McCabe, 1994). They include *ending* statements to indicate narrative completion. While setting, reaction and ending components are considered important for narrative quality and contextual reference, they are not

[3] This use of the term *complete* episode is not to be confused with use of the same term by Hedberg & Westby (1993) to define a level of narrative that includes every type of narrative component.

considered crucial to the essential or minimum episode plot structure (Merritt & Liles, 1987).

Specific language impairment

Some research findings conflict in their comparisons of children with LI and TDL on measures of narrative organisation. Evidence exists that narrative structure may be less vulnerable to the effects of LI and less effective at identifying LI than more linguistic measures such as cohesion and morphosyntax (Liles, Duffy, Merritt, & Purcell, 1995). On the other hand, it has been shown that difficulties with narrative structure resolve more slowly than difficulties with morphosyntax in children with a history of slow expressive language development, and may provide evidence of residual deficits in resolved LI (Paul, Hernandez, Taylor, & Johnson, 1996).

Nevertheless, a body of research evidence supports narrative structure deficits as a feature of SLI in children from the preschool to the adolescent years, summarised in Table 3.1. This evidence holds across a range of differing narrative stimuli, elicitation procedures, listener conditions, and analysis methods. School aged children with SLI produce less mature, earlier level narrative structures, than AM groups (Manhardt & Rescorla, 2002; Miranda, McCabe, & Bliss, 1998; Olley, 1989; Paul et al., 1996; Wagner, Sahlen, & Nettelbladt, 1999). Older children with SLI produce narratives with higher frequencies of the essential plot components than other quality and context components, as do children with TDL (Merritt & Liles, 1987). However, school-aged children with SLI, produce essential plot components less often than AM groups (Copmann & Griffith, 1994; Merritt & Liles, 1987; Olley, 1989), and produce fewer quality and context components than AM groups, resulting in less events and less complete episodes (Boudreau & Hedberg, 1999; Copmann & Griffith, 1994; Gillam & Carlile, 1997; Liles, 1987; Merritt & Liles, 1987; Olley, 1989).

Unlike studies of morphosyntax, few researchers have compared the structure of narratives produced by children with SLI, with those produced by younger LM groups. Two studies found that school-aged children with SLI produced simpler narratives than LM groups matched on reading ability, or a standardised assessment of language ability (Gillam & Carlile, 1997; Olley, 1989). This suggests that difficulties with narrative structure are a significant area of deficit or characterise a disordered pattern of development for children with SLI.

Table 3.1 Summary of studies investigating oral narrative deficits in SLI

Aspect	*Finding*	*SLI age (yrs)*	*Researcher(s)*
Structure	SLI produce simpler, earlier level narratives than AM	5 to 10-	(Manhardt & Rescorla, 2002; Miranda et al., 1998; Olley, 1989; Paul et al., 1996; Wagner et al., 2000)
	SLI produce less complete & more incomplete episodes than AM	7 & older	(Liles, 1987; Merritt & Liles, 1987; Olley, 1989)
	SLI produce fewer components & events than AM	7 to 13	(Boudreau & Hedberg, 1999; Copmann & Griffith, 1994; Merritt & Liles, 1987)
	SLI omit more components than AM	7 & older	(Olley, 1989)
	SLI produce more confused structures than AM	8 to 11	(Gillam & Carlile, 1997; Merritt & Liles, 1987; Miranda et al., 1998)
	SLI produce narratives with similar structure to AM	2 to 5	(Boudreau & Hedberg, 1999; Kaderavek & Sulzby, 2000)
	SLI produce simpler narratives than LM	7 & older	(Gillam & Carlile, 1997; Olley, 1989)
	SLI produce more incomplete episodes; and omit more components than LM	7 & older	(Olley, 1989)
Cohesion	SLI produce less cohesive ties than AM	7 to 10	(Olley, 1989; Strong & Shaver, 1991)
	SLI produce less complete & more erroneous cohesive ties than AM	2 to 10	(Kaderavek & Sulzby, 2000; Olley, 1989; Strong & Shaver, 1991)
	SLI produce more repetitive lexical ties than AM	2 to 4	(Kaderavek & Sulzby, 2000)
	SLI produce less complete (& more erroneous) lexical ties; and more erroneous demonstrative ties than AM	7 & older	(Olley, 1989)
	SLI produce less complete (& more erroneous) pronominal ties than AM	2 to 10	(Kaderavek & Sulzby, 2000; Norbury & Bishop, 2003)
	SLI produce more lexical and less pronominal ties; but similar erroneous pronominal ties compared to LM	10 to 13	(van der Lely, 1997)
	SLI produce more erroneous (& less complete) ties than LM	7 & older	(Olley, 1989)
Content	SLI provide less information than AM	4 & 5	(Boudreau & Hedberg, 1999; Paul & Smith, 1993)
	SLI, pragmatic impairment & autism provide similar information to AM	6 to 10	(Norbury & Bishop, 2003)
	SLI produce less elaborated noun phrases but similar cognitive & linguistic verbs; & adverbs compared to AM	7 to 10	(Greenhalgh & Strong, 2001)
	SLI provide similar information to LM	8 to 11	(Gillam & Carlile, 1997)

Note: SLI = specific language impairment; AM = age-matched control group; LM = language-matched control group

The narrative structures of school-aged children with SLI are described as more ‘confused’ than those of AM groups (Gillam & Carlile, 1997; Miranda et al., 1998). Confused narratives are characterised by the omission of critical content, the inclusion of irrelevant information, the lack of a consistent theme, a lack of logical sequence and omission of a logical consequence or conclusion (Merritt & Liles, 1987).

Similar difficulties with narrative structure are identified in school-aged children with learning disabilities (who often include children with a history of SLI), in comparison to AM groups (Klecan-Aker & Kelty, 1990; Ripich & Griffith, 1988; Roth & Spekman, 1986). However, difficulties with narrative structure appear to be more pronounced in children with SLI, as school aged children with SLI recalled fewer events and fewer settings and reactions than AM groups with learning disabilities (Copmann & Griffith, 1994).

In two studies, no significant differences for narrative structure were evident between children with SLI and AM groups (Boudreau & Hedberg, 1999; Kaderavek & Sulzby, 2000). In both studies young children did not differ from AM groups in the essential structure of their narrative retells. Age may be a factor here, as the studies that reported significant differences examined school-aged children, while these latter two studies examined younger children (2 to 5-year-olds). This contradicts a claim that differences between SLI and AM groups are larger at younger ages (4 years) than at older ages (12 years) (Reilly, Losh et al., 2004).

Character Introduction

The tracking of characters within an oral narrative is important for production of a coherent narrative that is easy for the listener to follow, particularly in a narrative with multiple characters. Character introductions or *first mentions* of a character are important to examine as these provide the anchor for subsequent cohesion. If the characters are not introduced explicitly at the beginning of the narrative, (e.g., omission of subjects from initial propositions) the result is a lack of clarity about to whom the narrator is referring.

Children with SLI have relatively little difficulty with introducing characters, measured by their use of pronominal or lexical strategies and use of definite and indefinite articles (Kaderavek & Sulzby, 2000; Norbury & Bishop, 2003; van der Lely, 1997). Choice in using the definite or indefinite article with character naming reflects the pragmatic function of the article (O'Neill & Holmes, 2002). Use of the definite article or determiner has a deictic function and implies that the character is known to the listener, has been previously introduced, or is present in the shared picture stimulus. Conversely, use of the indefinite article implies that a character is unknown to the listener and has not been previously introduced. While school age children with SLI used more definite articles (incorrect) and less indefinite articles (correct) for introductions than AM groups, the majority used indefinite articles correctly to introduce characters (Norbury & Bishop, 2003; van der Lely, 1997).

Cohesion

Cohesion serves to link meanings across sentences or clauses within a text or unit of discourse "when the *interpretation* of some element in the discourse is dependent on that of another" (Halliday & Hasan, 1976, p. 4). For example, characters need to be referred to in a way that enables a listener to understand and keep track of who does what to whom, often using both lexical and pronominal devices (e.g., '*The boy* picked up *the little frog*. Then *he* took *it* home to show *his mum*'). This literature review will focus on cohesion of characters in oral narratives because character cohesion in children with SLI is frequently identified in the literature as a source of difficulty for SLI (Kaderavek & Sulzby, 2000; Liles, 1985; Norbury & Bishop, 2003; Olley, 1989; Paul et al., 1996; Paul & Smith, 1993; Strong & Shaver, 1991).

Framework for analysis

The strategies used to provide cohesion are termed *cohesive devices*. Five types of cohesive devices are described by Halliday and Hasan (1976) that concern identity and the tracking of information pertaining to participants, events, objects and places. Firstly, *lexical* cohesion refers to the use of lexical items that are related semantically to preceding lexical items (Gerot & Wignell, 1994; Halliday & Hasan, 1976; Paltridge, 2000). Lexical cohesive devices range from highly specific terms (e.g., the little green frog on the rock) to less specific use of generic terms (e.g., an animal), and include the use of repetition, synonymy (similarity of meaning), antonymy (opposite or contrastive meaning), hyponymy (super/subordinate classes) and meronymy (whole-part relationships). A high density of lexical cohesive devices can indicate a high level of topic maintenance (Peterson & Dodsworth, 1991).

The remaining cohesive devices are primarily grammatical in nature (Gerot & Wignell, 1994; Halliday & Hasan, 1976; Paltridge, 2000). The second device of *reference* uses pronouns or demonstratives that refer to specific information that can be retrieved from within the text (endophoric). Sometimes, referencing may operate outside the text, referring to information in the situational context (exophoric). Thirdly, *comparative reference* denotes a contrastive or similar identity (e.g., the *other* frog). Fourthly, *substitution* is the use of a word to replace another word or phrase (e.g., he wanted *one*). Finally, *ellipsis* describes the deletion of words or phrases because the information can be implied from the surrounding text or situational context, often in responses to question (e.g., “Where are you going?” “Home.”).

Analysis of cohesion in LI requires further examination of the adequacy and frequency of the devices used. Liles (1985) described the cohesive devices used by children with SLI as cohesive ties (emphasising links in meaning) and coded their adequacy as *complete* (correct), *incomplete* (exophoric) or *erroneous* (ambiguous or incorrect). Cohesive density (frequency) may be measured by calculating the number of cohesive ties per utterance (c-unit or t-unit) (Strong & Shaver, 1991).

Specific language impairment

Cohesive density is lower in the narratives of children with SLI than in AM groups. School aged children with SLI produce proportionally fewer cohesive ties than AM groups (Olley, 1989; Strong & Shaver, 1991). Both younger and school aged children with SLI were found to use more lexical and demonstrative ties and fewer pronominal ties than children without SLI (Kaderavek & Sulzby, 2000; Liles, 1985; Norbury & Bishop, 2003). Young children with SLI produce more repetitive lexical labelling of characters than AM groups, in contexts where pronouns for already introduced characters would be appropriate.

A fundamental difference, between children with and without SLI, lies in the adequacy of the cohesive ties in their oral narratives. Children with SLI produce less complete and more erroneous cohesive ties than AM groups (Liles, 1985; Olley, 1989; Paul et al., 1996; Paul & Smith, 1993; Strong & Shaver, 1991). Ambiguous pronouns (an erroneous tie) are noted as a particular feature of language impairment in school aged children with SLI (Norbury & Bishop, 2003).

By contrast, van der Lely (1997) found similarities in a comparison of cohesion between a older children with SLI and a LM group. The children with SLI produced few ambiguous pronouns (erroneous ties), indicating that they may achieve relative mastery of the pronominal referencing system by 10 to 13 years of age. However, the SLI group used more lexical ties than the LM group to reintroduce characters, and used fewer pronominal ties than the LM group to maintain reference. It seems that in their early years children with SLI demonstrate difficulties with the pronominal referencing system through ambiguity and incorrect use of pronouns; but later, their difficulties are demonstrated in a preference for lexical ties in place of pronominal ties.

Content

Information provision in oral narratives is linked to lexical knowledge and expressive vocabulary development. Varied systems are used by researchers to measure narrative content: broadly grouped into systems for scoring information content and systems for measuring the diversity or types of lexical items used. Findings for content deficits in children with SLI differ.

Information scores

Two studies identified differences between young children with SLI and AM groups (Boudreau & Hedberg, 1999; Paul & Smith, 1993), in retell tasks using wordless picture books. Boudreau and Hedberg investigated the content of narratives produced by young children in a retell task, using a frog wordless picture book (Mayer, 1969), and found that the SLI group provided significantly less information than the AM group. They analysed content by scoring against a checklist of information contained in the original narrative told to the children. Paul and Smith identified that young children with SLI achieved lower information scores than AM groups using the Bus Story (Renfrew, 1991).

Conversely, two others studies identified similar levels of information provision between older children with SLI and AM groups (Gillam & Carlile, 1997; Norbury & Bishop, 2003). Norbury and Bishop analysed narrative generation using an information scoring system that focussed on semantic propositions, with limited scope for scoring individual information items. They also determined that there were no significant differences in the production of bizarre or irrelevant information. However, judgement of what constituted irrelevant information was highly variable, with poor inter-rater reliability. Gillam and Carlile found no differences in the degree to which the information in narrative retells matched or diverged from the original narratives that had been presented auditorily.

Lexical diversity

The number of different words (NDW) in controlled length samples is often used as a global measure of lexical diversity. However, reports of the success of NDW as a diagnostic indicator of LI vary. Klee (1992) and Watkins, Kelly, Harbers and Hollis (1995) reported that NDW in language samples from 2 to 5-year-olds in play sessions effectively distinguished LI from age-matched children with TDL. In narrative tasks, some authors have determined that NDW distinguished children with SLI from AM groups (Boudreau & Hedberg, 1999; Fey et al., 2004; Paul et al., 1996;

Paul & Smith, 1993), while others determined that NDW did not distinguish SLI and AM groups (Greenhalgh & Strong, 2001; Scott & Windsor, 2000; Westerveld et al., 2005). NDW measures may also be a product of narrative length, with shorter narratives resulting in a higher NDW, and longer narratives resulting in a lower NDW (Greenhalgh & Strong, 2001). This may be due to the frequent repetition of closed class words such as articles, auxiliaries and prepositions in longer samples.

Types of words and phrases typically used in oral narratives have also been examined for LI effects. Greenhalgh and Strong (2001) identified that school aged children with SLI produced significantly less elaborated noun phrases than AM groups, while there were no differences in the use of cognitive verbs (e.g., think), linguistic verbs (e.g., said) or adverbs.

NARRATIVE FEATURES OF NLI AND OTHER LANGUAGE IMPAIRMENTS

Narrative Structure

One study of narrative skills in school aged children with NLI determined that their narratives were of significantly poorer structure than those of an AM group, and structurally similar to those of the SLI group (Fey et al., 2004) for plot, context and quality components. Fey et al. also showed that a group with TDL but low non-verbal cognition (LC) also produced narratives that were significantly poorer than the AM group, suggesting that NVCA also played a role in narrative abilities. Other studies of oral narrative in NLI were not evident in the literature, but an exploration of findings for other LIs will provide information on whether the narrative deficits identified for SLI are unique to SLI or characteristic of a broad range of LIs.

A range of deficits in oral narrative structure are evident in children with LIs that arise from or are associated with a range of identified aetiologies, including intellectual disability, autism (Tager-Flusberg & Sullivan, 1995), William syndrome (Reilly, Losh et al., 2004), brain injury (Chapman, Levin, Wanek, Weyrauch, & Kufera, 1998; Ewing-Cobbs, Brookshire, Scott, & Fletcher, 1998; Reilly et al., 1998), and hearing impairment (Crosson & Geers, 2001; Young, James, Brown, Giles, Hemmings, Hollis et al., 1997). These deficits are similar to those found in SLI. Studies that have compared more than one type of LI have identified no significant differences among them including autism compared to intellectual disability (Tager-Flusberg & Sullivan, 1995), and autism compared to SLI (Norbury

& Bishop, 2003). These findings suggest that narrative structure deficits in NLI may also be similar to SLI and other LIs.

People with Down syndrome produce more complex narratives than LM groups (MLU-matched), but narratives of less or similar complexity to children matched for mental age or syntactic comprehension (Boudreau & Chapman, 2000; Miles & Chapman, 2002). This suggests that narrative difficulties in LI may be less than expected for their level of expressive syntax development.

Character Introduction

Character introductions have not been examined in children with NLI, but have for children with autism and intellectual disability, with varied findings (Norbury & Bishop, 2003; Tager-Flusberg, 1995). Norbury and Bishop found that school-aged children with different types of LI (SLI, pragmatic LI and high functioning autism) and an AM group all primarily introduced characters using a lexical strategy. However, Tager-Flusberg found that young adolescents with autism and with intellectual disability used less lexical introductions than a LM group. Greater use of definite articles (incorrect) and lower use of indefinite articles (correct) is identified for high level autism in comparison to AM groups, and for intellectual disability in comparison to a cognitively matched group with TDL (Norbury & Bishop, 2003). This indicates common difficulties in use of reference for character first mentions in children with SLI, and suggests that similar findings may be evidenced for NLI.

Cohesion

Difficulties with cohesion are identified in children with LI associated with a range of aetiologies, including autism (Norbury & Bishop, 2003; Tager-Flusberg & Sullivan, 1995), intellectual disability (Hemphill et al., 1991; Tager-Flusberg, 1995), traumatic brain injury (Biddle, McCabe, & Bliss, 1996) and hearing impairment (Crosson & Geers, 2001). Conversely, similarities between children with LI and AM groups for cohesion skills have been identified in late talkers (Manhardt & Rescorla, 2002), children with a unilateral sensorineural hearing impairment (Young et al., 1997), and traumatic brain injury (Chapman, Levin et al., 1998; Ewing-Cobbs et al., 1998; Jordan, Murdoch, & Buttsworth, 1991; Reilly et al., 1998). Boudreau and Chapman (2000) found that adolescents and adults with Down syndrome did not differ in their use of cohesive devices from a LM group (MLU-matched), but produced less cohesive devices than children matched for mental age or syntactic comprehension. These findings suggest that children with NLI will also show difficulties with cohesion, compared to an Am group, but not necessarily when compared to a LM group.

Content

Children with NLI produced oral narratives with lower lexical diversity than an AM group (Fey et al., 2004). Other investigations of information content for oral narratives in children with NLI are not evident, but poorer narrative content has been evident for children with LI associated with several different aetiologies. Children with autism produce less causal descriptions and explanations, particularly in relation to emotional states, than children with TDL matched for mental age, but similarly to children with developmental delay matched for mental age (Capps, Losh, & Thurber, 2000). When compared to children matched for receptive vocabulary, children with autism were found to produce less causal descriptions and explanations than both children with intellectual disability and TDL (Tager-Flusberg, 1995). Similarities were found in the use of emotional and cognitive terms for autism, intellectual disability and LM groups (Tager-Flusberg & Sullivan, 1995). Content problems in other LIs suggest that narrative content may also be problematic for NLI.

EXPLANATIONS FOR NARRATIVE DEFICITS IN LANGUAGE IMPAIRMENT

Deficits in narrative structure and cohesion in children with SLI may be due to poor internal narrative schemas or due to insufficient language skills to encode the narrative information. Deficits in processing capacity could contribute to both aspects of narrative production, while cognitive deficits may contribute more to deficits in narrative structure than to linguistic deficits. This suggests that, children with NLI are likely to have poorer underlying narrative schemas than children with SLI.

Linguistic Explanations

Norbury and Bishop (2003) argued that linguistic ability determined narrative competence, a view supported by finding no differences in narrative skills among three LI diagnostic groups (SLI, pragmatic LI and high functioning autism). Linguistic deficits in morphosyntax and lexical acquisition will limit the resources available to produce a narrative. A linguistic account of narrative difficulties in children with LI would suggest that the organisational structure of the narrative would remain relatively intact with the main breakdown effect impacting on cohesion and morphosyntactic aspects of text production.

Cohesion is often considered to be a linguistic skill (Halliday & Hasan, 1976; Liles, 1993; Strong & Shaver, 1991). A narrator needs to be able to relate the various narrative elements to each other to create a cohesive text. In particular, the narrator needs to have mastery of a range of lexical and grammatical cohesive devices in order to maintain distinctions among characters and keep track of the characters and their actions without confusion (Hemphill et al., 1991). The narrator also needs to be able to use morphosyntactic and lexical strategies to impart information about temporal and causal relationships, including verb tenses, adverbials and complex sentence structures such as conjunctions. Events can only be described if the narrator has the morphosyntactic and semantic skills to describe the participants, processes and circumstances involved.

A linguistic explanation of narrative ability is supported by a stepwise discriminant function analysis (Liles et al., 1995) conducted on 114 school aged children with and without SLI. Liles et al. identified cohesive adequacy, together with a grammatical measure (percentage of grammatical t-units), as a strong predictor of diagnostic group membership (79% to 98% correct classification, variable for the three video narratives that were retold). The measures of narrative structure (percentage of possible episodes and total number of episodes) and clause complexity (number of words per subordinate clause and mean number of subordinate clauses) were excluded as predictors by the stepwise discriminant function analysis of the variables. Liles et al. concluded that the narrative difficulties of children with SLI were not related to poor knowledge of causal and temporal relationships between events.

If narrative deficits are primarily due to linguistic deficits, then children with SLI and NLI are expected to have similar difficulties with narrative production. Greater deficits in cohesion, than in narrative organisation and structure would be predicted for both SLI and NLI.

Processing Capacity Explanations

A processing model of discourse

A high level of information processing is reflected in a process model of discourse production proposed by van Dijk and Kintsch (1983). The first stage of an oral narrative production is to plan and develop the narrative structure. In the case of generating a narrative from a picture stimulus this will involve inferring a theme, goals and motivations from the picture(s). If the request is for an impromptu oral narrative, this may all be required in a matter of seconds. The final stage of oral narrative production is to determine the actual utterances or text that will realise the narrative structure. This involves cognitive, social, pragmatic, semantic, lexical and syntactic choices, that all contribute to the final morphosyntactic and lexical sentence form. At the global level, this will involve overarching choices of style, tense and meaning; with decisions at the local level for individual utterances that are influenced by what has been said before and anticipation of what will be said next.

Considerable cognitive processes and organisational skills are therefore required to produce a narrative. The narrator needs to have knowledge of narrative structure and the ability to access a narrative schema (or story grammar) that describes a set of rules governing how the essential components and content of a narrative may be organised (Stein & Glenn, 1979). Narrative production requires the ability "to hold multiple events in consciousness at the same time, which supports understanding of the relationship between events" (Boudreau & Chapman, 2000, p. 1147).

Narrative production is considered to be demanding of working memory (Eaton, Collis, & Lewis, 1999; Shapiro & Hudson, 1991; van Dijk & Kintsch, 1983). Memory deficits or a limited processing capacity in children with LI are therefore expected to have an adverse affect on aspects of their narrative productions (Abbeduto et al., 1995). In discourse, working memory for comprehension is typically limited to a current semantic theme, and to the immediately preceding clauses and the ideas expressed in them (van Dijk & Kintsch, 1983). For production, processing must also work forward to subsequent clauses.

Van Dijk and Kintsch (1983) proposed that *episodic memory* is also critical for discourse production. Episodic memory contains information about situations and events; topics and related world knowledge; and about structured ideas and related beliefs. Schematic structures of possible events are stored in memory and assist with organising production of a text or make a text easier to remember, comprehend or produce (van Dijk & Kintsch, 1983).

Production of a narrative from a previewed wordless picture book will require the narrator to hold in episodic and working memory the observed narrative structure, together with inferences made about relevant goals, motivations and cause and effect relationships. At the same time, the speaker will need to construct text about the scene(s) immediately in front of them that delivers the script and is coherent with the preceding text and the text that will follow. Limitations in working or episodic memory will therefore have a detrimental effect on narrative organisation and structure in the oral narratives produced by children with LI.

The use of cohesive pronouns may also be constrained by limitations in short-term memory, working memory or processing capacity in children with language impairments. The identity of a pronoun referent is retrievable from the prior text while it remains within working memory or must be otherwise inferred from the situational context. When these conditions are not met, the identity of the pronoun referent becomes ambiguous or unknown. In addition, Miranda et al. (1998) suggested that cohesion difficulties may arise from difficulties with word retrieval, complex sentence production, syntactic mastery of pronouns and articles, and pragmatic processing (ability to adapt message to the needs of the listener).

Predictions for language impairment

A limited processing capacity account of both morphosyntactic and narrative difficulties in children with LI would suggest breakdown across a broad range of narrative skills. That is, deficits would occur at the levels of organisational structure, cohesion, lexical choices and morphosyntactic aspects of text production. Trade-off effects among these skills and individual differences in underlying deficits may result in variation across measures for individuals with LI (Crystal, 1987).

If a limited processing capacity primarily affects cognitive functions, then deficits would be more limited to narrative structure, with less impact on linguistic characteristics. This explanation predicts that children with NLI would have greater difficulties with narrative structure than children with SLI. If the limited processing capacity primarily relates to linguistic functions, then a broad range of morphosyntactic characteristics would be affected, with less impact on structural characteristics. This latter explanation predicts that children with NLI and SLI would have similar difficulties with linguistic aspects of narrative production.

Evidence for a limited processing capacity as an explanation for the narrative deficits associated with LI comes from studies of children with brain injuries (Biddle et al., 1996; Brookshire, Chapman, Song, & Levin, 2000). Brookshire et al. found that oral narrative deficits (number of propositions, key propositions and minimum episodic structure) in children with brain injuries correlated positively with problem solving and working memory deficits, as well as with receptive vocabulary. Biddle et al. suggested that “the disruptions evident in the narratives of the children and adults with TBI [traumatic brain injury] were related less to language impairments than to difficulties with the executive processes utilized in discourse production" (p. 463). On the other hand, Chapman et al. (1998), did not find a clear association among measures of discourse deficits, memory and vocabulary in children with brain injuries.

Interaction and Independence among Linguistic and Cognitive Skills

The relative contributions of social, pragmatic, linguistic and non-verbal cognitive skills and processes to oral narrative production are not conclusively determined in the literature, but there is some support for the notion that they are dissociated (Boudreau & Chapman, 2000; van der Lely, 1997). Boudreau & Chapman proposed that there was a dissociation between the linguistic and cognitive aspects of narrative in people with Down syndrome, whose non-verbal cognitive skills were more advanced than their expressive language skills. They found that their participants with Down syndrome performed similarly on measures of narrative structure (number and type of events described) to a younger control group matched for mental age, and performed significantly better than a LM group. Conversely, the participants with Down syndrome performed similarly on a range of linguistic measures (NDW, connectives and referencing skills) to the LM group matched and performed more poorly on the linguistic measures than the cognitively matched group. This research was based on a supposition that a measure of event representation reflected non-verbal functioning. However, it must be noted that the ability to relate events must also rely on linguistic skill (morphosyntactic and lexical) and that children with LI may economise on a difficult language task by relating less events. Thus, there may be too much overlap for this to be a pure measure of non-verbal cognitive contributions.

van der Lely (1997) argued that narrative discourse is a function that lies outside a morphosyntactic modular language system, based on evidence that although older children with SLI make morphosyntactic errors, they know how to use pronouns as a cohesive referencing device. The syntactic aspects of pronoun use were perceived to be dissociated from their pragmatic discourse functions. Van der Lely argued that modular morphosyntactic abilities were independent from central language functions such as processing capacity and pragmatic functioning, particularly inferential communication.

Alternatively, a functional linguistics approach argues that all aspects of language, cognition and social context interact and work together under the auspices of communicating meaning (Armstrong, 2000). An interactional model of language impairment (introduced in Chapter 1) can be used to aid understanding of how different aspects of functioning contribute to narrative difficulties in children with LI. Limitations in the innate linguistic data base will mean that a child with SLI or NLI will lack the language tools or abilities required to acquire narrative skills. Alternatively, limitations in the innate processing device will limit a child's ability to manipulate and work with the information and schemas required to comprehend or produce a narrative. A child with NLI may have greater or broader processing limitations and thus show difficulties with a broader range of narrative skills than the child with SLI. If SLI is simply a case of restricted linguistic capabilities, then narrative difficulties in SLI are expected to be restricted to a narrower range of linguistic domains. The acquired component of the dynamic interactional model may be evident in age differences that reflect differing years of experience with oral narratives

The Role of Experience

Knowledge about the world and human behaviour are critical for narrative comprehension and production, including knowledge of cause and effect, goals and intentions, beliefs, attitudes, emotions, personality and social role (van Dijk & Kintsch, 1983). Organised units of knowledge about events that occur in our world, often described as schemas or scripts, are derived from concrete and verbal experience. Inference from world knowledge and situational context is used to support comprehension of a text and relationships between events (e.g., cause and effect) (Stein & Glenn, 1979; van Dijk & Kintsch, 1983).

A narrator needs to understand the social and educational purpose of the narrative and understand the perspective of the listener who needs to receive information in an organised, coherent manner. The narrator needs to understand that they are responsible for making information appropriately explicit for the listener. Experience, including personal life event experiences is therefore a powerful contributor to the development of narrative skills. Experience in listening to narratives, discussing narratives, recounting life events and creating fictional narratives is essential to building the foundations for narrative production. Early in life this is in the form of play experiences and exposure to story-book experiences at home; later to more formalised story-writing experiences at school (Eckler & Weininger, 1989; Westby, 1991).

Variation in the type and level of narrative production may arise from differences in the child's experiences, family discourse and interaction styles and socio-cultural background (McCabe, 1997; Peterson & McCabe, 1994). Time and experiences with stories at home, at preschool and school may be varied for each child (Spinillo & Pinto, 1994). Motivation and feelings (including internal states such as tiredness, hunger, or discomfort in a new situation) may also result in individual variation in narrative production (Johnson, 1995).

The role of experience suggests an advantage held by older children with LI over younger children with TDL. If experience is a significant factor, then children with LI may produce more developed narratives than LM groups. Younger children used as LM controls have less years of exposure and experience with narrative so it is anticipated that they will be less advanced that the children with SLI in the narrative structures they use, but similar or more advanced in their linguistic skills (e.g., morphosyntax, vocabulary).

SUMMARY

Strong evidence exists for narrative deficits in SLI that affect organisational structure, content and cohesion. Evidence also exists for narrative deficits in LI associated with a range of aetiologies outside the diagnostic classification of SLI. The few comparative studies available suggest similar patterns of narrative impairments across different diagnostic categories of LI in children. However, the narrative deficits found in SLI have not been comprehensively compared with children with NLI. Comparison of narrative abilities between these two groups will help to clarify whether the diagnostic distinctions are supported by measurable differences in language characteristics. Comparisons will also reveal information about the relative contributions of linguistic and cognitive abilities to narrative production. They will also contribute to debate on the relative merits of linguistic versus processing capacity accounts of language impairment.

HYPOTHESIS AND QUESTIONS

The second hypothesis examined by this thesis is that: *Levels of narrative structure and adequacy of cohesion in oral narrative tasks will not differ between children with NLI and children with SLI. However, the narrative features of the two LI groups will differ significantly from age-matched (AM) and younger language-matched (LM) children with normal language abilities.*

More specifically, several questions arise in relation the identification of differences for specific narrative measures (numbering continued from the first hypothesis and questions in Chapter 2):

7) Are there differences in the structural complexity of their oral narratives: specifically narrative structure, and type and frequency of narrative components?

8) Are there differences in the information content of their oral narratives: specifically, number of information items against a checklist?

9) Are there differences in their ability to maintain the identities of narrative characters: specifically, the adequacy of cohesive ties?

10) Are some narrative variables more discriminating than others for achieving a differential diagnosis of LI?

CHAPTER 4: METHODOLOGY: PARTICIPANTS AND PROCEDURES

PARTICIPANT CRITERIA

A total of 75 children participated in this study. Thirty four children with language impairments (LI) aged from 5;0 to 6;3 years were recruited from Adelaide suburbs and nearby rural areas in South Australia. Speech pathologists and teachers working in the Department of Education, Training and Employment, in Catholic Education and in private practice were asked to refer children with a LI who also met the exclusionary criteria, described below. Twenty one children with normally developing language skills (TDL) aged from 5;0 to 6;0 years were recruited from the same or nearby preschools and schools as the participants with LI, to form an age-matched control group (AM). Twenty children with TDL aged from 2;7 to 3;6 years were recruited from the same or nearby preschools and child care centres, to form a control group matched on language ability (LM). In addition, 19 children referred to the research project were excluded after the standardised language assessment because they did not meet the criteria, including seven children referred for the LI groups, two referred for the AM group and ten referred for the LM group. One child referred to the project was not assessed or included following a parental decision to withdraw from the project.

Processes for excluding and including participants, according to determined criteria, will be described, followed by processes for sorting the LI participants into two diagnostic groups and matching them on language measures. The characteristics for five research groups are summarised in Table 4.1: high specific language impairment (HSLI – with mild to moderate impairment), SLI (moderate to severe language impairment), NLI, AM and LM. The HSLI group was excluded from all group comparisons, but included in a discriminant function analysis, discussed later in Chapter 5.

Exclusion Criteria

In keeping with the exclusionary criteria for SLI, referring speech pathologists and teachers were requested to exclude children with histories of persistent hearing impairments of more than 25 dB; neurological disorders; syndromes or chromosomal disorders (e.g., Down syndrome, Fragile X syndrome); autism; or socio-emotional disorders from their referrals. They were also asked to exclude children with speech impairments and children from non-English speaking backgrounds. Children from non-English speaking and Aboriginal backgrounds were excluded because potential dialect and cultural differences influencing morphosyntax and oral narrative might confound the data (Berman & Slobin, 1994; Crais & Lorch, 1994; Dinos, 2002; Emmitt et al., 2003; Gould, 2004).

Children with speech impairments were excluded if their impairment interfered with speech intelligibility or use of word-final inflections (e.g., the presence of phonological processes such as stopping, consonant deletion and weak syllable deletion). This was because they would make it difficult to achieve an accurate transcription of what the child said and because omission of inflectional morpheme suffixes in these children may be attributable to the phonological processes. All children were screened by the researcher in use of /t/, /d/, /s/ and /z/ at the ends of words, and use of word-final /t/ and /s/ in phrases where the target word preceded a vowel. A short picture-naming task was administered, using line drawings to elicit the following words: *house*, *hose, toilet, scissors, hat, bird, cat in a basket, cat under a chair, mouse under a leaf* and *house on a leaf.*

Many participants across groups (68.1%) used an allophonic variant for word-final /t/ (glottal stop or a flap in phrases). Inconsistent use of final /s/ (i.e., not elicited in the screen but elicited in a small percentage of plurals) was also evident for one participant in the LM group under 3 years of age but the child was not excluded as this was within normal limits for the age group (Bowen, 1998; Grunwell, 1987). In South Australia, children are given a routine hearing screen at four years of age. It was anticipated that persistent hearing losses would have been identified through this screening. Because most of the data collection was carried out in preschools, schools and homes it was considered that screening by the researcher with a portable audiometer in these conditions would not necessarily hold greater reliability than the 4-year-old health screen. None of the children included in this research were identified with persistent moderate or severe hearing losses. Bishop and Edmundson (1987) used similar methods to exclude children with hearing impairments. Children with an early history of transient otitis media were not excluded, as this is a common occurrence in young children and not always associated with language impairment (Paradise, Dollaghan, Campbell, Fledman, Bernard, Colborn et al., 2003).

Inclusion Criteria

All children with LI needed to score below the 10th percentile on the Expressive Language scale of the Clinical Evaluation of Language Fundamentals - Preschool (CELF-P), (Wiig et al., 1993). The CELF-P is a standardised assessment of language abilities designed for children aged 3;0 to 6;11. It was selected because it covered the target age group, assesses both expressive and receptive language abilities, and was used widely by speech pathologists in South Australia for diagnosis and determining eligibility for special education services. The 16th percentile has been identified as a clinical cut-off point for SLI for the CELF-P test, and recommended by other researchers (Aram et al., 1993; Conti-Ramsden et al., 2001). Use of the 10th percentile, recommended by Fey (1986) ensured inclusion of children with moderate and severe expressive impairments and a gap in scores between the LI and AM groups. No criteria were set for receptive language scores as the focus was on expressive language impairments that can occur with or without receptive language impairments. No attempts were made to include or exclude any subgroups of language impairment (e.g., grammatical LI, semantic-pragmatic LI), apart from the selection of expressive language impairment.

Participants for the control groups needed to score above the 16th percentile (the lower limit of the average range) on both receptive and expressive language components of a standardised language assessment. The CELF-P was administered to all AM participants, while the LM participants were assessed using the Reynell Developmental Language Scales 3 (RDLS) (Edwards, Fletcher, Garman, Hughes, Letts, & Sinka, 1997). The RDLS was used for the younger control group because it was standardised for children aged 1;09 to 7;03, whereas the CELF-P was standardised for children of 3 to 6 years. The RDLS also contained toys and tasks that were more interesting and motivating for younger children. All children recruited for the control groups were judged to have normally developing language skills by their teachers or child care workers. Language assessment results are shown in Table 4.1 using percentiles to enable comparisons among all groups.

Non-verbal Ability Criteria

The 34 children with LI were divided into SLI and NLI diagnostic groups on the basis of their non-verbal cognitive abilities using the Raven's Coloured Progressive Matrices (RCPM) (Raven, Court, & Raven, 1995). The RCPM is a standardised test of perceptual reasoning, without reliance on language abilities. It assesses the ability to form comparisons and reason by analogy, and the ability to organise spatial perceptions into systematically related wholes (i.e. pattern completion). The RCPM has acceptable reliability and validity as a test of non-verbal ability, is reliably correlated with IQ scores (Sattler, 1990), and is used by other researchers as a measure of non-verbal ability in children with language impairments (Conti-Ramsden et al., 1997; Norbury et al., 2001).

Differentiation into the two diagnostic groups was based on the RCPM scores. The raw score of 10, equating to the 10th percentile for 5 ½ year old children in Great Britain in the RCPM manual, was used as the upper cut-off score for differentiation into the NLI group (10th percentile figures were not available for 5 ½ year old Australians). The raw score of 13, equating to the 25th percentile for 5 ½ year old Australians, was determined as the lower cut-off score for differentiation into the SLI group.

The RCPM manual did not provide normative information that would provide differentiation based on the traditional SLI non-verbal IQ cut-off score of 85 (16th percentile). However, results on more comprehensive cognitive assessments were available for seven LI participants who attained RCPM scores ranging from 10 to 13 (10 to 25th percentiles). Five participants had recent results for the Weschler Preschool and Primary Scale of Intelligence Revised (Wechsler, 1989); one for the Differential Ability Scales (Elliott, 1990); and one for the Wechsler Intelligence Scale for Children III (Wechsler, 1992). Results on these assessments placed six children in the NLI group and one child in the SLI group.

This process of determined that there were 21 children with SLI and 13 children with NLI. Interestingly, this is close to the ratio of SLI to NLI children (111:75) recruited from an epidemiological sample of 538 children in one study (Fey et al., 2004).

The RCPM was also administered to children in the two control groups to enable comparisons. The assessment materials were modified for the younger LM group as the RCPM manual indicated that a form board version could be made for younger children and for those with motor disabilities. A laminated version was created with separate pattern pieces mounted on blu-tack so that the children could manipulate and place them following demonstration on the first item by the researcher. Results on the RCPM are shown for all groups in Table 4.1.

PARTICIPANT MATCHING

Close matching was considered important for revealing true differences and similarities between the LI diagnostic groups.

Group Matching Criteria

Matching of the SLI, NLI and LM groups on a constant language variable(s) will enable comparisons against a general measure of syntactic ability as the constant variable. As discussed in Chapter 2, MLU and language assessment scores are typically used in the literature as language matching variables.

Table 4.1. Participant and group characteristics: showing means, standard deviations and ranges for age, language and non-verbal cognitive ability results

Variable	*Group*				
	HSLI	***SLI***	***NLI***	***AM***	***LM***
Total (N)	6	15	13	21	20
Male (n)	5	9	7	11	10
Female (n)	1	6	6	10	10
Age (mths)	66.2	65.1	66.7	66.5	36.2
	(3.7)	(4.5)	(5.5)	(3.5)	(4.0)
	62-71	60-74	59-74	59-71	30-41
MLU (morphemes)	4.17	3.61	3.63	5.05	3.95
	(.43)	(.66)	(.69)	(.72)	(.76)
	3.77-4.70	2.64-4.50	2.37-4.56	3.80-6.65	2.89-5.05
Expressive Language	9.3 [a]	2.8 [a]	1.7 [a]	49 [a]	60.6 [b]
	(1.0)	(1.6)	(1.3)	(18.9)	(27.0)
	8-10	1-5	1-5	21-93	17-96
Receptive Language	27.2 [a]	6.4 [a]	5.9 [a]	69.3 [a]	58.7 [b]
	(33.4)	(11.2)	(9.2)	(19.1)	(22.5)
	1-91	1-39	1-32	32-98	21-92
RCPM[c] Raw Score	17.7	16.8	9.1	19.6	8.2
	(4.6)	(3.2)	(2.9)	(3.6)	(4.4)
	14-26	13-24	2-13	14-27	0-17

Note: standard deviations are shown in parentheses; value ranges from minimum to maximum follow the standard deviations; [a]CELF-P percentiles; [b]Reynell Developmental Language Scales III percentiles; [c]Raven's Coloured Progressive Matrices

Despite its widespread use, some problems have been identified with the practice of MLU matching. MLU is considered a broad index or simple indicator of morphosyntactic complexity for early language development on the basis that longer utterances characterise greater syntactic complexity and greater use of grammatical morphemes. However, length of utterance and complexity do not always correspond (Klee & Fitzgerald, 1985). For example, the utterance "He wanted to find his frog so he went outside to look." (13 morphemes) contains a dependent clause attached to each of two independent clauses, whereas the following two sentences convey the same meaning, contain more morphemes and are comprised of four independent clauses “He wants his frog and he’s looking for him. Then he went outside and he looked for him there.” (22 morphemes).

MLU can be used as an index of morphosyntactic complexity during the early years (from 2 to 4 years of age, in TDL), but becomes unreliable as a measure in later years (Chan, McAllister, & Wilson, 1998; Johnston, 2001; Klee, 1992; Klee & Fitzgerald, 1985; Klee, Schaffer, May, Membrino, & Mougey, 1989; Miller & Chapman, 1981). MLU has therefore often been used to distinguish between young children with SLI and TDL (up to 6 years old), using words or morphemes, or calculated for intonation units or syntactic units (e.g., t-unit or c-unit) in a variety of discourse contexts (Boudreau & Hedberg, 1999; Kaderavek & Sulzby, 2000; Paul & Smith, 1993; Westerveld et al., 2005). However, Eisenberg, Fersko and Lundgren (2001) argued that “MLU should not be viewed as a measure of syntactic development but as one way of measuring utterance length” (p. 338). Their evidence suggested that while a lower MLU usually supported a diagnosis of SLI, a higher MLU did not always concur with the absence of a language impairment.

Alternative or modified MLU measures have been suggested by some researchers to reduce pragmatic discourse effects on the standard MLU measure. Klee and Fitzgerald (1985) eliminated pragmatic influences imposed by one-word responses to questions, by excluding single word utterances from an alternative MLU calculation, which they termed *mean syntactic length*. Mean syntactic length was found to produce a higher correlation with age than MLU in a group of children with TDL aged from two to four years (Klee, 1992). Eadie (1999) reduced pragmatic effects by excluding *yes* and *no* responses from a MLU count used to match participants. Johnston (2001) developed an alternative MLU calculation that aimed to reduce the effects of repetition and ellipsis. This calculation removed self and conversational partner repetitions, yes/no responses to comments and questions, and ellipted responses to questions. Johnston found that the difference between the original and alternative MLU calculations was considerable for some participants and minimal for others, showing that discourse differences can influence MLU. However, the alternative MLU was not a better predictor of age than the original MLU.

While some control for pragmatic effects may be a good thing, the validity of excluding certain aspects of discourse may introduce unwanted bias. Pragmatic effects resulting from differing discourse styles in investigators are undesirable (e.g., asking closed questions more or less often across participants) but, differing discourse styles among participants may be worthy of examination rather than exclusion. The inclusion of discourse variations may allow examination of interactions between discourse style and morphosyntactic characteristics.

There are also many conceptual challenges to the use of MLU-matched control groups (Plante, Swisher, Kiernan, & Restrepo, 1993). Older children with LI may differ from younger LM groups on a number of other developmental parameters (Rice & Bode, 1993). They have a broader, more varied and more complex set of life experiences than younger children and different topics and concepts to talk about (e.g., school and classroom contexts, rule-based and interactional games, sport and computers). This may influence the kinds of utterances attempted by children with LI, in comparison to a younger LM group. Despite these issues, MLU continues to be used by numerous researchers as the main point of comparison for children with language impairments.

Matching on standardised language ability tests reduces variation between groups by applying a broader range of variables, such as receptive language and vocabulary, as constants. Such matching may counter the narrow focus of MLU matching. Therefore, the SLI and NLI groups were matched on their expressive and receptive language assessment results from the CELF-P, and for MLU. The LM group were matched to the SLI and NLI groups for MLU.

MLU was calculated using complete and intelligible utterances, with the exclusion of *yes*, *no* and *okay* responses, to control for any discourse influences imposed by the researcher asking more yes/no questions of some children than others. The full set of conventions for calculating MLU is provided in Table B-1 in Appendix B. MLU was calculated using the SALT software (Miller, Iglesias, & Nockerts, 2004). Group effects were examined using the Kruskall-Wallis test, and group comparisons were examined using the Mann-Whitney test.

Participant Characteristics

Language matching

An initial examination of the CELF-P results revealed a significant difference between the initial SLI and NLI groups on the Expressive Language scale for the children referred (Z = -2.916, p = .003), with the SLI group having less severe language impairments than the NLI group. Therefore, six children with Expressive Language standard scores above 75 (percentiles above 5) were excluded from the SLI group and placed in a 5th group labelled *high specific language impairment*

(HSLI). This resulted in 15 participants in the SLI diagnostic group, matched with the NLI group on their CELF-P Expressive Language and Receptive Language standard scores ($p > .05$).

Group effects for the participant characteristics of age, MLU, CELF and RCPM results for the four main research groups of SLI, NLI, AM and LM, are shown in Table B-2 in Appendix B All pairwise comparisons are reported in Table B-3 in Appendix B.

The SLI, NLI and LM groups were all matched for MLU ($p > .05$). Comparisons with the younger MLU-matched control group would enable considerations of how language impairment varied from earlier, normal stages of development. The MLU of the AM group was significantly higher than that for the remaining groups ($p < .001$). The SLI, NLI and AM groups were matched for age, enabling considerations of how language impairment varied from normal attainments in children of the same age.

As expected, the AM group's CELF-P Receptive and Expressive and Language standard scores were significantly higher than for the SLI and NLI groups ($p < .001$). It was not possible to match the LI groups with the LM group on their language assessment measures, as different tests were used. The HSLI group was excluded from the research group comparisons, but included in the discriminant function analysis. Means and standard deviations for all participant characteristics discussed in this section are shown for each group in Table 4.1.

Non-verbal cognitive ability matching

Matching for non-verbal ability for the SLI and AM groups, and for the NLI and LM groups would enable exploration of cognitive influences on language skills. However, while the NLI and LM groups were matched for RCPM scores, the AM group's RCPM scores were significantly higher than the SLI group ($p < .05$). Matching of the NLI and LM groups for MLU and for RCPM scores meant that any differences between these groups for the variables explored by this research could possibly be attributed to differences in world experience, to specific deficits, or to cognitive/language differences not differentiated by either the RCPM or MLU. The lack of matching between the SLI and AM groups meant that any differences for research variables could arise from their different NVCA as well as their significantly different language abilities. This was not considered a difficulty for the main purpose of this research, to explore language differences between the two diagnostic groups, SLI and NLI. The SLI group's RCPM scores were significantly higher than the NLI group ($p < .001$).

Language Impairment Domains

Three indexes were created from the CELF-P subtests (used with the 5-year-old AM, SLI and NLI groups) for the domains of memory, vocabulary and morphosyntax. This would enable an exploration of differences or similarities in the language profiles of the participant groups, in similar fashion to Tomblin and Zhang (1999). The first, a memory index, was created from the averaged standard scores for the Linguistic Concepts and Recalling Sentences in Context subtests. Both these subtests are highly demanding of verbal memory. The second, a vocabulary index, was calculated from the Basic Concepts and Formulating Labels subtests. The third, a morphosyntax index, was calculated from the Sentence Structure and Word Structure subtests. Each of these indexes was derived from a subtest in each of the receptive and expressive modalities. This process was not possible for the younger LM group who were assessed with the RDLS, which did not provide subtests.

Examination of Table 4.2 shows that the AM group attained higher scores on all domain indexes than the SLI and NLI groups, with a flat profile across indexes. The SLI and NLI groups both attained higher vocabulary index scores than memory or morphosyntax index scores, with the SLI group attaining a higher vocabulary score than the NLI group.

Table 4.2. Language domain indexes

Variable	*Measure*	*Group*		
		SLI	***NLI***	***AM***
Memory Index	Median	3.5	3.0	11.0
	IQR	1.0	1.25	2.0
Vocabulary Index	Median	6.0	4.5	11.5
	IQR	2.5	2.5	2.5
Morphosyntax Index	Median	3.5	3.5	11.0
	IQR	2.5	1.25	3.5

Significant group effects were evident for each index shown in Table 4.3. Post-hoc pairwise comparisons revealed that the AM group had significantly higher scores for each index than both the SLI and NLI groups ($p < .001$), while there were no significant differences between the SLI and NLI groups for any index. All pairwise comparisons for the indexes are shown in Table B-4 in Appendix B.

Differences among the language domain indexes were also explored. Friedman's test revealed significant effects for the domain indexes for the SLI and NLI groups, but not for the AM group (see Table 4.4). Post-hoc comparisons using the Wilcoxon Signed Ranks Test showed that both the SLI and NLI groups attained significantly higher index scores for vocabulary than either the memory ($p < .01$) or morphosyntax ($p < .05$) indexes. There were no significant differences between the memory or morphosyntax domains for either the SLI or NLI groups. Pairwise comparison results are shown in Table B-5 in Appendix B.

Table 4.3. Group effects for language domain indexes

Variable	*Kruskal-Wallis* χ^2	*df*	*p*
Memory Index	35.683	2	< .001
Vocabulary Index	35.606	2	< .001
Morphosyntax Index	35.287	2	< .001

Table 4.4. Group effects among language domain indexes

Group	*Friedman* χ^2	*df*	*p*
Specific language impairment	19.240	2	< .001
Non-specific language impairment	8.143	2	.016
Age-matched controls	2.795	2	.256

Socio-Economic Status

Socioeconomic status (SES) has been shown to influence language development (Hoff & Tian, 2005). Therefore, the SES for place of residence by postcode was examined for each participant, using Socio-Economic Indexes for Areas (SEIFA) from the 2001 National Census conducted by the Australian Bureau of Statistics (Trewin, 2001). Four socio-economic indexes were provided, described in Table 4.5.

Median index values for SES variables for each participant group are shown in Table 4.6, together with corresponding quantiles for the South Australian population. Overall, the NLI group appeared to reside in lower SES areas and the LM group in higher SES areas.

Significant group effects were evident for the Advantage, Economic Resources and Education & Occupation Indexes but not for the Disadvantage Index and are shown in Table 4.7. Post-hoc pairwise group comparisons, were only significant between the NLI and AM groups ($p < .01$), with the NLI group residing in areas of lower SES. All post-hoc pairwise comparisons are presented in Table B-6 in Appendix B.

Table 4.5. Description of socio-economic indexes from the Australian Bureau of Statistics.

Index	*High score*	*Low score*
Disadvantage	Few people on low incomes with little training, in unskilled occupations.	Many people on low incomes with little training, in unskilled occupations.
Advantage	Many people with high incomes and skilled occupations.	Few people with high incomes and skilled occupations.
Economic Resources	Many high income families, living in large dwellings.	Many low income families, living in small dwellings.
Education and Occupation	Many people with higher education qualifications in more skilled occupations.	Many people with low levels of education in unskilled occupations or unemployed.

Note: Sourced from the Australian Bureau of Statistics (Trewin, 2001)

Table 4.6. Median socio-economic indexes for participants' place of residence postcode area (interquartile range in brackets)

Variable	*Group*			
	SLI	***NLI***	***AM***	***LM***
Disadvantage	996 (105)	932 (117)	1007 (98)	1018 (143)
SA Quantile[a]	25-50%	10-25%	25-50%	50-75%
Advantage	980 (115)	913 (71)	979 (86)	999 (144)
SA Quantile[a]	50-75%	25-50%	50-75%	50-75%
Economic Resources	967 (94)	916 (70)	967 (78)	967 (113)
SA Quantile[a]	50-75%	25-50%	50-75%	50-75%
Education & Occupation	992 (91)	923 (42)	995 (83)	1011 (132)
SA Quantile[a]	50-75%	25-50%	75-90%	75-90%

[a] corresponding South Australian quantile index values for postal area level (Trewin, 2001)

Table 4.7. Group effects for socio-economic indexes

Variable	*K-W* χ^2	*df*	*p*
Disadvantage	7.148	3	.067
Advantage	8.733	3	.032
Economic Resources	8.573	3	.033
Education and Occupation	7.909	3	.044

PROCEDURES

Language Sampling Issues

Naturalistic versus structured tasks

A review of methodologies used in oral narrative research shows considerable variation among studies. This limits the viability of finding good comparisons of SLI and NLI across studies and emphasises the importance of using a consistent methodology to enable direct comparison between oral narrative production in SLI and NLI. A tension exists between the relative benefits and disadvantages of eliciting a naturalistic language sample, and the elicitation of targeted linguistic structures through more structured systems of prompts and stimuli (Evans & Craig, 1992; Gerken, 2000). Naturalistic samples have the benefit of providing information about the functional use of language (Kemp & Klee, 1997; Leadholm & Miller, 1992; Miller, 1981; Westerveld et al., 2005). However, they may not always elicit the language structures of interest or elicit sufficient numbers of obligatory contexts (OCs) for the language structures of interest to be examinable.

Difficulties may also arise in determining the intention of a child's utterance. Where utterances lack grammatical markings there may be insufficient context to suggest which tense was intended (Gerken, 2000). For example, if a child said, "farmer push tractor", did the child intend to say "the farmer is pushing the tractor", "the farmer pushes the tractor" or "the farmer pushed the tractor"? What is known is that a finite tense morpheme was omitted. This means that the reliability of scoring individually omitted finite tense morphemes may be limited. In this situation, a composite measure of finite tense morphemes may overcome difficulties in determining which tense the child was attempting to use (Eadie et al., 2002; Rice, 2000). Combination measures for individual grammatical morphemes may also avoid problems with low numbers of OCs for some morphemes. The issue of relative reliability for individual morpheme measures versus a composite measure has not, however, been discussed in the literature.

An alternative strategy for appropriately tapping into a child's productive linguistic skills is to prompt the elicitation of the target forms (Gerken, 2000; Rice & Wexler, 1996b; Rice et al., 1995). This method can elicit many more occurrences of the target form, reducing the problem of insufficient OCs. The target form is interpreted to be the child's intended form, eliminating difficulties in making judgements. While prompted elicitation may address the limitations of naturalistic sampling methods, it can fail to be useful when a child lacks sufficient comprehension to provide the targeted response. The stimulus materials, construction of the verbal prompts and their appropriateness for the age group are all important to determining success in elicitation of the target form, either through imitation, or through more open probing. In constructing the verbal prompt, consideration needs to be given to matching the length of the verbal prompt to the child's processing capacity (Gerken, 2000), and also to pragmatic effects. For example, ellipsis is common and appropriate for responses to questions, so more open instructions need to be provided if a full clause is the target form. In addition, a child may perseverate with a form and overgeneralise its application to subsequent prompts for a different form, not processing the changes in meaning. Young children and children with LIs may lack the comprehension required for prompted elicitation tasks and perform better in natural spontaneous language sampling methods.

Therefore, both naturalistic and prompted language sample methods will be used, because each has varied benefits and disadvantages. Conversation in a play context will allow the child to take some control over interactions, and comment on concrete *here and now* experiences. Provision of prompts during play sessions may elicit morphosyntactic forms that may not be produced in child-directed discourse. Oral narratives will require the child to apply their linguistic skills to a more complex, less contextualised discourse task.

Impact of elicitation procedures on narrative production

A range of stimulus procedures are used by clinicians and researchers to elicit oral narrative samples including: videos, picture sequences, wordless picture books, single pictures, requests on a topic or simple requests to just 'tell a story' (Applebee, 1978; Crais & Lorch, 1994; Hughes et al., 1997; Stein & Glenn, 1979, 1982). Children may be asked to retell a narrative they have heard or seen, or to generate their own narrative from an idea or story starter. Hedberg and Westby (1993) and Hughes et al. (1997) discuss the issues around stimulus selection, but their summaries of normal narrative development are not specific to any stimulus.

The selection of a narrative stimulus and procedures can affect the nature of the narrative elicited (Crais & Lorch, 1994; Liles, 1993) and may contribute to contradictions between studies. In young children, longer, more complex and more complete narratives have been elicited through the use of problem-based picture sequences, such as a wordless picture book (Shapiro & Hudson, 1991). Visual provision of the narrative idea and event structure can reduce the cognitive load on a demanding task and thus assist young children in their narrative production (Hudson & Shapiro, 1991). Visual support is likely to be useful for children with LI affected by a limited working memory or processing capacity. Better narrative production associated with more explicit visual support may indicate the effects of a limited processing capacity. In addition, children with higher NVCA, such as in SLI, may be better able to access and use the visual stimulus to aid narrative production than children with lower NVCA, such as in NLI.

Generation of a narrative is considered a more difficult task than retelling a narrative. It requires retrieval of possible narrative scripts from memory (experience), creation of an idea/structure and organisation of the narrative events without assistance, and is thus more demanding of experience, working memory and linguistic formulation (Johnson, 1995; Naremore, 1997; Ripich & Griffith, 1988). Difficulties with narrative generation tasks may indicate a limited processing capacity, or indicate limited knowledge and experience with narrative structure or a topic (Eaton et al., 1999; Hudson & Shapiro, 1991; Shapiro & Hudson, 1991). Narrative generation tasks may therefore be useful for eliciting these effects in children with LI.

On the other hand, retells are considered useful because they have elicited more complex and complete narrative episodes, and it is easier to develop consistent and more reliable scoring procedures (Liles, 1987; Ripich & Griffith, 1988). Retells may thus provide the easiest pathway to the development of standardised narrative assessment. Provision of the narrative structure in a retell allows more focus on assessment of the ability to retrieve recent information and content, and to structure the discourse linguistically.

Modelling, rehearsal and previewing conditions have also been shown to result in more complex syntactic structures and more narrative components (Gummersall & Strong, 1999; Shapiro & Hudson, 1991). Such opportunities also develop familiarity with the task and reduce anxiety (Strong & Shaver, 1991). The choice of characters or topic can also affect the complexity of narratives (Stein & Albro, 1997).

The context of the narrative stimulus and elicitation procedures will influence how appropriate it is to use implicit devices such as pronominal reference, substitution or ellipsis as opposed to more explicit lexical devices (Campbell et al., 2000; Halliday & Hasan, 1976; Halliday & Hasan, 1985; Hasan, 1975; Karmiloff-

Smith, 1986; Peterson, 1993; Peterson & Dodsworth, 1991; Shapiro & Hudson, 1991; Wigglesworth, 1990).

Use of a shared picture or picture book will allow a higher level of implicit and exophoric referencing, than a stimulus without a picture or situational context. The number of characters depicted in a stimulus will also influence the level of explicitness required to understand who is being talked about, while the stated action may also clarify or maintain the ambiguity of a pronominal reference. For example, the pronominal *he* may be implicitly interpreted if there is only one animate character depicted performing the stated action, but will be ambiguous if there are several characters shown on a page performing the same stated action. By contrast, lexical cohesion will be required more when there are many characters (Hemphill et al., 1991; Kaderavek & Sulzby, 2000; O'Neill & Holmes, 2002; Shapiro & Hudson, 1991). Pronominal strategies may be used to maintain reference in a narrative with few characters, or to maintain reference to a main character.

While it is understood that differing procedures will influence narrative production, its differential effects on children with SLI and NLI have not been researched. It is possible that some procedures may provide an advantage, or may prove more challenging for one group over the other. Therefore, two narrative stimuli will be provided, with differing numbers of characters and level of visual support. Generation of a narrative will be requested, to set a more demanding task that may elicit greater processing capacity effects.

Elicitation Materials and Procedures

Two types of language sampling tasks were provided to elicit the dependent variables: conversation during play and oral narratives. It was expected that performance may vary across tasks, and that some tasks may be more effective than others at tapping into language differences between the diagnostic groups.

Play samples

Spontaneous language samples were elicited to enable analysis of verbal productivity, lexical diversity, and morphosyntactic accuracy and complexity. The samples were elicited during a 20 to 30 minute play session using a standard set of toys (e.g., farm animals, miniature people and vehicles). These are listed in detail, in Table C-1 in Appendix C. Spontaneous language samples are a commonly used methodology in language research, particularly in the study of syntax (Bliss, 1989; Cleave & Rice, 1997; Gavin et al., 1993; Leonard et al., 1997; Loeb & Leonard, 1991; Oetting & Horohov, 1997; Rice & Wexler, 1996b; Rice et al., 1995). The investigator used a minimum of questions and prompts, allowing the child to take the lead as much as possible. Some comments and open-ended prompts such as “What is happening?” or “What happened?” were used to encourage the participants to relate events during their play, particularly for children who talked little. Each set of toys was introduced at similar stages throughout the play session for each child, to facilitate consistency of topic and vocabulary coverage. A few standard events were acted out by the researcher for each participant, to prompt comments and conversation (e.g., animals drinking, a horse jumping over a fence, chickens flying onto a roof, a man climbing then falling off a ladder). The spontaneous language samples are described as *conversations* throughout the remaining chapters.

Two approaches to determining the size of a language sample have been adopted by researchers. Many suggest that 50 to 100 utterances are sufficient for syntactic analyses, with 50 utterances considered the minimum size (Hewitt, Hammer, Yont, & Tomblin, 2005; Klee et al., 1989; Miller, 1981; Owens, 1996; Paul, 1995). However, timed language samples of 15 to 30 minutes are also used and often elicit 100 to 200 utterances (Crystal et al., 1976; Klee, 1992; Menyuk, 1969; Miller, 1981). Miller (1981) and Klee (1992) argue that timed samples enable the researcher to examine the child’s verbal productivity. Since productivity is inconsistent at differentiating LI (discussed in chapter 2), this research used timed samples of 30 minutes and of at least 50 utterances in length. In a few situations, 20 to 25 minute sessions were used when children were impatient to finish or school breaks interfered.

Oral narratives

Oral narratives were elicited in order to analyse the features of narrative structure, cohesion and information content. They also served to analyse morphosyntactic accuracy and complexity, in a more demanding discourse task (Bishop, 1994a). Two oral narratives were elicited using problem-based picture stimuli, that is, the pictures depicted a problem that needed to be resolved.

For one narrative, a wordless picture book was used titled “Frog Where Are You” (Mayer, 1969) (FROG). The lost FROG narrative has been used for studies of normal development of narrative skills in English speaking countries, and for cross-linguistic studies (Berman, 1988; Berman & Slobin, 1994). It has also been used extensively to investigate disordered oral narrative production in children with specific language impairment (SLI) (Boudreau & Hedberg, 1999; Greenhalgh &

Strong, 2001; Manhardt & Rescorla, 2002; Norbury & Bishop, 2003; Reilly, Losh et al., 2004; Strong & Shaver, 1991; van der Lely, 1997) and children with NLI (Hemphill et al., 1991; Miles & Chapman, 2002; Reilly, Losh et al., 2004; Reilly et al., 1998; Tager-Flusberg, 1995; Thurber & Tager-Flusberg, 1993). Greenhalgh and Strong (2001) found that longer narratives were produced for the lost FROG narrative than for other frog stories by the same author. In particular, use of this stimulus will enable comparison with retells of 5-year-olds with and without SLI, reported by Boudreau and Hedberg.

In the lost FROG narrative, a pet frog escapes, and a boy and his dog then look for the frog. Along the way, they meet other characters, and encounter several events and obstacles before finding the frog. The narrative events depicted have the potential to elicit a narrative that is goal directed and focused on resolving a problem (i.e., finding the frog). They also have the potential to elicit obstacles, embedded episodes, and interactions between two protagonists and with other characters. A copy of the picture stimuli for the FROG narrative is provided in Figure C-1 in Appendix C.

For the second narrative, a single picture scene was used, consisting of a coloured-in line drawing showing two children looking up at a cat stuck in a tree (CAT), previously used in a study of Australian children from 3;0 to 7;11 years of age (James, 1999; James, 2001). This stimulus provides less visual support than the FROG book and requires children to create their own plot. This may therefore be more demanding of processing capacity. Use of this stimulus will also enable comparisons with young Australian children. A copy of the picture stimuli for the CAT narrative is shown in Figure C-2 in Appendix C.

For both stimuli, the children were asked to tell (generate) their own narrative. Each child told two narratives to the researcher, with the knowledge that they were being tape-recorded and that the examiner liked listening to children's narratives. The children previewed the FROG narrative pictures prior to telling their narrative. The children were then asked to tell their narrative, while again looking at the pictures, shared with the examiner who turned the pages (Abbeduto et al., 1995). Instructions created by the researcher for the FROG narrative were:

> I have a little book called "Frog, Where Are You" that I would like you to look at and tell me a story about. What I want you to do first is to have a good look at the book and quietly think about the story. There are no words in this book so it's up to you to make up your own story. When you have finished

looking and thinking, tell me the story and use the pictures to help you tell the story.

The CAT narrative instructions followed those created by James (1999), with additional prompts provided for children who found it difficult to start a narrative:

I've got a picture that I would like you to look at and tell me a story about. When you tell your story, you might like to start with "Once upon a time…." Also, see if you can have a beginning, middle and end to your story. (p. 109)

Prompts for both narratives are provided in Table C-2 and Table C-3, both in Appendix C.

Data Collection

Prior to commencement of data collection, ethics approval for the research project was obtained from the Flinders Clinical Research Ethics Committee (approval number 60/02) and the Research Council Unit of the Department of Education, Training and Employment (DETE). Approval was also obtained from the manager of each DETE site (preschools and schools) to proceed with the research project before seeing participants.

Background information on each participant was sought from the referring speech pathologists and parents, using a brief questionnaire, shown in Table C-4 in Appendix C. They were asked to provide information on age of first words and sentences, age at first speech pathology assessment, hearing status and history of any ear infections, results of any standardised language or non-verbal assessments administered during the previous twelve months. The information on hearing and ability assessments assisted with determining whether the children met criteria and whether recent assessments were available. The majority of participant parents did not provide the developmental information, so this could not be used.

Participants were assessed in a range of contexts including schools, preschools, clinic, homes, or university clinic, according to parental choice. This flexibility facilitated ease of access to the children. Most assessments took place in a school, preschool or child care centre (65.3%), while a third took place in the child's home (30.7%) and only a small number opted to attend a university clinic (4%). Each participant was assessed in a quiet room, removed from other activities. A parent was present for most assessments of the younger LM group and for some assessments of the older participants, according to parental preferences. In these cases, the parents were requested to say little and allow the researcher to interact freely with their child.

The assessments and language sampling took up to two hours per participant spread over two to three sessions, one to two weeks apart. Assessments occurred over three sessions for some of the children in the LI and LM groups who had difficulty attending to language tasks for a sufficient length of time. Most participants were administered the standardised assessments during the first session. The researcher administered all the RDLS (Edwards et al., 1997) and RCPM (Raven et al., 1995) assessments and most of the CELF-P (Wiig et al., 1993) assessments (82.4% for the language impaired participants). For the remainder, the CELF-P was administered by their treating speech pathologist within six months of the research data collection. The order of administration for the language sampling procedures was varied equally across participants in each group, to counter any order effects.

SUMMARY

Seventy-five participants were recruited for this research: 21 with SLI, 13 with NLI, 21 for an AM group and 20 for a LM group. Six participants with SLI who had higher language abilities than the NLI group were separated into a HSLI group leaving 15 in the SLI group that were matched to the NLI group for MLU and CELF-P Expressive Language scores. The LM group was matched to the SLI and NLI groups for MLU, and to the NLI group for NVCA.

Conversation and spontaneous language samples were elicited in a play context to enable analysis of morpheme accuracy and syntactic complexity. Two oral narratives were elicited to enable analysis of narrative structure, information and cohesion, and further analysis of morpheme accuracy and syntactic complexity.

CHAPTER 5: METHODOLOGY: ANALYSIS AND RELIABILITY

LINGUISTIC ANALYSIS

Transcription

The spontaneous language samples were audio-recorded using a Sony TCS-580V cassette tape recorder and lapel microphone. They were transcribed within two weeks of recording using the computer software Systematic Analysis of Language Transcripts (SALT) (Miller, Chapman, & Nockerts, 1996; Miller et al., 2004).

Transcription entry conventions described in the SALT manual were used, with some adaptations. SALT conventions treat irregular past tense verbs and the variant forms of do (does, don’t) as single morphemes because vowel differences mean that pre-literate children may regard them different words, and different processes of acquisition may apply (Miller, 1981). Caygill (1998) suggested that the word “can’t” should be treated similarly in British English because of vowel changes, which are not evident in American English (but evident in Australian English). The word “can’t” was therefore also transcribed as one morpheme. Other negative contractions were transcribed as bound morphemes (Miller et al., 1996). Variations or clarifications to how the SALT transcription conventions were interpreted are summarised in Table D-1 in Appendix D. Bound morpheme conventions additional to the SALT conventions are summarised in Table D-2 in Appendix D.

Non-verbal utterances (e.g., animal and vehicle noises) and mazes (e.g., verbal repetitions and reformulations) were excluded from analysis. For the morphosyntactic analyses, the two narrative samples were combined into a single combined narrative sample to provide a larger number of utterances and more valid data set (Wagner et al., 2000). Utterance boundaries were determined using conventions described by Paul (1995) that conformed well to SALT guidelines for conversational samples:

1. The end of an utterance is indicated by a pause preceded by a rising or falling intonation contour.
2. The end of a grammatical sentence is the end of an utterance. Two or more sentences can be said in one breath without a pause, but each should be treated as a separate utterance for transcription and analysis.

3. A group of words, such as a noun or a prepositional phrase that cannot be divided without losing meaning is an utterance, even though it is not part of a complete sentence, if it is followed by a pause of more that 2 seconds or by a pause preceded by a rising or falling intonation contour.
4. A sentence with two independent clauses joined by a coordinating conjunction (e.g., and, but, or) is counted as one utterance. If the sentence contains more than two such independent compound clauses, it is segmented so the third clause, beginning with the conjunction, is a separate utterance.
5. Sentences with subordinate, embedded, or relative clauses are counted as single complex sentences. (p. 300)

The narrative transcripts were further parsed into c-units (conversational unit), devised by Loban (1976) for use with oral texts and frequently used in analysis of oral narratives (Nippold, 1998; Paul, 1995). These smaller units of meaning more readily enable analysis of specific narrative features. The c-unit consists of a main clause with all subordinate clauses or modifiers attached to or embedded within it. Main clauses that begin with coordinating conjunctions (and, but, or) initiate a new c-unit except in cases where there is a co-referential participant deletion in the second clause. The c-unit also includes single words and phrase fragments (e.g., “yes please”) that occur more frequently in oral communication, particularly in response to questions.

Morphosyntactic Coding and Analysis

Relevant variables for this study that SALT calculates included the number of utterances (e.g., verbal, nonverbal and unintelligible utterances) and MLU. SALT readily generates lists of coded words; word roots, bound morphemes and coded utterances for further analysis.

Obligatory Contexts and Calculation of Accuracy

A common methodology among morphosyntactic studies of SLI is to measure the accuracy of grammatical morphemes as the percentage of correct use in obligatory contexts (OCs) (Beverly & Williams, 2004; Morehead & Ingram, 1973; Rice & Wexler, 1996b). This is calculated by dividing the number of correct uses of the morpheme by the total number of OCs for the morpheme in the sample studied. This may be calculated, not only for individual morphemes, but also for composites of morphemes considered to have like features, or belonging to a certain class such as noun phrases, inflections or finite verb morphemes.

Studies varied in the minimum number of OCs required for analysis, ranging from three (Eadie, 1999; Eadie et al., 2002; Lahey et al., 1992; Rice et al., 1995) to five (Brown, 1984; Steckol & Leonard, 1979) or not reported at all (Bedore & Leonard, 1998; Leonard et al., 1997). When minimum requirements for OCs were not met, participant numbers contributing to individual language measures were often reduced, as their data was excluded (Ingram & Morehead, 2002). The use of a minimum number of OCs limits the risk of over-interpreting percentages that based on low incidence (Balason & Dollaghan, 2002; Eadie, 1999; Rice et al., 1995).

Three OCs was used as the minimum for this research. Data were also only reported and analysed when there were at least eight participants in a group meeting the minimum OCs criterion for a variable. This reduced bias that may be present in a small sample. Eight was the smallest sample size in the morphosyntactic literature reviewed (Rice et al., 1997) and also the criterion used by Rescorla and Roberts (2002).

Morphology

Targeted morphosyntactic forms were coded for their syntactic role in the language samples, using the SALT2 Coder program (Miller, Chapman, & Nockerts, 1993). All word level morphosyntactic coding conventions used are summarised in Table D-3 in Appendix D. Verb phrase elements selected for coding and analysis were copula (COP), auxiliaries (AUX), modals (MOD), and lexical verbs. The primary verb operators BE, DO and HAVE comprised the AUX measure (Leech, Deuchar, & Hoogenraad, 1982; Leech & Svartvik, 1994). One noun phrase form targeted for coding and analysis was articles (ART). Bound morphemes of interest that were identified were contractions of AUX and COP, the genitive marker ‘s (GEN), regular past tense (ED), third person singular (3S), continuous aspect (ING) and plural (PLS). Lists of coded forms, and the bound morphemes targeted for analysis were generated by the SALT program. The OCs, correct use, omissions and errors for the targeted forms were counted from the SALT Analysis Reports. This enabled calculation of accuracy for grammatical morphemes as the percentage of correct use.

Five composite accuracy measures were calculated by totalling all instances of correct use and OCs for the relevant forms and then calculating composite percentages of correct use: 1) a finite tense composite (FTC) from the finite tense morphemes of ED, 3S, AUX and COP; 2) a finite tense inflection composite (FTIC) from the bound morphemes ED and 3S; 3) a non-tense verb composite (NTVC) composed of the non-tense verb morphemes of ING and MOD (*can*, *will*, *may*, *shall* and their variants); 4) a noun phrase composite (NPC), included articles (ART), regular plurals (PLS) and possessives (GEN); and 5) a noun phrase inflection composite (NPIC) included only the bound morphemes PLS and GEN.

Composite accuracy measures have been used previously for analysis, but have varied in their composition (Bedore & Leonard, 1998; Eadie, 1999; Eadie et al., 2002; Rice et al., 2004; Rice, Wexler et al., 1998). The FTC and NPC used for this research was the same as used by the afore-mentioned researchers. The composition of non-tense composites has varied among researchers. The FTIC composite for this research was also used previously (Eadie, 1999; Eadie et al., 2002). The morphosyntactic features were analysed separately for each of the conversation and narrative contexts.

Syntax and clause complexity

All utterances from the conversations and narratives were coded for their type of clausal structure: fragments, complete clausal structure (i.e., containing the essential clausal elements required by the argument structure) and number of clauses. Clausal complexity was examined by calculating the proportion of fragments as a percentage of the total verbal utterances in each sample. The proportion of utterances with single, and two clauses was also calculated. This has similarity with complexity measures used by other researchers such as the percentage of grammatical t-units (Liles et al., 1995) and the percentage of complex t-units (Manhardt & Rescorla, 2002).

A commonly used measure of clausal complexity in narratives and written language is the subordination index (Hunt, 1965; Scott, 1988b), originally designed for use with adolescents and children over 9 years of age. The subordination index is calculated by dividing the total number of clauses by the number of c-units with complete clausal structure. Fragments, phrases, elliptical and yes/no responses are excluded from this analysis, but are characteristic of early language development and conversation samples. The subordination index was therefore calculated for the narratives only.

Errors in the conversation and narrative samples, which could not be coded at the morpheme or phrase level, were coded at the utterance level: specifically, ambiguous errors (where the utterance was syntactically incorrect with more than one possible construal of the nature of the error), semantic errors (confused meanings) and word order errors. The proportion of utterance errors was calculated as a percentage of all verbal utterances in the sample. Utterance level morphosyntactic coding conventions are summarised in Table D-4 in Appendix D.

Narratives Coding and Analysis

The structure of each narrative was analysed at three levels, described in the following section: narrative components, narrative structural level and narrative organisation level. A summary of these levels is provided in Table 5.1.

Narrative components

Each c-unit in the narratives was evaluated for its role in the narrative and scored for one or more *story grammar components*[4], as described by Hedberg and Westby (1993). C-units in early developing non-goal directed (NGD) narratives, that could not be attributed the status of a true narrative component, were coded for the NGD component categories described by Hedberg and Westby. Their four components of *external states*, *internal states*, *actions* and *natural occurrences*, were expanded by this researcher, with the addition of four further categories to account for components that did not easily fit the original categories. *Label* components comprised utterances that served only to label items in the pictures (e.g., "a tree"). *Questions* connected to the narrative, but not linked within a purposeful goal-directed narrative, were also coded in relation to *identity* (e.g., "who's there?"), *location* (e.g., "where are you?") and *actions* (e.g., "what was he doing?"). A description of the NGD narrative components coded is provided in Table E-1 in Appendix E.

Each c-unit in true goal directed (GD) narratives was coded for the GD narrative component categories described by Hedberg and Westby (1993). *Obstacles*, as described by Hedberg and Westby, were also coded, to aid the analysis process. *Obstacles* are comprised of an *attempt* followed by a *consequence* that leads to a further *attempt* (e.g., a failed attempt that led to another attempt). A description of the GD narrative components coded is provided in Table E-2 in Appendix E. The narrative components were coded into the narrative transcripts using SALT for Windows (Miller et al., 2004). The number of each type of narrative component per c-unit was calculated for analysis.

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[4] In the interests of consistency of terminology within this thesis, the term *narrative component* will be used henceforth, in place of the term *story grammar component*.

Structural level

Narrative structural levels were analysed using a decision tree and descriptors adapted from several sources (Hedberg & Westby, 1993; Hughes et al., 1997; James, 2001; Saliba, 2001). The sixteen structural levels represent a hierarchy of increasing complexity and elaboration, so they were assigned ordinal values for analysis and are described in Table E-3 in Appendix E. The decision tree is described in Table E-4 in Appendix E.

Five modifications were made to the structural levels (narrative levels) described by Hedberg and Westby (1993) to reflect some differences in the features found in the narratives collected from the participants and to better cover the variations in the ways in which the children chose to elaborate their narratives. These modifications are described below:

1) A question was added to the first step of the decision tree to guide assignment of the *isolated description* level (James, 2001).

2) Another level, the *fragmented episode,* was added to cater for narratives that were partially goal directed but were missing a clear *initiating event* or *consequence*. This is similar to the incomplete episodes described by Merritt and Liles (1987) but different from the *incomplete episode* described by Hughes et al. (1997).

3) Two streams were created for levels from *complex episode* to *interactive episode* to cover narratives that included or omitted *internal plans*.

4) The *multiple* and *embedded* narrative levels were subdivided into those with subsequent episodes only at the *reactive sequence* level (RS), or at the *abbreviated episode* level or higher (EP).

5) The defining characteristics of *interactive episodes* were refined, using the work of Saliba (2001) to include defined perspectives from at least two characters demonstrated by the presence of at least two of the following narrative components from each character's perspective: *internal response, attempt* or *reaction*.

Mixed narratives that contained elements of several structural levels were classified for the predominant narrative and the theme or goal expected for the stimulus. Thus a narrative that was largely NGD (e.g., a Descriptive Sequence) containing a brief goal directed segment (e.g., an Abbreviated Episode) not related to the main goal expected for the narrative, would be classified for the predominant NGD level. Alternatively, a narrative that was largely GD (e.g., an Abbreviated Episode) with a NGD segment would be classified for the predominant GD level.

Minimal cause and effect relationships, in the form of an *initiating event* followed by a *consequence*, were accepted for a *reactive sequence*, without the relationship needing to be made explicit with an appropriate conjunction (e.g., “The boy was stuck on the reindeer’s antlers. (So) The reindeer ran and threw him off the cliff.”).

Organisational level

The structural levels were clustered into broader bands of narrative organisation in order to examine whether this was a more useful measurement in terms of reliability or group comparisons. Broader analysis systems are quicker to conduct and may be more useful for busy clinicians than a detailed analysis of individual narrative components or structural levels. The NGD band incorporated the narrative structure levels of *isolated description*, *descriptive sequence*, *action sequence* and *reactive sequence*. The GD band incorporated the structural levels of *fragmented episode*, *abbreviated episode* and *complex episode*. The Elaborated band incorporated the *multiple*, *embedded* and *interactive* episode structural levels. The general relationship among organisational levels, structural levels and narrative components is summarised in Table 5.1.

Table 5.1. Summary of aspects of narrative structure analysis and their inter-relationships

Organisational level	*Structural level*	*Component*
Non-Goal Directed (NGD)	Isolated Description Descriptive Sequence Action Sequence Reactive Sequence[a]	Labels External States Internal States Actions Natural Occurrences Questions
Goal Directed (GD)	Fragmented Episode Abbreviated Episode Complex Episode	Setting Initiating Event Response Internal Plan Attempt Consequence Obstacle Reaction Ending
Elaborated	Multiple Episode Embedded Episode Interactive Episode	

Note: [a] while the Reactive Sequence was classified as NGD, the GD components of Initiating Event and Consequence applied.

Key event and information scores

The narratives were also coded for the information they contained. A system for scoring key events and information for the FROG narrative developed by other researchers (Boudreau & Hedberg, 1999; Pomper, Rosier, Sauer, Thompson, Weaver, & Hedberg, 1995) was adapted for this research. Aspects of this were similar to the information scores used for the Renfrew Action Picture and Bus Narrative Tests (Renfrew, 1988, 1991). The original FROG information scoring system by Pomper et al. was based on a retell so modifications were made to suit a more open narrative generation, such as replacing character names with an appropriate lexical label (i.e., boy, dog) and providing for a more generous interpretation of events. The information scoring for the FROG narrative contained up to 130 information items that could be scored, and is presented in Table F-1 in Appendix F.

The FROG key events (Boudreau & Hedberg, 1999) covered two aspects each of the initiating event, search (attempt) and resolution (conclusion), with a maximum score of six. This scoring system was thus closely related to narrative plot structure, as well as to information content. Clear definitions for each score meant that less independent judgement and interpretation was required than for the analysis of narrative components and narrative structure levels described earlier.

This researcher created a similar information and key event scoring system for the CAT narrative. The single scene picture provided significant scope for content producing up to 126 information items that could be scored. The key event score was developed by analysing the range of responses provided by the AM control group, categorising them into narrative plot elements and extracting six key events. The key events were limited to the most likely attempts and resolutions inferred from the pictured problem. The information scoring for the CAT narratives is shown in Table F-2 in Appendix F. The key event scoring for the FROG and CAT narratives are shown in Table F-3 and Table F-4 in Appendix F.

Because the information scores for the two narratives were constructed quite differently, percentage scores were calculated to enable comparison of relative information provision between groups across the narratives. The information score for each participant was divided by the maximum information score achieved by the AM participants for each narrative (85 for FROG and 18 for CAT) and then converted to a percentage.

Character cohesion

Categories of cohesive devices described by (Halliday & Hasan, 1976) were used as the basis for coding cohesion of character identity chains within the text and any exophoric reference to the characters shown in the narrative pictures. A full list of the categories and the codes used is provided in Table G-1 in Appendix G. These encompass lexical naming, pronominal reference, demonstrative reference, comparative reference, substitution and ellipsis. The category of omission was added to cover instances where the agent of a proposition could be inferred as missing. Use of demonstratives for character cohesion, was primarily as a determiner or article attached to a lexical form so articles and other demonstratives were initially coded separately. However, use of a single demonstrative for a character was extremely rare and begged for a lexical attachment (e.g., 'that owl is flying' is acceptable whereas 'that is flying' is unacceptable for a narrative character). Therefore, the few uses of demonstratives were collapsed into the category of definite articles for analysis. Comparative reference was used in only a couple of instances for the FROG narrative and was therefore disregarded for further analysis.

Each cohesive device or absence of cohesion was coded for the adequacy of the attempted cohesive tie: complete, exophoric or erroneous, similar to the cohesive adequacy classification described by (Liles, 1985). Definitions for each category of cohesive tie adequacy are provided in Table 5.2. Descriptions for the adequacy for each cohesive device are provided in Table G-2 in Appendix G. Acceptable lexical terms for the animals in the FROG narrative are provided in Table G-3 in Appendix G.

Ties were coded as complete when consistent identity of the character was retrievable from within the text (introduced lexically, with subsequent and appropriate anaphoric reference, substitution or ellipsis), sometimes with additional support from the picture context. Referents were coded as exophoric when the character had not been introduced lexically, but could be identified from the textual and picture context. This category was used only when there was no prior lexical identification of the referent. Incorrect or ambiguous referents were coded as erroneous.

Adequacy coding for the articles reflected the type of article used. Definite article forms were coded as complete and indefinite articles as erroneous. Articles were coded as unclear when the identity of the named character could not be retrieved from either the text or the picture context.

Table 5.2. Definition of cohesive tie adequacy

Adequacy	*Definition*
Complete	the information referred to by the cohesive device is found in the text, without ambiguity, and may be supported by the picture context
Exophoric	the information is not present within the text, but is implicit and retrievable from the picture context
Erroneous	the information is not provided in the text or picture context; the reference is ambiguous or incorrect

Examples of anaphoric, exophoric and ambiguous referencing for the first segments of the FROG narrative are shown in Table 5.3. In the anaphoric reference example, the boy is clearly identified in the first utterance, with subsequent pronouns referring back to the boy (a complete cohesive tie). The exophoric reference example illustrates lexical identification of the frog in the first utterance. The pronoun used in subsequent utterances, implicitly refers to the boy, as it relates to actions of the boy shown in the pictures. In the ambiguous reference example, the frog is once again labelled lexically in the first utterance but the subsequent pronoun may refer to either the boy or the dog, as both the boy and the dog are performing the actions described (an erroneous tie). The use of *he* in the third utterance could be attributed exophorically to the boy if one accepts a world view that only the boy is capable of expressing thoughts. Otherwise, it too is ambiguous.

Table 5.3. Examples of anaphoric, exophoric and ambiguous reference in contiguous c-units.

Anaphoric Reference	*Exophoric Reference*	*Ambiguous Reference*
One night *a little boy* got out of bed and looked at his frog. And then *he* hopped back into bed. And when *he* went to sleep the frog, (tip) he tiptoed out.	The frog is in the thing. And when *he* was asleep he was going out. Then *he* looked under *his* boot. Then *he* called him outside.	Here is a frog. The frog crept out when <u>he</u> was asleep. And <u>he</u> thought “where was <u>he</u>”? Then <u>he</u> was looking everywhere.

Note: Lexical naming and pronominal referencing for *the boy* is shown in italics. Ambiguous pronouns (could refer to the boy or the dog) are underlined. Both examples are from 5 year olds with normally developing language (AM group), from the beginning of the narratives.

Composite adequacy measures were calculated for the total number of complete, exophoric and erroneous cohesive ties, as percentages of the total number of cohesive ties for characters. Adequacy measures for each cohesive strategy were calculated as proportions of the total number of c-units.

A cohesive density measure was calculated by dividing the number of cohesive ties (whether complete, exophoric or incomplete) by the total number of c-units in each narrative. This was done for the total number of cohesive tie attempts and for each cohesive strategy. The ties per c-unit measure accommodated narratives without any cohesive ties. Composite adequacy measures were calculated for the total number of complete, exophoric and erroneous cohesive ties, as percentages of the total number of cohesive ties for characters. Adequacy measures for each cohesive strategy were calculated as proportions of the total number of c-units.

RELIABILITY

Inter-rater reliability for transcription and coding was examined for a random selection of play conversation and narrative samples from eight participants (10.7%). Four speech pathologists were independently responsible for discrete aspects of checking the transcription or coding. One speech pathologist who was experienced with language transcription and the SALT software, independently transcribed, and entered the morphosyntactic coding for the selected conversation and narrative samples. The remaining three speech pathologists were experienced in narrative analysis. One checked the c-unit divisions. Another was trained in the coding and scoring procedures for narrative structure, and yet another was trained in the procedures for information scores, key event scores and character cohesion. The reliability results for each aspect are summarised in Table 5.4.

Inter-rater reliability was examined for utterance boundaries; morpheme by morpheme transcription, including marking of bound morphemes; and for all syntax and utterance codes entered in the first 50 utterances of the conversation samples and for all utterances in both the FROG and CAT narrative samples. The inter-rater agreement was high for utterance boundaries (98.5%) and morphosyntactic coding (97.4%), and lower for the morpheme-to-morpheme transcription (88.3%). Differences were resolved through discussion and consensus.

For the narratives, inter-rater reliability was examined for c-unit division; coding of narrative level, narrative organisation, narrative components, cohesion, information scores and key event scores. Agreement was high for organisational level (100%), c-unit division (97.2%) and information scores (96.0%). Agreement was lower for the cohesion (86.8%), key event scores (84.7%), and narrative structural level (81.3%). Agreement was quite low for the coding of the individual narrative components (67.6%). The agreement levels for most narrative measures were within the parameters found by other researchers (73% to 100%) (Jordan et al., 1991; Manhardt & Rescorla, 2002). However, 80% was considered a more reasonable criterion level for reliability, so the narrative components were removed from further analysis. Differences in narrative were also resolved by discussion and consensus. This process led to clearer guidelines for some aspects of narrative coding.

Table 5.4. Percentage of agreement for transcription and coding

Measure	*Agreement*
Utterance boundaries	98.5%
Morpheme transcription	88.3%
Morphosyntactic coding	97.4%
C-unit division	97.2%
Narrative component	67.6%
Narrative structural level	81.3%
Narrative organisational level	100%
Character cohesion	86.8%
Information scores	96.0%
Key event scores	84.7%

STATISTICAL ANALYSIS OF GROUP COMPARISONS

All results were entered into SPSS (2002), a statistical software package, and examined for differences among and between groups, using an analysis of variance. The validity of using parametric or non-parametric methods was explored for each measure (Pallant, 2001). In many instances, data was skewed and did not meet normal distribution or homogeneity of variance criteria for parametric statistical methods. Ordinal measures such as narrative level were examined using non-parametric methods.

The Kruskal-Wallis test ($K\text{-}W\ \chi^2$) was used to test for significant group differences, followed by pairwise post-hoc testing, if required, using the Mann-Whitney test. *Z* scores for the Mann-Whitney test results are presented in the appendices rather than within the text, as many variables were explored and this approach improved readability. Descriptive statistics are presented in the form of medians and interquartile ranges to better reflect the skewed nature of some data. The Monte Carlo exact significance values were used from the SPSS system and significance was assessed at the .05 level. Ordinal measures such as narrative level were examined using non-parametric methods. Some variables met criteria for parametric statistical analysis; however, non-parametric statistics are reported for consistency and ease of making comparisons.

The Holm method was used to adjust *p* values for significance when post-hoc pairwise comparisons were conducted between each of the four research groups (Aickin & Gensler, 1996), using either the Tukey HSD or Mann-Whitney tests. The Holm method reduces the risk of Type 1 errors in multiple comparisons (i.e., rejecting the null hypothesis when it is actually true; determining that differences exist between groups when there are none). The Holm method provides less risk of a Type 2 error (i.e., accepting that there are no differences when differences actually exist) than the more stringent Bonferroni method. Briefly, the calculation involves dividing the alpha value (.05) by the rank order of the *p* values, constrained by the total number of comparisons. The total number of comparisons possible between the four research groups is six: 1) AM and LM, 2) AM and NLI, 3) AM and SLI, 4) LM and SLI, 5) LM and NLI, and 5) SLI and NLI. The Holm adjusted *p* values used to judge statistical significance from smallest to highest *p* values found for comparisons between each of the four research groups are provided in Table 5.5.

Table 5.5. Holm adjusted *p* values for six group comparisons

	Rank	*p value*
Smallest *p* value	6	.008
	5	.01
	4	.0125
	3	.017
	2	.025
Largest *p* value	1	.05

DISCRIMINANT FUNCTION ANALYSIS

Rationale

One challenge for this research is to sift through the large number of variables investigated and weigh up their relative significance or usefulness for the diagnosis of LI. The results of several studies (Bedore & Leonard, 1998; Conti-Ramsden et al., 2001; Liles et al., 1995) support the applicability of using a discriminant function analysis to determine the diagnostic validity of variables investigated. A discriminant function analysis was therefore used to determine which variables or combinations of variables were most useful and effective for identifying or classifying the children with LI (SLI and NLI) and the age-matched children with TDL (AM).

The identification success ratings of *good* (≥ 90%), *fair* (≥ 80%) and *poor* (< 80%), proposed by Plante and Vance (1994), were adopted. In addition, a correct identification rate of 100% was considered *excellent*. Variables were considered effective identifiers if they provided at least fair specificity for TDL and sensitivity to LI. Variables that provided poor specificity or sensitivity were considered ineffective identifiers.

Analysis Procedure

The SLI, NLI and HSLI (high SLI: scored above the 5th percentile and at or below the 10th percentile on the CELF-P Expressive Language scale) groups were combined for the discriminant function analysis, as the main interest here was the diagnosis of LI present these groups. Inclusion of the six children with HSLI will provide information regarding the effectiveness of the specified variables at identifying LI in children with moderate impairments, as well as severe impairments. This resulted in an LI group consisting of 34 participants. Together with the AM group consisting of 21 participants, this created a total of 55 participants for the discriminant function analysis.

Variables were selected for analysis following analysis of the group comparisons. The variables were initially selected based on two criteria. Firstly, they were selected based on their effectiveness at eliciting significant differences between the AM and two LI groups. Secondly, they were selected based on their coverage of the range of language domains explored, specifically: morphosyntactic accuracy, morphosyntactic complexity, narrative structure, narrative information and narrative cohesion. It was decided that data needed to be available for at least 75% of participants for each group for each variable, so as not to compromise the integrity of the groups and to ensure the model was not compromised by measures based on limited data.

Various combinations of the variables that were better at identifying LI were subjected to further discriminant analysis. The use of too many variables runs the risk of overfitting (i.e., the results are biased towards the sample and may not generalise to other samples or the wider population) (Tabachnick & Fidell, 2001). Therefore, the maximum of eight variables were considered in any one discriminant function model, meeting criterion that there are at least four or five times as many cases as independent variables (Garson, 2005). Care was also taken not to combine similar or complementary variables within one model (e.g., complete and erroneous cohesive ties; percentage of complete clauses and fragments), which may have also resulted in overfitting.

SUMMARY

A range of variables from the conversation, probe and narrative samples were coded and analysed for group differences, and are summarised in Table 5.6. Inter-rater reliability was checked for transcription and coding. Variables that were effective in differentiating groups were later subject to a discriminant function analysis, to determine the most effective variables for classification of LI.

Table 5.6. Types of variables derived from each sampling context

Variable	***Conversation***	***Narrative***
Accuracy: Morpheme composites	✓	✓
Utterance complexity: Type of clause	✓	✓
Utterance complexity: Subordination index	x	✓
Utterance level errors	✓	✓
Narrative: Structure	x	✓
Narrative: Content	x	✓
Narrative: Character cohesion	x	✓

Note: ✓ variable derived; x variable not derived

CHAPTER 6: RESULTS: GROUP COMPARISONS

This chapter presents results for the language sample analyses. The morphosyntactic characteristics of the conversation and narrative language samples are described first, including the number of utterances, grammatical accuracy and grammatical complexity. Five grammatical morpheme composites were examined for differences in the number of OCs and accuracy. In some cases, low numbers of OCs restricted the range of grammatical morpheme composites that could be examined.

Results follow for the narrative features for the FROG and CAT narratives produced by the participants. Firstly, the narrative structure results are described for the structural level and organisational level. Results follow for information and cohesion. Results are presented for both the FROG and CAT narratives for each type of analysis, describing the group differences and similarities elicited by each narrative. Because three children from the LM group refused to tell a CAT narrative, most data for the CAT narratives was based on only 17 participants from the LM group.

The results revealed that the SLI and NLI groups performed similarly on all measures examined: there were no significant differences between them. Significant differences were identified between the AM and LM groups for most variables. Significant differences between the AM and LI groups were also frequent, but not always consistent across the SLI and NLI groups. On a small number of measures, the LM group performed significantly better or more poorly than the SLI or NLI groups.

NUMBER OF UTTERANCES

Descriptive statistics for the number of utterances for the conversations (CON), FROG and CAT narratives, and for the narratives combined (NAR) are shown in Table 6.1. All participants produced at least 50 utterances for the conversation samples, but not for the narrative samples. Each group produced a similar number of utterances for the conversation samples, but the AM group produced more c-units than other groups for the narratives. Group effects showed no significant differences for the conversation number of complete and intelligible utterances ($\chi^2(3) = 4.308$, p = .228). However significant group effects were identified for the number of c-units in the narratives. Group effects for utterance length are shown in Table 6.2.

Post-hoc pairwise comparisons showed that there were no significant differences between the SLI and NLI groups for the narratives. However, the AM group produced significantly more c-units than the SLI ($p < .01$) and NLI groups ($p < .001$) for the narratives combined, and significantly more than the NLI group for the FROG narrative ($p < .001$). For the CAT narrative, the SLI group produced significantly less c-units than the AM ($p \leq .001$) and NLI groups ($p < .01$). All pairwise comparisons for number of c-units are shown in Table H-1 in Appendix H.

Table 6.1. Number of utterances

Variable	*Measure*	*Group*			
		SLI	***NLI***	***AM***	***LM***
CON Total verbal utterances	Median	223	249	227	267
	IQR	113	96	118	154
CON Complete & Intelligible –yn	Median	139	196	184	198
	IQR	102	71	97	92
NAR Combined no. of c-units	Median	34	28	46	39
	IQR	24	16	17	22
FROG no. of c-units	Median	27	21	38	31
	IQR	23	14	16	21
CAT no. of c-units	Median	5	7	8	5
	IQR	4	5	6	4

Table 6.2. Group effects for number of utterances

Variable	*KW* χ^2	*df*	*p*	*sig*
CON Total verbal utterances	2.857	3	.418	
CON Complete & Intelligible –yn	4.308	3	.228	
Combined no. of c-units	15.204	3	.001	***
FROG no. of c-units	15.514	3	.001	***
CAT no. of c-units	13.382	3	.003	***

Note: *** results are significant at ≤ .001 level; ** results are significant at ≤ .01 level; * results are significant at ≤ .05 level.

MORPHOSYNTACTIC CHARACTERISTICS

Calculation of accuracy for the grammatical morpheme composite first required a calculation of the number of obligatory contexts (OCs) for each composite. The number of OCs are therefore reported, before presentation of the results for morpheme accuracy.

Obligatory Contexts

Before calculating accuracy for a grammatical morpheme composite, all groups were also required to meet the minimum criterion of three OCs for at least eight participants. The number of participants in each group that met criterion for the minimum number of OCs for the composite accuracy measures is summarised in Table 6.3. For the conversations, all groups met the minimum criterion for all composites. However, for the narratives not all groups met the criterion for FTIC or NPIC. Therefore, statistical analysis of accuracy was possible only for FTC, NTVC and NPC. The median number of OCs for each group in the conversations and narratives is shown in Table H-2 in Appendix H.

Table 6.3. Number of participants with minimum obligatory contexts for composite grammatical measures in conversations and narratives

Variable	*Group*							
	SLI		***NLI***		***AM***		***LM***	
	CON	*NAR*	*CON*	*NAR*	*CON*	*NAR*	*CON*	*NAR*
FTC	15	15	13	13	21	21	17	17
FTIC	15	9	13	**4**	21	19	17	8
NTVC	15	12	13	10	21	20	17	15
NPC	15	15	13	13	21	21	17	17
NPIC	15	10	13	**1**	21	17	17	12

Note: Participant numbers that did not meet criteria for calculating accuracy appear in bold.

Grammatical Morpheme Accuracy

Descriptive statistics for the accuracy levels for all targeted grammatical morphemes composites in the conversations and narratives are shown in Table 6.4. Higher accuracy levels were obtained for NTVC (73% to 100%) and NPC (71% to 100%) while the lowest accuracies were obtained for FTC (49% to 91%). Variance within all composites was low for the AM group, but higher for the SLI, NLI and LM groups. Group effects are summarised in Table 6.5.

Post-hoc pairwise comparisons showed that there were no significant differences between the SLI and NLI groups. The AM group achieved significantly higher accuracy than the SLI, NLI and LM groups for the three composites for both the conversations and narratives: FTC ($p < .001$), NTVC (conversations $p < .001$; narratives ($p < .01$) and, NPC (conversations $p \leq .001$; narratives $p < .01$). The LM group also produced significantly higher accuracy for FTC than the NLI group ($p \leq$

.05) in the narratives. All pairwise comparisons for morpheme composites are shown in Table H-3 in Appendix H.

Table 6.4. Median accuracy for grammatical morpheme composites in conversations and narratives

Variable	*Group*							
	SLI		***NLI***		***AM***		***LM***	
	CON	*NAR*	*CON*	*NAR*	*CON*	*NAR*	*CON*	*NAR*
FTC	67 (23)	67 (43)	49 (44)	65 (38)	91 (9)	91 (7)	67 (25)	76 (18)
NTVC	73 (24)	100 (15)	77 (27)	97 (17)	98 (3)	100 (0)	86 (23)	95 (29)
NPC	82 (14)	88 (27)	77 (50)	71 (31)	95 (7)	100 (3)	88 (16)	76 (18)

Note: Interquartile ranges are shown in parentheses; [a] too few cases (n < 8) to calculate accuracy

Table 6.5. Group effects for accuracy of grammatical morpheme composites

Variable	***CON***				***NAR***			
	K-W χ^2	*df*	*p*		*K-W* χ^2	*df*	*p*	
FTC	33.464	3	< .001	***	29.965	3	< .001	***
NTVC	35.745	3	< .001	***	13.688	3	.002	**
NPC	19.299	3	< .001	***	35.259	3	< .001	***

Note: *K-W* χ^2 Kruskal-Wallis Test; [a] too few cases (n < 8) to calculate accuracy;
*** significant at ≤ .001 level; ** significant at ≤ .01 level; * significant at ≤ .05 level.

Variance and Distribution of Morpheme Accuracy

Variance for the SLI and NLI groups was high for FTC and NPC, illustrated in their high interquartile ranges. High variance could account for lower diagnostic classification rates for single variables, and different findings among researchers. A closer examination of variance for some variables therefore seemed warranted.

The distribution of accuracy scores for FTC, NTVC and NPC were examined, to enable comparison with the position of Rice (2000), that the finite tense marker is bimodally distributed between children with SLI and TDL. The score ranges for the grammatical morpheme composites are presented in Table 6.6. While the AM group participants had high accuracy levels for the composites (over 70%) in the conversations and narratives, not all SLI, NLI and LM group participants had low accuracy levels, contributing to overlap in accuracy levels across groups.

The distribution of individual scores was further analysed, using 70% as the criterion for dividing participants into those with high or low accuracy measures. This accuracy level was used because the AM group had accuracy levels over 70% for all composites. The number and percentage of participants with high grammatical accuracy is shown in Table 6.7. This showed that FTC accuracy levels overlapped with the AM group for nearly a quarter of NLI participants in the conversations, and for half of SLI participants in the narratives. Overlap of NTVC and NPC accuracy levels with the AM group was high for both SLI and NLI groups.

Table 6.6. Range of accuracy measures for composite grammatical measures in play conversations (expressed as minimum and maximum percentage correct use)

Variable		*Group*			
	HSLI	***SLI***	***NLI***	***AM***	***LM***
FTC conversation	40 - 87	42 - 89	12 - 94	74 - 97	17 - 90
NTVC conversation	78 - 89	4 - 100	43 - 96	75 - 100	61 - 98
NPC conversation	86 - 94	46 - 100	15 - 99	77 - 99	45 - 98
FTC narrative	39 - 70	22 - 100	0 - 75	71 - 100	25 - 94
NTVC narrative	100	8 - 100	40 - 100	100	50 - 100
NPC narrative	81 - 100	35 - 100	12 - 85	89 - 100	38 - 97

Overlap of FTC accuracy levels was high for the HSLI group in the conversations but lower in the narratives: This difference was significant ($p < .05$). However, there were no significant differences between the HSLI and SLI groups for FTC in either the conversations or narratives.

Table 6.7. Percentage of participants with high accuracy levels for grammatical composites (> 70%).

Variable	*Measure*	*Group*				
		HSLI	***SLI***	***NLI***	***AM***	***LM***
Conversation						
FTC	Percentage	83.3%	40%	23.1%	100%	45%
	n	5/6	6/15	3/13	21/21	9/20
NTVC	Percentage	100%	53%	61.5%	100%	80%
	n	6/6	8/15	8/13	21/21	16/20
NPC	Percentage	100%	86.7%	61.5%	100%	80%
	n	6/6	13/15	8/13	21/21	16/20
Narrative						
FTC	Percentage	33.3%	53.3%	30.8%	100%	70.6%
	n	2/6	8/15	4/13	21/21	12/17
NTVC	Percentage	100%	91.7%	90%	100%	80%
	n	4/4	11/12	9/10	20/20	12/15
NPC	Percentage	100%	80%	53.8%	100%	70.6%
	n	6/6	12/15	7/13	21/21	12/17

Summary

In summary, the findings show that in both the conversations and narratives there were no significant differences between the SLI and NLI groups for morphosyntactic accuracy. However, the AM group stood out as performing significantly better than the SLI, NLI and LM groups. The LM group also produced achieved significantly higher accuracy for FTC in the narratives than the NLI group.

UTTERANCE COMPLEXITY AND ERRORS

Clausal Structure

Descriptive statistics for the clausal status of utterances in the conversations and c-units in the narratives is provided in Table 6.8. A quarter to a third of the conversation utterances for the SLI, NLI and LM groups were fragments. While the proportion of utterance fragments were similar across the conversation and narrative contexts for the SLI and NLI groups, the AM group produced less fragments in the narratives than the conversations. The proportion of complete, single clause utterances was higher in the narratives than the conversations for all groups. Group effects are shown in Table 6.9.

Table 6.8. Proportion of fragments, single clauses, two-clause utterances, as percentage of all verbal utterances or c-units; and the subordination index

Variable	*Group*							
	SLI		***NLI***		***AM***		***LM***	
	CON	*NAR*	*CON*	*NAR*	*CON*	*NAR*	*CON*	*NAR*
FRAG	29	25	37	29	22	8	33	44
	15	30	21	45	11	9	22	23
Single clause	34	59	41	53	45	71	39	42
	19	20	19	37	10	13	14	25
Two clause	4	4	6	7	11	13	5	2
	7	12	6	14	6	8	8	8
Subord. index	n/a	1.07	n/a	1.09	n/a	1.19	n/a	1.14
		0.16		0.19		0.15		0.27

Note: Interquartile ranges are shown in parentheses.

Post-hoc pairwise comparisons showed that there were no significant differences between the SLI and NLI groups. The AM group produced significantly more grammatically complete and complex utterances than the SLI, NLI and LM groups, in their conversations and narratives. This was evident in the AM group producing significantly less fragments (CON $p < .01$; NAR $p \leq .001$) and significantly more two-clause utterances (CON $p < .01$; NAR $p \leq .01$) than the other three groups. For the conversations the AM group also produced significantly more single-clause utterances than the SLI ($p \leq .001$), and LM groups ($p < .05$). For the narratives, the AM group produced significantly more single-clause utterances than the NLI and LM groups ($p < .01$) The AM group also had a subordination index that was significantly higher than the SLI group ($p < .01$). The SLI group produced more complex utterances than the LM group in the narratives, shown in significantly less fragments and significantly more single-clauses ($p < .01$). All pairwise comparisons for clausal complexity are shown in Table H-4 in Appendix H.

Table 6.9. Group effects for clausal status of utterances in conversations

Variable	***CON***				***NAR***			
	K-W χ^2	*df*	*p*		*K-W* χ^2	*df*	*p*	
FRAG	18.032	3	< .001	***	33.528	3	< .001	***
Single clause	13.043	3	.004	**	21.762	3	< .001	***
Two clause	16.212	3	< .001	***	20.461	3	< .001	***
Subord. index	n/a				10.356	3	.014	*

Utterance Errors

Utterance level errors for both the conversations and narratives constituted less than 3% of utterances for all groups. Descriptive statistics for utterance level errors are shown in Table 6.10. The median percentage of utterance level errors in the conversations was highest for the SLI group, followed by the NLI and LM groups, with the lowest for the AM group. In the narratives, the median percentage of utterance level errors was highest for the SLI group and zero for the other three groups. Variance was relatively high for all groups, with the interquartile ranges higher than the medians. The incidence of individual error types (syntactic and semantic) was very low across the groups so these are not reported separately. Significant group effects were evident for the percentage of utterance errors in both the conversation ($\chi^2(3) = 21.949$, $p < .001$) and narrative samples ($\chi^2(3) = 8.615$, $p = .032$).

Post-hoc pairwise comparisons showed that there were no significant differences between the SLI and NLI groups. However, both the SLI and NLI groups produced significantly more utterance errors in the conversations than the AM group ($p < .01$). The SLI group also produced significantly more errors than the LM group ($p \leq .001$) in the conversations. Although the SLI group appeared to produce twice as many errors than the NLI group for the conversations, this difference was not significant. In the narratives, the SLI group produced significantly more utterance level errors than the AM group ($p < .01$). All pairwise comparisons for utterance errors are shown in Table H-4 in Appendix H.

Table 6.10. Utterance errors: as percentage of all verbal utterances for the play conversations, and percentage of all c-units for the narratives.

Variable	*Measure*	*Group*			
		SLI	***NLI***	***AM***	***LM***
Conversation utterance errors	Median	2.6	1.3	0.4	0.6
	IQR	4.5	1.8	0.8	1.1
Narrative utterance errors	Median	2.4	0	0	0
	IQR	6.9	3.5	0.7	2.0

Summary

As for morphosyntactic accuracy, there were no significant differences between the SLI and NLI groups for measures of utterance complexity. The AM group produced significantly more complex utterances than the other groups. The

LM group also produced significantly less complex c-units in the narratives and less utterance errors in the conversations than the SLI group.

NARRATIVE STRUCTURE AND ORGANISATION

Structural Level

The percentage of narratives produced at each structural level for each group is shown in Table 6.11. For the FROG narrative, the AM group produced narratives with the broadest range of structural levels, from the *action sequence* level to the *interactive episode* level. The SLI group produced narratives ranging from the *isolated description* to the *embedded episode* level and the NLI group produced narratives ranging from the *isolated description* level to the *abbreviated episode* level. The LM group produced narratives covering the narrowest range of narrative structure levels from the *isolated description* level to the *action sequence* level. The median narrative structure levels were *action sequence* for the SLI group, *descriptive sequence* for the NLI and LM groups and *embedded episode* for the AM group.

For the CAT narrative, the AM group produced narratives across a narrower range of simpler structural levels than they did for the FROG narrative. Their narratives ranged from the *descriptive sequence* to the *multiple episode* level. The SLI group also produced CAT narratives across a narrower range of structural levels than they did for the FROG narrative, ranging from the *isolated description* to the *fragmented episode* level. The NLI group produced CAT narratives across a similar range of levels to the FROG narrative. However, the LM group produced CAT narratives across a broader range of levels compared to the FROG narratives, from *isolated description* to *fragmented episode* level. Several of the LM group also refused to produce a CAT narrative. The median narrative structure levels for the CAT narrative were descriptive sequence for the SLI and NLI groups, isolated description for the LM group and abbreviated episode for the AM group.

Since internal plan components were not evident in any narratives, narrative structure levels requiring this component were removed from the final ordinal ranking of levels. These were complete episodes (containing all narrative components) and multiple, embedded and interactive episodes with plans. This decreased the number of levels from 16 to 12. Group effects were significant for both the FROG ($\chi^2(3) = 41.883$, $p < .001$) and CAT narratives ($\chi^2(3) = 28.977$, $p < .001$).

Table 6.11. Percentage of narratives at each individual narrative level

Variable	*Group and Narrative*							
	SLI		***NLI***		***AM***		***LM***	
	FROG	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*
0. Refusal								15.0
1. Isolated description	6.7	33.3	23.1	30.8			15.0	**40.0**
2. Descriptive sequence	13.3	**26.7**	**30.8**	**30.8**		14.3	**70.0**	15.0
3. Action sequence	**33.3**	6.7	7.7	15.4	9.5	9.5	15.0	15.0
4. Reactive sequence	6.7	26.7		7.7				10.0
5. Fragmented episode	13.3	6.7	15.4	0		14.3		5.0
6. Abbreviated episode	6.7		23.1	15.4		**28.6**		
7. Complex episode	6.7				38.1	28.6		
8. Multiple episode RS						4.8		
9. Embedded episode RS	6.7				**33.3**			
10. Multiple episode EP								
11. Embedded episode EP	6.7				4.8			
12. Interactive episode					14.3			

Note: Percentages in bold align with median narrative levels. Cells with zero percentages have been left blank.

Post-hoc pairwise comparisons showed that there were no significant differences between the SLI and NLI groups for either the FROG or CAT narratives. The AM group produced both FROG narratives at significantly higher levels than the other three groups (p < .001); while the SLI group produced FROG narratives at significantly higher structural levels than the LM group (p < .001). The AM group produced CAT narratives at significantly higher levels than the other three groups (p < .001). All pairwise comparisons for narrative structure measures are shown in Table H-5 in Appendix H.

Organisation Level

The percentage of oral narratives produced at each organisation level is shown for each group in Table 6.12. Analysis of the narrative organisation levels revealed that for the FROG narrative the majority of the AM group produced elaborated narratives, while the majority of SLI and NLI participants produced NGD narratives. All LM participants produced NGD FROG narratives. For the CAT narrative, the majority of AM participants produced GD narratives, while large majorities of SLI, NLI and LM participants produced NGD narratives. Significant group effects were evident for both the FROG ($\chi^2(3) = 36.522$, $p < .001$) and CAT narratives ($\chi^2(3) = 32.272$, $p < .001$).

Table 6.12. Percentage of narratives at each narrative organisation level

Variable	*Group*							
	SLI		***NLI***		***AM***		***LM***	
	FROG	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*
Refusal	0	0	0	0	0	0	0	15
Non-goal-directed	**60**	**93**	**62**	**85**	10	24	**100**	**80**
Goal-directed	27	7	39	15	38	**71**	0	5
Elaborated	13	0	0	0	**52**	5	0	0

Note: Percentiles for median levels in bold font.

Post-hoc pairwise comparisons showed that there were no significant differences between the SLI and NLI groups for narrative organisation level. The AM group produced both FROG narratives at significantly higher organisation levels than the other three groups ($p < .001$). Both the SLI and NLI groups produced FROG narratives at a significantly higher organisational level than the LM group (less NGD, more GD and more elaborated) ($p < .01$). The AM group produced CAT narratives at significantly higher organisation levels than the other three groups ($p < .001$). All pairwise comparisons for narrative organisational level are shown in Table H-5 in Appendix H.

Summary

The results showed that there were no significant differences between the SLI and NLI groups for the structural or organisational level of their narratives. The AM group produced narratives that were significantly more complex than the other three groups, although this was not evident for each type of component. The LM group produced significantly less complex narratives than the SLI and NLI groups.

KEY EVENT AND INFORMATION SCORES

Descriptive statistics for the *key event* and *information* scores for the FROG and CAT narratives are shown in Table 6.13. The SLI and NLI groups performed similarly on both measures. For the FROG narrative the median *key event* and *information* scores were highest for the AM group and lowest for the LM group. For the CAT narrative, the median *key event* score was also highest for the AM group and lowest for the LM group, while the median *information* score was highest for the AM group and lowest for the SLI group. Group effects are summarised in

Post-hoc pairwise comparisons showed that there were no significant differences between the SLI and NLI groups for either the FROG or CAT narratives. For the FROG narrative, the AM group attained significantly higher *key event* and *information* scores than the other three groups ($p < .001$). The NLI group described significantly more *key events* than the LM group ($p < .01$) and the SLI group attained significantly higher *information* percentage scores than the LM group ($p < .01$) for the FROG narrative.

For the CAT narrative, the AM group attained significantly higher *information* score percentages than all other groups ($p < .001$) and more *key events* than the LM and NLI groups ($p < .01$). All pairwise comparisons for event and information scores are shown in Table H-5 in Appendix H.

Table 6.13. Median key event and information scores

Variable	*Group*							
	SLI		***NLI***		***AM***		***LM***	
	FROG	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*
Key Event Score	1 (2)	2 (2)	1 (1.5)	1 (2.5)	4 (1.5)	2 (2.5)	0 (1)	1 (2)
Information percentage	37 (27)	22 (17)	24 (15)	28 (19)	68 (28)	56 (25)	22 (11)	22 (17)

Note: Interquartile ranges are presented in parentheses.

Table 6.14. Group effects for event, key event and information scores

Variable	***FROG***				***CAT***			
	K-W χ^2	*df*	*p*		*K-W* χ^2	*df*	*p*	
Key event scores	34.529	3	.001	***	12.308	3	.004	**
Information score	37.406	3	.001	***	26.976	3	.001	***

CHARACTER COHESION

Adequacy

All participants produced cohesive tie attempts in the FROG narratives but not all in the CAT narratives. Since adequacy is calculated as a percentage of the total number of ties, the group numbers for calculating adequacy percentages for the CAT narrative were reduced: to 12 for the SLI group, 12 for the NLI group, 20 for the AM group and 13 for the LM group. The median number of cohesive ties per c-unit is shown in Table H-6 in Appendix H.

Descriptive statistics for the cohesive adequacy are presented in Table 6.15. For the FROG narrative, the median percentage of complete ties was highest for the AM group and lowest for the NLI group. The median percentage of erroneous ties was highest for the NLI and LM groups and lowest for the AM group. The median percentage of exophoric ties (reference to the picture stimulus) was below 1.5% for all groups (and therefore not shown in the table or subject to further analysis).

For the CAT narrative, the median percentage of complete ties was highest for the SLI group and lowest for the NLI and LM groups. The median percentage of erroneous ties was highest for the LM group and lowest for the AM group. The median percentage of exophoric ties was zero for all groups. Group effects for cohesive tie adequacy are shown in Table 6.16.

Table 6.15. Adequacy of cohesive ties expressed as median percentages of total cohesive ties (interquartile range in brackets)

Variable	*Group and Narrative*							
	SLI		***NLI***		***AM***		***LM***	
	FROG	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*
Complete Ties	59 (33)	93 (44)	41 (33)	36 (74)	90 (19)	85 (28)	43 (37)	33 (80)
Erroneous Ties	30 (33)	0 (19)	46 (38)	50 (50)	2 (9)	8 (19)	45 (38)	56 (80)

Table 6.16. Group effects for adequacy of cohesive ties

Variable	***FROG***				***CAT***			
	K-W χ^2	*df*	*p*		*K-W* χ^2	*df*	*p*	
Complete ties	30.954	3	< .001	***	12.551	3	.004	**
Erroneous ties	40.052	3	.001	***	19.223	3	< .001	***

Post-hoc pairwise comparisons showed that there were no significant differences between the SLI and NLI groups for the FROG narratives. The AM group produced a significantly higher percentage of complete cohesive ties than the other three groups (p < .01). The SLI group also produced significantly more complete cohesive ties than the LM group (p < .01). The AM group produced significantly less erroneous ties than the other three groups (p <.001).

For the CAT narratives, the SLI group produced significantly less erroneous ties than the NLI and LM groups (p < .01). The AM group produced significantly more complete cohesive ties and significantly less erroneous ties than the LM and NLI groups (p < .01). All pairwise comparisons for cohesive adequacy are shown in Table H-7 in Appendix H.

Adequacy of Cohesive Strategies

Cohesive tie adequacy was further investigated for the two cohesive strategies that occurred most frequently: lexical and pronominal ties. Descriptive statistics for the adequacy of lexical and pronominal cohesive strategies for both the FROG and CAT narratives are presented in Table 6.17.

For the FROG narrative, the AM group used complete lexical ties and complete pronominal ties to similar extents, whereas the other groups used complete lexical ties more than they used complete pronominal ties. The median number of complete lexical ties per c-unit was highest for the SLI group, followed by the AM and NLI groups, with lowest use by the LM group. The median number of complete pronominal ties per c-unit was highest for the AM group and lowest for the LM group, with use for the SLI and NLI groups a little higher than the LM group. The median number of erroneous pronominal ties was highest for the LM group, followed by the SLI and NLI groups, with median use for the AM group at zero. Erroneous lexical ties were infrequent, with median use highest for the LM and NLI groups. Use of exophoric pronominal ties was also infrequent, with zero or near zero median use per c-unit for all groups, so this variable was excluded from the table and from further analysis.

Table 6.17. Adequacy of cohesive ties strategies, measured as median number per c-unit (interquartile range in brackets)

Variable	*Group and Narrative*							
	SLI		***NLI***		***AM***		***LM***	
	FROG	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*
Lexical Complete	.50 (.51)	0 .40	.38 (.30)	.05 .24	.41 (.29)	.13 .40	.16 (.28)	0 .20
Lexical Erroneous	0 (.08)	0 -	.03 (.08)	0 0	0 (.03)	0 0	.04 (.09)	0 -
Pronominal Complete	.11 (.17)	0 .47	.11 (.17)	0 .34	.38 (.41)	.45 .40	.07 (.05)	0 .11
Pronominal Erroneous	.16 (.21)	0 0	.10 (.40)	0 .15	0 (.07)	0 .10	.20 (.23)	0 .16

Note: Interquartile ranges are shown in parentheses.

For the CAT narrative, the AM group used more complete pronominal ties than complete lexical ties, while there was little difference for the other groups. The median number of complete lexical and pronominal ties was highest for the AM group. The median use for the other groups for both complete and incomplete lexical and pronominal ties was zero or close to zero. Median use of erroneous lexical, erroneous pronominal and exophoric pronominal strategies by the AM group was zero. Group effects are presented in Table 6.18.

Table 6.18. Group effects for adequacy of selected cohesive tie strategies

Variable	***FROG***				***CAT***			
	K-W χ^2	*df*	*p*		*K-W* χ^2	*df*	*p*	
Complete lexical	12.881	3	.004	**	7.369	3	.056	
Erroneous lexical	6.680	3	.083		4.359	3	.216	
Complete pronominal	36.755	3	.001	***	14.564	3	.002	**
Erroneous pronominal	17.646	3	.001	***	3.688	3	.297	

Post-hoc pairwise comparisons showed that there were no significant differences between the SLI and NLI groups for the adequacy of their main cohesive strategies. For the FROG narrative, the AM group used significantly more complete pronominal ties ($p < .001$) and significantly less erroneous pronominal ties than the other three groups ($p < .01$). The LM group used significantly less complete lexical ties than the AM and SLI groups ($p < .01$). The SLI group also used significantly more complete pronominal ties than the LM group ($p < .01$). For the CAT narrative, the AM group produced significantly more complete pronominal ties than the LM and SLI groups ($p < .01$). All pairwise comparisons for adequacy of cohesive tie strategies are shown in Table H-7 in Appendix H.

Summary

The results showed that the SLI group produced significantly more erroneous ties than the NLI group for the CAT narrative. However, the SLI and NLI groups did not differ significantly for the FROG narrative on the measures for cohesive strategies. The AM group produced significantly more cohesive narratives than the other three groups. The LM group produced significantly less cohesive narratives than the SLI groups.

SUMMARY OF GROUP COMPARISON RESULTS

1) The SLI and NLI groups performed similarly on the morphosyntactic and narrative variables except on one isolated variable for the CAT narrative:

- The SLI group produced significantly more erroneous ties than the NLI group.

2) Significant differences among the SLI, NLI and LM groups were rare. The SLI and NLI groups differed significantly from the LM group on a small selection of morphosynctactic measures:

- The NLI group had significantly poorer accuracy for FTC in the narratives than the LM group;
- The SLI group produced utterances that were more complex, with significantly more more complete single-clauses, and significantly less fragments than the LM group in the narratives;
- The SLI group produced significantly more utterance level errors in the conversations than the LM group.

3) The LM group produced FROG narratives that were structurally less complex and less cohesive than the SLI group (and sometimes less complex than the NLI group), demonstrated in:

- Significantly more narratives at lower structural levels;
- Significantly more narratives at lower organisational levels (and significantly more than the NLI group);
- Significantly lower information scores;
- Significantly less complete cohesive ties.

4) The AM group produced utterances that were more grammatically accurate and complex than the LM, SLI and NLI groups, demonstrated in:

- Significantly higher accuracy for the composite measures of FTC, NTVC and NPC in both conversations and narratives;
- Significantly less fragments in both conversations and narratives;
- Significantly more complete two-clause utterances/c-units in both conversations and narratives;
- Significantly higher subordination index in the narratives.

5) The AM group produced narratives that were structurally more advanced and complex than the LM, SLI and NLI groups, demonstrated in:

- Significantly more FROG and CAT narratives at higher structural and organisational levels;
- Significantly higher information scores for both the FROG and CAT narratives;
- Significantly more complete cohesive ties and less erroneous ties for the FROG narrative;
- Significantly less erroneous ties than the LM group for the CAT narrative.

CHAPTER 7: DISCUSSION: GROUP COMPARISONS

INTRODUCTION

The primary aim of this thesis is to determine whether NLI can be differentiated from SLI, and to examine which of the variables investigated contribute to a differential diagnosis of SLI or NLI. This chapter discusses the group comparisons reported in chapters five and six, in relation to the hypotheses and to the work of other researchers. Subsequent chapters discuss implications for theory and clinical practice.

The first hypothesis is that: *The morphosyntactic characteristics of children with NLI and those of children with SLI will not differ on like tasks, but the morphosyntactic characteristics of the two LI groups will differ significantly from age-matched (AM) and language-matched (LM) children with normally developing language (TDL).*

Findings from the morphosyntactic analysis of the conversation and narrative tasks supported the first proposition in the first hypothesis: the morphosyntactic characteristics of the children with SLI and children with NLI were similar, with no significant differences between them on the measures of interest. The second proposition within the first hypothesis was also supported: the children with SLI and NLI both differed significantly from age-matched (AM) children with normal language abilities on most measures. However, the third proposition was not upheld: that the children with SLI and NLI would differ significantly from language-matched (LM) children with normal language abilities. On the majority of measures, there were no significant differences between the two LI groups and the LM group.

The second hypothesis examined by the thesis is that: *Levels of narrative structure and adequacy of cohesion in oral narrative tasks will not differ between children with NLI and children with SLI, but the narrative features of the two LI groups will differ significantly from age-matched (AM) and younger language-matched (LM) children with normal language abilities.*

Findings from the analyses of narrative structure cohesion and information supported the first proposition in the second hypothesis. The SLI and NLI groups had similar patterns of narrative deficits. In relation to the second proposition within the second hypothesis, the children with SLI and NLI both differed significantly from the AM group on most narrative measures. The hypothesis that the children with SLI would differ significantly from the LM group was supported by significant differences for several measures. However, the hypothesis that the children with NLI would differ significantly from the LM group was, in the main, not supported. There were many similarities among the narrative features of the LI and LM groups.

PROCESS FOR EXAMINATION OF THE RESULTS

First, evidence for differences between the SLI and NLI groups was examined. Differences between the SLI and NLI groups would implicate the influence of non-verbal cognitive skills on language impairment and give support for a diagnostic difference. Similarities between the SLI and NLI groups would suggest that the effects of language impairment were universal across aetiologies rather than specific to a certain diagnostic group, and relatively independent of non-verbal cognitive skills.

Secondly, the variables that differentiated impairment effects (significant differences between the AM group and the SLI or NLI groups) were identified. Variables that did not differentiate impairment effects could be insensitive measures or could measure language areas that are resistant to the effects of language impairment. Variables that differentiated impairment effects between the AM and LI groups, but did not differentiate developmental effects between the AM and LM groups could be indicators of significant impairment or disorder.

Thirdly, variables that differentiated either, the SLI or NLI groups from the LM group were identified. Differences here would point to variables that may be useful in distinguishing delay or lag patterns from disordered patterns of development. The LI groups could perform better than the LM group on some variables, indicating the benefits of more experience, biological maturation or areas resistant to impairment effects. Conversely, the LI groups could perform more poorly than the LM group on some variables, pointing to areas that were particularly susceptible to the effects of impairment and typical of disordered development.

Finally, it was important to identify the variables that differentiated developmental effects (differences between the 5-year-old AM group and the younger 3-year-old LM group). Variables that did not differentiate between the AM and LM groups could be insensitive to developmental changes or could be subject to limited developmental change.

The consistency of significant group differences across variables also required consideration. Isolated differences could suggest specific areas of vulnerability to language impairment, or could indicate some anomalies in the data. A pattern of consistent differences across related variables would suggest strong or broad areas of vulnerability to language impairment and reinforce the internal validity of the measures. Within this framework, the results of this study were also compared with the results from other studies. Consistency with other studies would reinforce the validity of the results. Differences with other studies would require consideration of possible explanations, possibly related to differences in methodology or in the population sample studied.

A summary of the variables that successfully differentiated groups based on development (AM compared with LM), impairment (AM compared with SLI, AM compared with NLI), disorder/experience (LM compared with SLI; LM compared with NLI) or diagnostic group (SLI compared with NLI) are provided in Table 7.1 and Table 7.2.

Table 7.1. Significant morphosyntactic accuracy and complexity variables in conversations and narratives

Variable	*Differentiator of:*							
	Development		***Impairment***		***Disorder/ Experience***		***Diagnostic Category***	
	CON	*NAR*	*CON*	*NAR*	*CON*	*NAR*	*CON*	*NAR*
Accuracy								
FTC	✓	✓	✓	✓	x	LM>NLI	x	x
NTVC	✓	✓	✓	✓	x	x	x	x
NPC	✓	✓	✓	✓	x	x	x	x
Complexity								
Fragments	✓	✓	✓	✓	x	LM>SLI	x	x
Single clauses	✓	✓	AM>SLI	AM>NLI	x	SLI>LM	x	x
Two clauses	✓	✓	✓	✓	x	x	x	x
Utterance errors	x	x	✓	SLI>AM	SLI>LM	x	x	x
Subord index	-	x	-	AM>SLI	-	x	-	x

Note: ✓ = significant difference identified between groups; x = no significant difference identified between groups; differences between individual groups indicated.

Table 7.2. Significant narrative structure variables for the FROG and CAT narratives

Variable	*Differentiator of:*							
	Development		***Impairment***		***Disorder/ Experience***		***Diagnostic Category***	
	FROG	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*	*FROG*	*CAT*
Structural level	✓	✓	✓	✓	SLI>LM	x	x	x
Organisation level	✓	✓	✓	✓	✓	x	x	x
Key event score	✓	✓	✓	AM>NLI	NLI>LM	x	x	x
Information score	✓	✓	✓	✓	SLI>LM	x	x	x
Erroneous ties	✓	✓	✓	NLI>AM	x	LM>SLI	x	NLI>SLI
Lexical complete	✓	x	x	x	SLI>LM	x	x	x
Pronominal complete	✓	✓	✓	AM>SLI	SLI>LM	x	x	x
Pronominal erroneous	✓	x	✓	x	x	x	x	x

Note: ✓ = significant difference identified between groups; x = no significant difference identified between groups; differences between individual groups indicated.

DIFFERENTIATION OF SLI FROM NLI

The NLI group performed more poorly than the SLI group on some variables analysed, but the differences were not significant. This suggests that any differences were merely a matter of degree of severity, and certainly not sufficient to entertain the notion that LI in children with SLI may be qualitatively or categorically different to the type of LI that occurs in children with NLI. This finding supports the hypotheses that there would be no differences between children with SLI and NLI on morphosyntactic or narrative measures.

Morphosyntax

None of the language variables focusing on grammatical accuracy, utterance complexity or utterance level errors differentiated the SLI and NLI groups from each other. This is consistent with other researchers who have found common profiles of language characteristics or response to intervention for children with SLI and NLI (Bishop, 1994b; Cole et al., 1990; Fey et al., 1994; Stothard et al., 1998; Tomblin & Zhang, 1999).

The findings of this research did not support the findings of Rice et al. (2004), who found that children with NLI has significantly poorer finite tense accuracy than children with SLI.. However, Rice et al. did not match the SLI and NLI groups on any language measure, which may be the source of apparently conflicting findings. The differences they identified could be due to differing degrees of severity rather than to diagnostic group characteristics. This thesis showed that when SLI and NLI participants were matched for severity of language impairment (on MLU and the CELF-P), there were no significant differences in their grammatical profiles. Other studies, reported in the literature review, have found similar patterns of morphosyntactic deficit in LI of different aetiologies (including Down syndrome, Williams syndrome, autism, intellectual disability and brain injury). This suggests that when language ability is compromised, there are common areas of vulnerability regardless of the cause.

Narrative

The SLI and NLI groups were similar on all measures of narrative structure and information. Only one variable, from one narrative, indicated significant differences between the two LI groups: the NLI group produced significantly more erroneous cohesive ties than the SLI group in the CAT narrative. It is difficult to determine whether this is an important difference, or whether it represents an anomaly in the data, against the pervasive pattern of similarity. Considering the fact that the CAT narrative elicited fewer impairment and disorder/experience effects than the FROG narrative, it is more likely to be an anomaly. This needs to be confirmed by further research. If the difference in cohesive adequacy identified for the CAT narrative, is a valid one, then it suggests that the SLI group had a greater mastery of cohesion than the NLI group. It also suggests that the picture support provided by the FROG narrative was helpful to the NLI group, in comparison to the open-ended nature of the CAT narrative.

The lack of differences between the SLI and NLI groups suggests that oral narrative production is primarily a language-based process, not affected greatly by differences in non-verbal cognition. The fact that narrative structure and organisation did not differ between the two groups suggests that they are more influenced by linguistic ability, the ability to verbalise the structure, than by non-verbal cognitive skills. However, narrative structure was more advanced in the LI groups than the LM group, suggesting that there may be more than innate linguistic ability involved, in the form of experience and learning.

The findings indicate that when language breaks down it does so in very similar ways, across a range of narrative measures, regardless of whether or not non-verbal cognition is also an area of deficit. Linguistic ability and non-verbal cognition appear to operate somewhat independently of each other. Nonetheless, it should be noted that the NLI group often performed at a lower level than the SLI group, although the differences were not sufficient to be significant. This could mean that the measures used were not sensitive to valid differences, or that the participant groups were not large enough to detect the differences. However, variance in both groups was high, suggesting that heterogeneity and individual differences are a feature of both SLI and NLI. This also raises the possibility that sampling variations could lead to different results among small studies.

DIFFERENTIATION AND IDENTIFICATION OF LANGUAGE IMPAIRMENT

The SLI and NLI groups were distinguished from the AM group on most measures, showing that these measures were effective at identifying LI. This supports both hypotheses that the two LI groups would differ significantly from an AM group on morphosyntactic and narrative characteristics.

Morphosyntax

Grammatical accuracy successfully discriminated children with both SLI and NLI from the AM group. This finding is consistent with other researchers (Bedore & Leonard, 1998; Eadie et al., 2002; Rice & Wexler, 1996b; Rice et al., 1995; Rice, Wexler et al., 1998).

The three composite measures of FTC, NTVC and NPC were consistent in identifying LI across the SLI and NLI groups in both the conversation and narrative contexts. It is interesting to note that it was not only the finite tense morphemes, identified by researchers (Bedore & Leonard, 1998; Rice et al., 2004; Rice, Wexler et al., 1998), but the use of other grammatical morphemes as well that were able to differentiate the LI groups from the AM group. This is consistent with the findings of Bedore and Leonard (1998), who also found a significant difference between an SLI and AM group for NPC, as well as FTC. This finding argues that grammatical impairments in LI are far reaching across a range of grammatical morphemes, and not only restricted to finite verb tenses, as the arguments of Rice and colleagues often seem to suggest (Rice, 2000; Rice et al., 2004; Rice et al., 2005). While the difference in actual percentage correct was greatest for FTC, statistical differences for all three composites were significant.

The lowest accuracy levels for, FTC were consistent with other research findings that difficulties with the finite tense verb morphology is a distinctive feature of SLI. Accuracy levels in this research were mostly of similar magnitude to the accuracy levels reported for children with SLI by Rice and colleagues (Rice & Wexler, 1996b; Rice et al., 1995; Rice, Wexler et al., 1998) and by Eadie et al. (2002).

The ability of inflection morpheme accuracy measures (FTIC and NPIC) to differentiate LI across a range of contexts was limited, due to low numbers of OCs. This suggests that the composite measures FTC, NTVC and NPC are more useful for diagnostic purposes as they provide a larger data set for analysis. The FTC measure better accounts for normal variations in the participant's choice of tense and aspect (e.g., ED, 3S, AUX plus ING). The number of OCs for specific grammatical morphemes may also vary according to the nature of the genre (e.g., more past tense in narratives and less in play-based conversation; less present tense in narratives and more in play-based conversations) and the style of the speaker (e.g., simple past tense with regular or irregular marking versus past auxiliary with continuous aspect).

Some measures of utterance/c-unit complexity were more effective at identifying LI than others. The findings were consistent with other researchers who found that children with LI produce less complex utterances than children with TDL (Greenhalgh & Strong, 2001; Manhardt & Rescorla, 2002; Marinellie, 2004, 2006; Reilly, Losh et al., 2004). Proportions of fragments and two-clause utterances/c-units were effective measures for differentiating LI in both the conversations and narratives. The proportion of single-clause utterances differed in its ability to differentiate both SLI and NLI from the AM group.

Utterance level errors in conversations were effective at identifying LI in both the SLI and NLI groups. Utterance level errors in narratives differentiated the SLI group from the AM group but did not differentiate the NLI group from the AM group. This suggests that utterance level errors, which represented confused syntax and/or semantics, may be a stronger feature of SLI than NLI. The subordination index for the narratives also differentiated the SLI group from the AM group but did not differentiate the NLI group from the AM group. Reasons for inconsistency across the SLI and NLI groups for the subordination index are not clear.

Narrative

Most broad measures of narrative structure and information were effective identifiers of LI across both narratives. These measures were structural level, organisational level, and information scores. Both the SLI and NLI groups produced narratives that were, in comparison to the AM group, less goal directed, less complex and less elaborated. These findings are consistent with others who have found that children with SLI produce less mature and more poorly constructed oral narratives than age-matched controls (Copmann & Griffith, 1994; Liles, 1987; Manhardt & Rescorla, 2002; Merritt & Liles, 1987).

The key event score was also inconsistent at identifying LI across both the SLI and NLI. The findings suggest that differences in performance on the CAT narrative were more subject to individual differences, and less subject to the effects of language ability or impairment than was the case for the FROG narrative. The key event score (adapted from Boudreau & Hedberg, 1999) was effective at identifying LI in the FROG narratives. These results differ somewhat from those of Boudreau and Hedberg who found no significant differences between children with SLI and TDL in the key event scores but significant differences for the total event score for the FROG narrative. The SLI group attained lower key event scores for this research than a similarly aged SLI group in Boudreau and Hedberg's research, while the AM group attained similar scores. The different results may be attributable to the fact that Boudreau and Hedberg used a retell task whereas this research used a generation task. The comparative findings suggests that a narrative generation task is more challenging than a retell task and more effective at eliciting differences between children with LI and an AM group. Narrative generation is believed to be more demanding of processing capacity, which has been implicated as a causal factor for LI (Eaton et al., 1999; Hudson & Shapiro, 1991; Johnson, 1995; Naremore, 1997; Ripich & Griffith, 1988; Shapiro & Hudson, 1991).

The information score from both the FROG and CAT narratives were also effective at identifying language impairment. Both the SLI and NLI groups produced significantly less information than the AM group. This result is consistent with the findings of other research (Boudreau & Hedberg, 1999).

The cohesive measure was inconsistent in its ability to identify impairment in both the SLI and NLI groups across both narratives. Cohesive adequacy, measured by the percentage of erroneous ties, was successful in identifying impairment in both the SLI and NLI groups for the FROG narratives. The results for the FROG narrative are consistent with the findings of other researchers who have identified that children with SLI produce less adequate cohesive ties than their age-matched peers (Liles, 1985; Olley, 1989; Paul et al., 1996; Paul & Smith, 1993; Strong & Shaver, 1991). For the CAT narratives, the NLI group was distinguished from the AM group based on cohesive adequacy, but not the SLI group. The lack of consistent findings for the CAT narrative may be explained by the shortness of the narratives, which provided fewer cohesive ties.

For the FROG narrative, analysis of cohesive strategies indicated impairment, in both the SLI and NLI groups. The SLI and NLI groups produced proportionally more erroneous pronominal ties. For the CAT narrative, the am group produced more complete pronominal ties than the SLI group. A higher production of erronewous or ambiguous pronominal ties was also identified as a feature of LI by Norbury and Bishop (Norbury & Bishop, 2003).

Summary

Impairment effects were evident for variables measuring grammatical accuracy and complexity, and narrative structure, information and cohesion. The cohesion measure was an effective discriminator for the FROG narrative, but not for the CAT narrative, advising against the use of the CAT narrative for diagnostic purposes.

DIFFERENTIATION OF DELAY OR DISORDER

There was little evidence from this thesis to suggest disorder patterns, as might be reflected in one or both of the LI groups performing more poorly than the younger LM group. It is possible though, that individual profile differences may be lost in the group statistics. The LI groups performed similarly to the LM group on most variables, suggesting that these variables were dominated by impairment effects, and subject to a delayed pattern of development.

The LM group performed at a significantly higher level than the SLI or NLI group on two measures of morphosyntax, but these differences were not consistent for LI group or across tasks. In particular, the SLI group performed better than the LM group on several narrative measures. This suggests an advantage from more years of experience and exposure to oral narratives and partially supports the hypothesis that both the SLI and NLI groups would differ significantly from the LM group.

Morphosyntax

The morpheme accuracy measures did not differentiate both LI groups from the LM group. However, the FTC measure from the narratives differentiated the NLI group from the LM group, with the NLI group achieving lower levels of accuracy than the LM group. This suggests that the NLI group had greater difficulties with finite tense than expected with a delay pattern, while the SLI group did not. The finding of many similarities among the SLI, NLI and LM groups suggest that the grammatical impairments are abilities at the low end of the continuum.

This finding differs from other researchers that have identified significant differences between SLI and LM groups for both tense and non-tense morphemes (Eadie, 1999; Eadie et al., 2002; Rice, 1997; Rice & Wexler, 1996b; Rice et al., 1995). The reasons for the different results are not entirely clear, but may be due to sampling variation. The heterogeneous nature of LI, together with small sample sizes, may mean that this research had a different ‘draw’ of LI profiles. Different tests used to determine language ability and non-verbal ability across research studies also contribute to variability in sample selection (Aram et al., 1993; Cole et al., 1995; Conti-Ramsden et al., 1997; Howlin & Cross, 1994; Merrell & Plante, 1997). MLU was the primary matching variable used by other researchers for studies of morphosyntactic accuracy, and used to match the LI groups with the LM group in this study. Matching of raw scores of age equivalents on a comprehensive assessment of language ability may be required to achieve a more rigorous matching between LI and LM groups.

The lack of significant differences between the LI and LM groups is, however, compatible with the findings of Beverly and Williams (2004). Beverly and Williams found that young children with SLI with MLUs below 3.00 had higher accuracy for BE than younger children with TDL matched for MLU. Their explanation was that processing limitations acted as constraints that facilitated early morphological mappings, termed the ‘less is more’ account. These constraints were effective at facilitating learning because the child’s attention is focussed on smaller elements of the input. The children in this research had severe LI, some with MLUs below 3.00 (down to 2.37), and therefore possibly subject to this effect.

A noteworthy longitudinal study (Rice, Wexler et al., 1998) also showed that difference or similarity between SLI and LM groups varied over time, suggesting that this distinction may lack stability. Differences between the SLI and LM groups were not significant for younger children with SLI, but were significant from six years of age.

The influence of learning experiences is an alternative explanation for young children with SLI and LM controls. In comparing 4-year-old children with SLI to 2-year-old children with TDL, Beverly and Williams (2004) were effectively comparing one group to another with half their years of life experience. The LM group was very young and both groups were at a very early period of language development, still using many single and two-word utterances. Young children with SLI have had a much greater exposure to language input, including tense morphemes, over time than younger children matched for MLU. This longer time period may be an advantage to children with SLI when compared with a much younger control group. Younger, MLU-matched children have had a shorter period of exposure to language and may focus on different features of language performance such as lexical and syntactic development, and less on morphology. A comparable measure of vocabulary across the two groups could have contributed to this explanation, but was not included in this research. The limitations of MLU as a sole matching variable have been raised before (Plante et al., 1993).

The measures of utterance complexity did not consistently differentiate both LI groups from the LM group in the conversations and narratives. However, in the narratives, the SLI group produced significantly more complex c-units (more single clauses, and less fragments) than the LM group, while the NLI group was similar to the LM group. This has some consistency with Fey et al. (2004) who found that children with SLI produced significantly more complex c-units than children with NLI. In the conversations, the SLI group also produced significantly more utterance errors (semantic and syntactic) than the LM group.

This higher incidence of utterance errors in the SLI group is interesting. It suggests that children with SLI, in producing more complex utterances than expected for their MLU, also produce more semantic and syntactic errors. This is also suggestive of trade-off relationships and suggestive for some level of disorder in the syntactic abilities of children with SLI.

Narrative

Comparisons between the LI groups and the younger LM group showed some evidence that narrative structure was not as vulnerable to LI, as suggested by MLU. The LI groups showed the benefits of developmental maturation and more experience with narratives, by producing more complex and more goal directed narratives than LM group. The LM group did not achieve higher results than the LI groups on any narrative structure measures. The fact that more narrative measures were subjected to the *experience effect* for the SLI group than the NLI group suggests that the NLI group were less able to benefit from experience with narratives, or that their non-verbal cognitive deficits had an impact on their narrative development.

Disorder effects were not evident for any narrative measures. However, experience and maturity effects were evident for some narrative measures. Both the SLI and NLI groups produced FROG narratives that were significantly more complex than the LM group, measured by organisation. In addition, the SLI group showed greater evidence of more complex FROG narratives as significant differences were also evident for structural level and information score. These results are similar to the finding that children with Down syndrome produce structurally more complex narratives than LM groups (Boudreau & Chapman, 2000; Miles & Chapman, 2002). Comparisons of children with SLI or NLI to LM groups were not evident in the literature for narrative structure and information.

The cohesion measures were not consistent at differentiating between the LI groups and the younger LM group across both narratives. Most measures did not differentiate any disorder or maturity effects. Despite having similar grammatical skills and similar lexical diversity, the SLI group produced narratives that were more cohesive than the younger LM group.

Specific measures that differentiated the SLI and lim groups in the FROG narratives were the percentage of complete lexical and pronominal ties. Cohesive adequacy also differentiated the SLI and LM groups in the CAT narratives for the percentage of erroneous ties. This suggests that children with SLI have less difficulty keeping track of characters and applying appropriate cohesive strategies than the LM group, whereas the NLI group perform similarly to the LM group.

Less experience and experience with narratives at home or preschool may have contributed to the LM group performing more poorly than the LI group on measures of narrative structure and cohesion. It is possible that the LM group could have performed better than the LI group on a discourse task that was easier for them, such as a personal event narrative or recount, as fictional narratives have been identified as a more challenging task for 3-year-olds (Allen, Kertoy, Sherblom, & Pettit, 1994; Berman & Slobin, 1994; McCabe & Rollins, 1994). More importantly, the findings show that narrative structure and cohesion are less vulnerable to the effects of SLI than morphosyntactic skills. This was not evident for the NLI group. The better NVCA of the children with SLI seems to have assisted them in structuring their narratives.

While comparisons of children with LI and younger LM groups are common for studies of morphosyntax, few researchers have compared the narrative abilities of children with LI to the narrative abilities of a LM group. The findings of this research has congruency with research that has identified that people with Down syndrome produce more complex narratives than children matched for MLU (Boudreau & Chapman, 2000; Miles & Chapman, 2002). Similarities have been identified for cohesive skills, in comparison to younger language-matched children, for children with SLI (van der Lely, 1997) and children with Down syndrome (Boudreau & Chapman, 2000), findings which are not fully consistent with this research.

Implications

Some differences between the SLI and NLI groups are suggested by the comparisons between the LM group and each LI group. The differing results for the LM-SLI and LM-NLI comparisons suggest that, in comparison to NLI, children with SLI may achieve higher accuracy for finite tense, produce more complex syntax, produce more syntactic errors, and produce narratives that have more complex structure and better cohesion. There is some consistency here with researchers who have identified that children with SLI produce more complex utterances than children with NLI (Fey et al., 2004), and that children with SLI attempt more complex utterances and produce more errors than children with an intellectual disability (Kamhi & Johnston, 1982). Research comparing the narrative skills of children with SLI or NLI with LM groups was not evident in the literature.

Summary

Disorder effects were not evident for most variables measuring grammatical accuracy and complexity. However, experience and maturation effects were evident for the SLI group for some variables measuring narrative structure, information and cohesion in the FROG narratives. These effects were less evident for the CAT narrative, which is consistent with the findings for fewer impairment effects for this narrative.

DIFFERENTIATION OF DEVELOPMENTAL DIFFERENCES

Many of the variables studied were effective at differentiating developmental differences. The most consistent group differences, across the range of measures examined, were for comparisons of the AM group with the LM group.

Morphosyntax

As for the impairment differences, the composite accuracy measures (FTC, NTVC, and NPC) were effective in discriminating developmental differences, in both the conversations and narratives. The AM group, as expected, were more accurate in their use of grammatical morphemes. Both finite and non-finite verb phrase morphemes discriminated between these groups in both contexts The accuracy levels determined in this study for individual morphemes for the FTC composite for the AM and LM groups, were similar in magnitude to those reported by other studies of similarly aged children in Chapter 2.

Few of the researchers that examined an AM and LM group actually compared these two groups as they focussed primarily on making comparisons between the AM and SLI, and between the LM and SLI groups. Rice and Wexler (Rice et al., 1995) found that BE, 3S and ED were developmentally discriminating, while Leonard et al. (Leonard et al., 1997) found that COP, 3S, IP and ART were developmentally discriminating. The findings of this thesis were congruent with these findings. Full comparisons with other researchers were not possible, because examination of developmental effects for the composites was not evident in the literature. The evidence suggests that for language samples, whether conversations or narratives, broader composite accuracy measures provide more consistent information than accuracy measures for individual morphemes and narrower composites. This is most likely because the composite measures are based on a larger data set of obligatory contests and less vulnerable to bias resulting from an insufficient sample base.

Several utterance complexity variables differentiated developmental differences in the conversations and narratives: namely, the proportion of single clause utterances, two-clause utterances and fragments. In some methods of language analysis, fragments are excluded from analysis (e.g, Lee, 1974; Loban, 1976), but the evidence of this thesis shows that fragments were a strong feature of younger children’s language (a third of all utterances in 3-year-olds) and a significant differentiator of developmental change.

A direct comparison of specific complexity measures with other researchers is difficult because of the variety of methods used. However, the finding of more complex clausal structure in the AM group, compared to the LM group is consistent with the understanding that syntactic complexity develops with increasing age (Scott, 1988a). Since the AM and LM groups were clearly differentiated on MLU for the conversations, the effectiveness of mean length per c-unit (MLCU) for the narratives in differentiating developmental differences was expected.

The lack of developmental differences for the subordination index has consistency with researchers who found a significant age effect for the subordination index in children age 3 to 7 years, but not between small age differences (James, Watchman, Decelis, Gliddon, Kittel, Rayner et al., 2001). This measure excludes fragments, which were a strong feature of early language development. The findings suggest that this measure is not well suited to identifying differences in the younger years.

In contrast to the findings for impairment differences, utterance level errors were an insignificant feature in the language samples of the AM and LM groups. The percentages of utterance level errors (i.e., semantic, word order or undetermined errors) were extremely low and did not differentiate between the AM and LM groups.

Narrative

Clear and consistent developmental effects were evident for narrative organisation and structure for both the FROG and CAT narratives. The AM group produced narratives that were more frequently goal-directed and structurally more complex and elaborated than the LM group. These results showed that the narrative stimuli and measures used were sensitive to changes in narrative skill development. These results are consistent with the body of research that has documented the progression of narrative structure with age in young children (Berman & Slobin, 1994; James, 1999; James, 2001; Peterson & McCabe, 1994; Shapiro & Hudson, 1991). The wide range of narrative levels is consistent with researchers who have found wide variation in narrative levels for 5-year-olds (Berman & Slobin, 1994; Johnson, 1995; McCabe & Rollins, 1994). Higher information scores for the AM group, in comparison to the LM group are also consistent with expected development in narrative vocabulary and content (Renfrew, 1991).

The median structural level for the CAT narratives produced by the AM group (*abbreviated episode*) was the same as for the 5 year olds in James' study

(2001). However, the range of narrative levels produced by the AM group was broader (from *descriptive sequence* to *multiple episode*) than for James' study (*descriptive sequence* to *complex episode*). The LM group (2;7 to 3;6 year olds) produced narratives at lower levels than the 3-year-olds in James' study (3;0 to 3;11) with a median narrative level of *isolated description* (compared to *action sequence*), and narrower range of levels from *refusal* to *fragmented* (compared to ranging from *isolated descriptions* to *complex episode*). A similar comparison of narrative structural levels for the FROG narrative was not possible as other researchers used varied methods of analysis. However, other researchers have demonstrated developmental differences using the FROG narrative (Berman & Slobin, 1994).

Two young children from the LM group refused to tell a CAT narrative, while there were no refusals for the FROG narrative or from older children in the other groups (AM, SLI and NLI) for the CAT narrative. The proportion of CAT narrative refusals for the LM group was similar to the proportion noted by James (2001). The younger children also sometimes protested about the task (e.g., "not look any more") or sought escape (e.g., a toilet trip) and often needed coaxing to persist with the narrative (e.g., "Terrific, tell me more."). The relatively high proportion of ending statements (e.g., "the end", "finished") by the LM group for the FROG narrative may indicate a sense of relief that this long task was finished.

Many of the LM group expressed a preference for dialogue with the examiner about the narrative, rather than produce a monologue. They asked questions about the narrative (e.g., "what's that?") or demanded that the examiner tell the narrative (e.g., "you tell me"). This is consistent with Peterson who found that reliance on prompts decreases with age (Peterson, 1993). The reliance on prompts and higher rate of refusals in the younger children indicates that oral narrative tasks are challenging for young children. It has been argued that conversationally prompted personal event narratives (recount/account) are a more appropriate and successful genre for preschoolers than fictional narratives, as they deal with more familiar events and experiences (Allen et al., 1994; McCabe & Rollins, 1994).

The adequacy of cohesive ties showed developmental effects for both the FROG and CAT narratives, with the older AM group producing significantly less erroneous ties than the younger LM group. The findings of this thesis were consistent with other researchers who found a higher incidence of cohesive errors and ambiguity in younger children and an increase in the ability to use pronominal reference with age (Karmiloff-Smith, 1986; Peterson & Dodsworth, 1991; Shapiro &

Hudson, 1991; Wigglesworth, 1990). The AM group effectively demonstrated greater mastery of the pronominal cohesive system than the LM group in their higher use of complete pronominal ties, and lower use of erroneous pronominal ties. High use of pronouns was expected in the shared book/picture context, which Armstrong described as “common when interlocutors share the same physical space and can see what is being referred to” (2005, p. 140). The older AM group were able to use pronouns cohesively, without presenting ambiguity, while for the younger LM group the referents for the pronouns often were not clear.

The less consistent developmental effects for the CAT narrative are most likely explained by the short length of the CAT narratives. A greater number of utterances provide more opportunities for cohesive ties and a larger data set from which to analyse accuracy. A small data set is more likely to produce anomalies or inaccurate results. This factor may have affected the ability to detect cohesive differences in the CAT narratives. The higher density of cohesive ties in the AM group, compared to the LM group is consistent with developmental changes reported by others (Peterson, 1993; Peterson & Dodsworth, 1991).

The higher use of complete lexical ties for the FROG narrative most likely reflected the larger number of characters depicted in this narrative than in the CAT narrative. Lexical, rather than pronominal cohesion is required in the FROG narrative when switching reference from one character to another, in order to avoid ambiguity. Again, this suggests that the way in which highly specific variables or devices are used in narrative will vary for different stimuli. A broader measure, such as the overall cohesive adequacy, was more applicable to both narratives than individual cohesive strategies.

Summary

Developmental effects were evident for a range of variables measuring grammatical accuracy and complexity, and narrative structure, information and cohesion. As for the impairment differences, more narrative structure, information and cohesion variables were effective discriminators for the FROG narrative, than for the CAT narrative. This suggests that the latter narrative stimulus is less useful for diagnostic purposes. The broader narrative measures were more consistently discriminating than narrower measures such as cohesive strategy. The identification of developmental effects for a range of variables validates their ability to measure differences in linguistic characteristics in young children.

OBLIGATORY CONTEXTS FOR GRAMMATICAL MORPHEMES

The provision of obligatory contexts (OCs) has importance in the provision of sufficient data from which to analyse grammatical proficiency. The grammatical analysis for this research was somewhat compromised by the poor availability of OCs for some grammatical morphemes, in the narratives. The low numbers of OCs, however, were consistent with the reports of other researchers (Eadie et al., 2002; Ingram & Morehead, 2002; Rice et al., 1995). Low OCs in narratives suggests that small narrative samples are not well suited to the specific study of small sets of grammatical morphemes.

The composite measures of finite tense morphemes (FTC), non-tense verb morphemes (NTVC) and noun phrase morphemes (NPC) were much more viable across both the conversations and narratives, because they drew together the wider range of options for grammatical encoding, creating a sufficient pool of OCs. This is particularly important for tense marking where one or more tenses may not be attempted because of a preference for another tense.

SUMMARY

The results of this research are summarised against the hypotheses and research questions that shaped this thesis, in Table 7.3 for the first hypothesis and Table 7.4 for the second hypothesis. This research demonstrated that children with SLI and NLI could not be differentiated diagnostically based on the language characteristics explored, because the pattern and extent of their morphosyntactic and narrative deficits was similar. Although the NLI group obtained slightly poorer results than the SLI group for many measures of morphosyntactic accuracy and complexity and for oral narrative structure and cohesion, none of these differences were significant.

However, control group comparisons did reveal some differences of interest. Many variables that were effective at identifying LI were consistent with other researchers, and were also effective at identifying developmental differences. Against this pattern, utterance level errors were a particular feature of LI, but not a feature of normal development.

Differences between children with SLI and younger LM controls for morpheme accuracy were identified inconsistently by other researchers (Eadie, 1999; Leonard et al., 1997; Rice & Wexler, 1996b). In this research, the SLI and NLI groups could not be differentiated from the LM group based on general language sample or morphosyntactic measures. Comparisons between SLI and LM groups for oral narrative structure and cohesion were rare in the literature, yet were a source of significant differences in this research. The SLI group produced oral narratives (in response to a wordless picture book) that were more structurally complex and cohesive than the LM group. These differences were not replicated between the NLI and LM groups.

The composite morpheme accuracy measures, and measures of complexity using proportions of fragments and complex utterances were consistent in their sensitivity to developmental and impairment effects. More consistent group differences for the narrative features were obtained from the problem based wordless picture book ("Frog where are you?" by Mayer [FROG]) than the problem-based single scene picture showing a cat stuck in a tree [CAT].

Table 7.3. Summary of results for the first hypothesis and associated questions

Hypothesis 1	*Answer*
The morphosyntactic characteristics of children with NLI and those of children with SLI will not differ on like tasks.	TRUE
However, the morphosyntactic characteristics of the two LI groups will differ significantly from: age-matched (AM) and language-matched (LM) children with normal language abilities.	 TRUE FALSE
Questions:	
1. Are there differences in the use of finite verbs: specifically, accuracy of copulas, auxiliaries, regular past tense and third person singular?	NO
2. Are there differences in the use of non-tense verb morphemes: specifically, accuracy of the progressive verb aspect *ing* and modals?	NO
3. Are there differences in the use of bound and free morphemes in noun and adverbial phrases: specifically, accuracy of plurals, genitives, articles, and pronouns?	NO
4. Are there differences in clausal complexity: specifically, proportions of fragments, complete and complex clauses and the subordination index?	NO
5. Are there differences in the proportion of utterance level errors of a syntactic or semantic nature?	NO
6. Are some morphosyntactic language variables more discriminating than others for achieving a differential diagnosis of LI?	YES

Table 7.4. Summary of results for the second hypothesis and associated questions

Hypothesis 2	*Answer*
Levels of narrative structure and adequacy of cohesion in oral narrative tasks will not differ between children with NLI and children with SLI.	TRUE
However, the narrative features of the two LI groups will differ significantly from: age-matched (AM) and younger language-matched (LM) children with normal language abilities.	 TRUE TRUE
Questions	
7. Are there differences in the structural complexity of their oral narratives: specifically, narrative structure, and type and frequency of narrative components?	NO
8. Are there differences in the information content of their oral narratives: measured by number of information items against a checklist?	NO
9. Are there differences in their ability to maintain the identities of narrative characters: measured by adequacy of cohesive ties?	MINOR
10. Are some narrative language variables more discriminating than others for achieving a differential diagnosis of LI?	YES

CHAPTER 8: RESULTS AND DISCUSSION: EFFECTIVENESS OF VARIABLES IN CLASSIFYING LANGUAGE IMPAIRMENT

This chapter presents an exploration of variables in order to determine those that were most effective at identifying language impairment (LI) in the SLI, NLI and high SLI (HSLI – higher CELF-P scores than the matched SLI and NLI) groups. Since there was no evidence of significant differences between the SLI and NLI groups, the diagnostic question of interest is now the identification of a LI in the SLI and NLI groups.

A discriminant function analysis was conducted for a number of models to determine which was most effective. One model achieved excellent classification, with 100% specificity and sensitivity for a combination of selected morphosyntactic variables from the conversations and narrative structure, information and cohesion from the combined FROG and CAT narratives. The process for progressively examining the effectiveness of the variables will be described, before finally presenting the most effective model.

SELECTION OF VARIABLES

The initial variables for analysis were selected from the range of language domains explored that were also effective at eliciting significant differences between the AM and LI groups. Two composite measures of morphosyntactic accuracy were selected for analysis, the finite tense composite (FTC), and non-tense verb composite (NTVC). Measures of morphosyntactic complexity selected for analysis were MLU and percentage of fragments (FRAG). Three narrative structure measures were analysed for each narrative: narrative organisation (ORG) erroneous (ERRCOH) cohesive ties and information score percentage (INFO). These variables were each analysed separately to examine the effectiveness of individual variables in identifying LI. A key to all variable abbreviations used for the discriminant function analysis is included in the Glossary at the beginning of this thesis.

INDIVIDUAL VARIABLES

The discriminant function analysis results for individual morphosyntactic variables are shown for the conversation samples in Table I-1 and for the narrative samples in Table I-2 in Appendix I. None of the single measures for morphosyntax were effective identifiers of LI, as sensitivity were below 80% for the measures. All four morphosyntactic accuracy and complexity variables had higher specificity for TDL than sensitivity to LI.

The only single narrative sample variable that was an effective classifier for both narratives was INFO, with fair specificity for TDL (85.7%) and good sensitivity for LI (91.2%). The FROG narrative ORG variable was also an effective identifier of LI with fair to good specificity and sensitivity. The single morphosyntax variables from the combined narratives of FTC, NTVC and FRAG were not effective classifiers: although they had fair to excellent specificity, they had poor sensitivity to LI.

COMBINATIONS OF VARIABLES

Combinations of Morphosyntactic Variables

The most effective discriminant function analysis results for paired combinations of morphosyntactic variables are shown in Table I-3 in Appendix I. All combinations achieved fair to excellent specificity, but the only combinations to also achieve at least fair sensitivity to LI were MLU and FRAG from the conversations (specificity of 90.5% and sensitivity of 82.4%), and FTC and MLU from the narratives (specificity of 90.5% and sensitivity of 82.4%). This latter combination was determined an effective identifier of LI by Bedore and Leonard (1998), but it fell short of the effectiveness criteria for the conversation sample (specificity of 95.2%, sensitivity of 79.4%).

Combinations of Narrative Variables

The discriminant function analysis results for combinations of narrative structure and cohesion variables for the each of the FROG and CAT stories are shown in Table I-4 in Appendix I. Specificity and sensitivity were lower for the individual narratives, than for the narratives combined. The FROG narratives also had higher specificity than the CAT narratives for all combinations. The most effective classifiers for each individual narrative were the combination of the three variables of ORG, INFO and ERRCOH (specificity of 90.5% and sensitivity of 94% for the FROG narrative; specificity of 80% and sensitivity of 93.3% for the CAT narrative) and the combination of INFO and ERRCOH (specificity of 95.2% and sensitivity of 91.2% for the FROG narrative; specificity of 85% and sensitivity of 90% for the CAT narrative). A combination of the three narrative measures from both the FROG and CAT stories had the greatest effectiveness for classification, namely ORG, INFO and ERRCOH, with specificity of 95% and sensitivity of 96.7%.

Combinations of Morphosyntactic and Narrative Variables

The discriminant function analysis results for combinations of variables from the conversation and FROG narrative samples are shown in Table I-5 in Appendix I. Results for combinations of variables from the conversation and CAT narrative samples are shown in Table I-6 in Appendix I. All combinations were effective classifiers of LI and TDL.

For the FROG narrative, the most effective combination was MLU and FRAG from the conversations, plus ORG, INFO and ERRCOH from the FROG narratives (specificity of 95.2% for TDL and sensitivity of 94.1% for LI). For the CAT narrative, there were two highly effective combinations: firstly FTC, NTVC, MLU and FRAG from the conversations, plus ORG, INFO and ERRCOH from the CAT narrative (specificity of 95% and sensitivity of 96.7%); and secondly FTC, and NTVC from the conversations, plus ORG, INFO and ERRCOH from the CAT narrative (excellent specificity of 100% and good sensitivity of 93.3%).

The discriminant function analysis results for combinations of morphosyntactic and narrative variables from the combined FROG and CAT narratives are shown in Table I-7 in Appendix I. The most effective combination was FTC plus ORG, INFO and ERRCOH from the combined narratives (specificity of 100% and sensitivity of 96.7%). Most combinations were effective at classifying LI and TDL.

Finally, a combination of morphosyntactic variables from the conversation samples was combined with narrative variables from both the FROG and CAT stories. Results from this discriminant function analysis are shown in Table I-8 in Appendix I. The most effective and parsimonious combination for classification, was achieved for conversation FTC and MLU plus ORG, INFO and ERRCOH, with 100% specificity and sensitivity. This was the most effective classification combination trialled, and the highest level of correct classification achievable.

In summary, the most effective classifiers of LI and TDL with sensitivity and specificity of at least 95% that were identified by the discriminant function analysis, from all combinations of variables, are shown in Table 8.1.

DIAGNOSTIC EFFECTIVENESS

The Benefits of Single or Multiple Variables

Consideration of the relative effectiveness of one variable versus multiple variables in identifying LI brings to mind the old adage, “leave no stone unturned”.

The discriminant function analysis showed that a combination of several variables and contexts was better than single variables or a single context at identifying LI. This confirms the view that a comprehensive assessment that explores abilities across a range of language characteristics and contexts (i.e., turning over every stone) is more effective at diagnosing LI than assessment focusing on a single aspect of language (Fey et al., 2004; Paul, 2001).

Assessment using a single variable, such as FTC or MLU, creates too high a risk of misdiagnosis. FTC alone was not an effective identifier of LI. Although specificity was good (95.2%), sensitivity was unacceptably poor (67.6%), so attempts to diagnose LI on the basis of FTC alone would have misdiagnosed 32.4% of the children with LI as having TDL. Attempts to diagnose LI on the basis of the best single narrative variable (FROG ORG) would have misdiagnosed 21.3% of the participants (9.5% of children with TDL as LI, and 11.8% of children with LI as TDL).

Table 8.1. Most effective classifiers of LI and TDL

Variable(s)	*LI*	*TDL*	
Narratives ORG, INFO & ERRCOH	96.7% (29/30)	95.0% (19/20)	**
Conversation FTC, NTVC, MLU & FRAG; CAT ORG, INFO & ERRCOH	96.7% (29/30)	95.0% (19/20)	**
Narratives FTC, ORG, INFO, & ERRCOH	96.7% (29/30)	100% (20/20)	**
Conversation FTC, NTVC, MLU & FRAG; Narratives ORG, INFO, & ERRCOH	100% (30/30)	95.0% (19/20)	**
Conversation FTC, NTVC & MLU; Narratives ORG, INFO, & ERRCOH	100% (30/30)	100% (20/20)	***
Conversation FTC; Narratives ORG, INFO, & ERRCOH	100% (30/30)	95.0% (19/20)	**
Conversation FTC & MLU; Narratives ORG, INFO, & ERRCOH	100% (30/30)	100% (20/20)	***

Note: * effective classification with at least fair specificity and sensitivity; ** very effective classification with good specificity and sensitivity; *** extremely effective classification with excellent specificity and sensitivity.

These results indicate that children with TDL rarely have difficulties with morphosyntactic accuracy. However, the low sensitivity for these measures indicates that not all children with LI have difficulties with morphosyntactic accuracy. This does not support the bimodal distribution model of SLI proposed by Rice (2000), or support the view that difficulties with finite tense are a clinical marker of SLI. Children with LI may have difficulties with morphosyntactic complexity, vocabulary, narrative structure or cohesion, which will be identified through other measures. The findings reinforce that a good clinical assessment is a comprehensive one. While the parsimony associated with diagnosis based on only a single or small number of variables holds its attractions, it was shown to provide elevated risks of misdiagnosis.

The results of this research were less supportive of the classification effectiveness of a small number of morphosyntactic variables than the research of Bedore and Leonard (1998), which recommended use of FTC combined with MLU. In comparison to the findings of Bedore and Leonard, the FTC measure for this research had slightly lower specificity for children with TDL (both good) and much lower sensitivity for LI (poor versus fair). The MLU measure, and FTC combined with MLU, had similar levels of specificity for TDL (good) but much lower sensitivity for LI (poor versus good).

The results also indicate that children with TDL may experience difficulties with some aspects of narrative production. It might be that these children will have difficulties with some aspects of discourse production in the classroom, despite acceptable competency with other language skills. This finding is consistent with wide variation in narrative levels for 5-year-olds (Berman & Slobin, 1994; Johnson, 1995; McCabe & Rollins, 1994). However, it might also be the case that these are children with unidentified, mild language impairments. Resolution of this dilemma is beyond the scope of this research, and would require further assessment of the individual participants.

The Combined Roles of Morphosyntax and Oral Narrative

Language impairment (LI) was most effectively identified using a combination of key morphosyntactic measures from the conversations and key narrative feature measures from the two narratives elicited. These were broad measures of morpheme accuracy (finite tense composite) and syntactic complexity (MLU) from the conversation samples; and narrative organisation level, information score and percentage of erroneous cohesive ties from the two narrative samples combined. This supports the notion that assessment should be broad-based, covering a range of language characteristics in a range of contexts.

The morphosyntactic variables from the narrative samples were less effective than the conversation samples. The most effective way to identify LI was to use selected morphosyntactic measures from the conversations samples (FTC MLU) and selected narrative measures from both the FROG and CAT narratives (ORG, INFO and ERRCOH). The morphosyntactic measures from the conversation samples were developed from a larger number of utterances, which may be why they were more effective than the same measures from the narrative samples. It may be that longer narrative samples would also provide more effective morphosyntactic measures.

The findings of this research differed from those of Liles et al. (1995). While their measures and method differed from this study, some parallels can be drawn. Liles and colleagues concluded that measures of morphosyntactic complexity (particularly percentage of grammatical t-units) and cohesion (complete cohesive ties) were more effective than narrative organisation in identifying LI and TDL. This study found that measures of narrative organisation were singly more effective than measures of cohesion. Measures of narrative organisation for the FROG narrative were also more effective than measures of morphosyntactic complexity. The different findings may well be due to the different methodologies used, including the narrative stimulus, selection of variables and the use of a stepwise discriminant analysis.

Differing results for the discrimination function analysis across genres (conversation and narrative) and narratives (FROG and CAT) suggest that the most effective combinations of variables may not exactly replicate into different clinical or research assessment formats. However, it is anticipated that the principle of covering a range of language variables would apply in most contexts.

The SLI and NLI groups had less difficulty with narrative structure than other aspects of narrative production, evidenced in the way the LI groups performed better than the LM group on narrative structure, but not other linguistic measures. This implies that children with LI may need more help with how to use morphosyntax for the expression of tense and cohesion, than in how to structure their narratives.

The heterogeneous nature of LI, reflected in high levels of variance for some measures for the SLI and NLI groups, means that reliance on a small range of characteristics as diagnostic indicators is risky. Reliance on a small range or diagnostic indicators brings the risk of missing a valid diagnosis. The discriminant function analysis showed that many children with a LI would not be diagnosed as such, if a single variable, such as finite tense, were used.

SUMMARY

The most effective classifier of LI and TDL was the combination of measures for morphosyntactic accuracy (FTC) and morphosyntactic complexity (MLU) from the conversation samples, with narrative organisation level (ORG), information content (INFO) and percentage of erroneous cohesive ties (ERRCOH) from both narrative samples. With a specificity and sensitivity of 100%, no children with LI were misclassified as TDL using this combination. Single variables and combinations of variables from one genre (conversation or narrative) or one narrative (FROG or CAT) were less effective at classifying LI or TDL.

CHAPTER 9: DISCUSSION: IMPLICATIONS FOR DIFFERENTIAL DIAGNOSIS AND INTERVENTION

SLI and NLI could not be differentiated on the basis of their language characteristics as the pattern and extent of their morphosyntactic and narrative deficits were similar. Diagnostically, they have much in common and there seem few language-based clinical reasons for drawing distinctions between them. While the NLI group may experience more severe difficulties than the SLI group, the differences of degree or severity were not large enough to have diagnostic impact. The ability to distinguish between these two diagnostic groups remains primarily in the domain of non-verbal ability testing.

This chapter discusses the implications of the findings in relation to the themes identified in the literature in Chapters 1, 2 and 3. Implications for the influence of non-verbal cognition on language production and for explanations of LI will be addressed first. Discussion of the implications for finite tense deficits as a clinical marker for SLI, effective measures for diagnosis, and intervention will follow. Finally, limitations of the research will be addressed.

THE ROLE OF NON-VERBAL COGNITION

This lack of difference between SLI and NLI supports a model of relative independence between language and cognition, within the constraints of the variables assessed in this research. The findings suggest that non-verbal cognitive abilities have minimal influences on language and that differences in non-verbal ability are not indicative of differences in language characteristics. Thus, propositions that non-verbal cognition influences language, or that non-verbal cognition predicts language development, as proposed by some (Cromer, 1976, 1988a, 1988b; Miller & Chapman, 1981) are not supported. This is consistent, however, with the findings of others (Casby, 1992; Dale & Cole, 1991). To extend these conclusions to children with severe intellectual impairments, however, may well be beyond the boundaries of this research. The findings support the notion that language is modular in the sense that it is relatively independent of non-verbal cognition.

The lack of significant differences between the SLI and NLI groups on a range of narrative measures suggests that the contribution of non-verbal cognitive skills to oral narrative competence, including narrative organisation was limited. These findings suggest that narrative relies heavily on linguistic ability, consistent with the findings of Liles (Liles et al., 1995). This contrasts with the view of van der Lely (1997) who describes narrative discourse as a pragmatic function lying outside the modular language system (or grammatical acquisition device). The findings of this research argue that oral narrative features lie within or, at the very least, interact significantly with the modular language system. They are congruent with the findings of Norbury and Bishop (2003) who determined that a lack of differences among three language impairment (LI) diagnostic groups (SLI, pragmatic LI and high functioning autism) supported the notion that linguistic ability determines narrative competence.

Alternatively, the non-verbal assessments used may not tap into the types of non-verbal cognitive skill that contribute to narrative organisation. The role of non-verbal cognitive ability, as measured in a visual patterning task (Raven et al., 1995), in organisation of narrative structure is unclear. Verbal expression of narrative structure requires linguistic ability. Therefore, the boundaries between linguistic and non-verbal cognitive contributions to narrative structure may be rather murky. One way to tease out the relative contributions may be to compare production of a narrative script using visual methods (e.g., manipulation of miniatures or mimed drama with props) with verbal production. Such a task may reveal how much a child knows of how to sequence narrative events, independently of their verbal skills.

Notwithstanding the lack of significant differences between the SLI and NLI groups, there is some evidence of differences in narrative measures, based on non-verbal cognition. The LM group produced FROG narratives with significantly simpler structure and poorer cohesion than the SLI group who had higher scores on the Ravens' Coloured Progressive Matrices (RCPM), but performed similarly to the NLI group who were matched on both RCPM scores as well as MLU. This suggests the possibility of relationship between non-verbal cognition and narrative skills, with non-verbal cognitive skills supporting narrative plot structure and the tracking of characters (cohesion). However, the broad pattern of deficits does not support the modularity of language in the sense of morphosyntax being independent of other aspects of language.

Differences between the SLI and LM group for narrative structure suggest that the influence of non-verbal cognition on language ability is negligible for morphosyntactic measures but evident for narrative organisation. The more developed cognitive abilities of the older SLI group (due to maturation) contributed to the production of more complex narrative structures. However, this influence was not strong enough to produce significant differences between the SLI and NLI groups. This finding needs to be replicated in further research.

EXPLANATIONS OF LI

The exploration of issues throughout this thesis have led to the view that there are at least four attributes of LI requiring explanation. An adequate theory or explanation of LI must account for: 1) the full range of deficits present; 2) any focus in the type of deficits present; 3) the range of individual differences among children with LI and; 4) the independence of characteristic deficits from any specific aetiology. The first three attributes were described by Tomblin and Zhang (1999), with the fourth attribute relating directly to the findings of this thesis. In relation to the first attribute, Tomblin and Zhang argued that evidence of difficulties with most aspects of language, including vocabulary and narrative, means that explanations of LI need to account for more than just grammatical deficits. Many current linguistic theories are narrow, accounting for the focus of deficits (the second attribute) but only accounting for a small range of grammatical deficits found in LI (Leonard, 1998). Other theories may be too broad, not accounting for the focus of deficits in some areas, such as limited processing capacity accounts.

The range of individual differences among children with LI, the third attribute under consideration, is evident in the high levels of variance and low sensitivity for some measures. This is not accounted for by linguistic explanations such as the extended optional account (EOI) which proposes finite tense deficits as a clinical marker of SLI. Finally, similarities identified between SLI and NLI suggest a common explanation of LI. However, theories that focus on SLI generally fail to notice and explain similar patterns of deficit in other LIs that fall outside the diagnostic parameters of SLI or are associated with other aetiologies, such as the NLI group examined in this research. Such explanations require further comparisons among LIs of differing aetiologies. In summary, no single theory is identified that provides an explanation that encompasses all aspects of LI.

The dynamic interactional model of explanation for language impairment that was introduced in the first chapter is useful as a means of summarising the findings of this research. The innate capacity parameters incorporate both the linguistic and processing capacity accounts of language impairment, whereas the acquired parameters consider differences in provision of linguistic models and language use contexts that are influenced by years of experience, socio-economic status, parental language models and cultural background. The broad pattern of deficits present in children with SLI and NLI supports a dynamic interactional model of LI, as both the groups showed evidence of both linguistic and processing deficits. The effects of experience, an acquired parameter, are demonstrated in the significant differences between the SLI and LM groups. Other acquired parameters were beyond the scope of this research.

The findings of this research are also consistent with descriptions of LI as language ability at the low end of the continuum (Dollaghan, 2004; Leonard, 1991b; McCardle, Cooper, & Freund, 2005). They did not fit well with the alternative view of LI as a discrete categorical disorder that deviates significantly from normal developmental patterns, may be sub-typed and may differ according to aetiology (Aram, 1991; Bishop et al., 2000; Restrepo et al., 1992; Rice, 2000; Rice et al., 2005; Tomblin, 1991). Differences between groups were largely a matter of degree, with considerable variation and overlap. Similarities between children with SLI, NLI and the younger language-matched (LM) group support a model of protracted development rather than qualitative or disordered differences.

Evidence for linguistic and processing capacity deficits

Common linguistic and processing capacity deficits appear to underlie the impairments apparent in both SLI and NLI as they had similar difficulties on a wide range of characteristics. The implications of these results will be explored for two accounts of SLI, the extended optional infinitive account (EOI), and working and episodic memory accounts. Accounts requiring comparisons of different grammatical morphemes such as the surface account and the missing feature hypothesis could not be examined due to insufficient obligatory contexts for many individual morphemes.

Extended optional infinitive account

One view is that difficulties with finite tense is a clinical marker of SLI (Rice et al., 2004; Rice & Wexler, 1996b; Rice et al., 1995; Rice, Wexler et al., 1998). However, this view is at variance with the findings of the current study because not all children with SLI had such difficulties, evident in the high variance, and the discriminant function analysis. Difficulties with noun phrase morphemes and non-tense verb morphemes suggest broader grammatical difficulties than explained by the EOI account. However, the higher accuracy level for these morphemes than for the finite tense morphemes suggests that the EOI is a focus of deficits in SLI. The addition of the non-tense verb composite (NTVC) to the finite tense composite (FTC) in the discriminant function analysis increased both specificity and sensitivity, although the combination still provided poor sensitivity. This indicates that an impairment of language ability is more than just a verb tense disorder. Many other syntactic measures were equally or more effective at distinguishing or identifying LI including clausal completeness, and use of subordinate conjunctions. The EOI theory is insufficient as an explanation of the full range of grammatical deficits found in SLI.

Greater difficulties with finite tense morphemes were evident in the NLI group than the SLI group. This is because the NLI group performed more poorly on the FTC measure than the LM group, whereas the SLI group performed similarly to the LM group. This evidence, and the lack of differences between the SLI and NLI groups, shows that the EOI focus of deficits is just as applicable to NLI as to SLI.

High variability for grammatical morpheme accuracy was evident in the LI participants in this research. This has implications for consistent diagnosis of LI based on morphosyntactic measures. The danger exists of missing a diagnosis of LI if the diagnosis is based on grammatical accuracy measures alone, as promoted by the EOI account. The fact that some children diagnosed with LI had few grammatical difficulties suggests that other language characteristics are significant players.

Difficulties with morphosyntax identified LI more often than difficulties with narrative structure or cohesion. The SLI group also performed similarly to the LM group on morphosyntactic measures, but performed better than the LM group on some measures of narrative structure and cohesion. This pattern of greater difficulties with morphosyntax than oral narrative production has some fit with the primary locus of deficits being grammatical rather than processing related. The pattern of greater difficulties with finite tense than other grammatical morphemes also has some fit with the focus of the EOI account. However, this does not provide sufficient evidence for the EOI account as a sole explanation of LI in either SLI or NLI. The finding of a broad range of deficits is more consistent with a deficit in processing capacity.

Working and episodic memory

A deficit in working memory or episodic memory predicts a broad range of language deficits, including narrative organisation (Eaton et al., 1999; Shapiro & Hudson, 1991; van Dijk & Kintsch, 1983). Evidence for a limited processing account of LI is found in an examination of the narrative measures. The presence of difficulties with narrative structure and cohesion indicate difficulties beyond morphosyntax. Differences related to the stimulus used and method of elicitation also indicate how processing demands can affect the quality of narrative production.

Differences between this research and that of Boudreau and Hedberg (1999) for the narrative structure results (key event scores) is consistent with the view that a narrative generation is a more difficult task than a narrative retell. The SLI group differed significantly from the AM group for the FROG key event scores in this research, but not in the research by Boudreau and Hedberg. This suggests that a narrative generation task is more able to elicit impairment effects than a narrative retell. Since narrative generation is considered more demanding of processing capacity than a retell task, processing capacity is implicated as a causal factor (Eaton et al., 1999; Hudson & Shapiro, 1991; Shapiro & Hudson, 1991; van Dijk & Kintsch, 1983). The linguistic structuring of utterances and cohesion is modelled for children in retell tasks, but not for generation tasks. How well the children recalled features of the linguistic structure (e.g., tense) was not examined by Boudreau and Hedberg as their focus was on how well the children recalled and verbalised the content and narrative events (with picture prompts). Future comparison of morphosyntactic skills, as well as narrative structure, between a generation and a retell task could reveal interesting information on which variables are most vulnerable to processing capacity demands.

The lack of consistent results among research studies of narrative production suggests that stimulus selection and task parameters can affect the ability of participants to apply their narrative skills. This, in turn, implies that there is an interactive effect between linguistic abilities, context and task. A single linguistic explanation would predict much narrower effects that would remain more consistent across contexts and tasks. However, the presence of broad based difficulties with narrative production extending across the areas of narrative structure, cohesion and information lends support to a limited capacity account of LI in the form of a limited working or episodic memory.

It is not clear, either from this research or other researchers, whether the processing capacity deficit that accounts for LI is primarily linguistic or non-linguistic in nature (Adams & Gathercole, 2000). The processing deficits that account for SLI may be quite narrow and linguistic in focus, while those that account for NLI may be broader and include a non-linguistic focus. Other types of processing capacity deficit, such as visual working memory or central executive function may account for limitations in non-verbal ability in children with NLI. Exploration of differences between linguistic working memory and non-linguistic working memory for children with SLI and NLI is an important focus for future research. Such research will develop understanding of how different forms of working memory contribute to oral narrative production and comprehension.

The findings of this research are also consistent with research that has identified similar processing capacity limitations, in children with SLI, NLI and Down syndrome (Conti-Ramsden et al., 2001; Eadie et al., 2002; Ellis Weismer et al., 2000). This also supports the notion of commonality among LI of differing aetiologies.

Domain indexes

The SLI and NLI groups both experienced significantly greater difficulties with the CELF-P subtests that challenged verbal working memory (Linguistic Concepts, Recalling Sentences in Context) and morphosyntax (Sentence Structure, Word Structure) than with subtests that focussed more on vocabulary and concepts (Basic Concepts, Formulating Labels). This finding is consistent with both limited processing capacity and grammatical deficits as explanations for language impairment, and consistent with Tomblin and Zhang (1999) who found a divergence between grammatical and lexical subtests in children with SLI and NLI. The similarity in profiles between the SLI and NLI groups is further evidence of a common causal explanation for LI in each group.

The notion that both limited processing capacity and linguistic ability cause LI is further substantiated by evidence that this divergence was not apparent for the AM group. The flat profile for the AM group showed that the pattern of relative strengths and weakness in the three domains examined was unique to language impairment and not characteristic of TDL. It was not possible to isolate this divergence for the LM group, due to the use of different language ability tests.

Evidence for contributions from learning experience and maturation

The superior narrative skills of the older LI participants relative to the LM group, suggests that narrative and life experience benefited the older children with LI, even though they had similar morphosyntactic and lexical abilities to the LM group. The role of experience is highlighted when considering the comparison between the NLI and LM group.

The NLI and LM groups were matched for NVCA, as well as for MLU. The NLI group’s better performance on measures of narrative structure for the FROG narrative, suggests the involvement of factors that lie outside both the linguistic and non-verbal cognitive domains. Therefore, it seems appropriate to surmise that the higher performance of the NLI group on several measures of narrative structure and organisation implicates the benefit of developmental maturation and the benefit of greater experience with stories, social contexts, life events and educational tasks. This finding also suggests that narrative organisation skills are less vulnerable to the effects of LI, and are supported positively by greater experience with the world and with narratives.

These differences have some fit with research showing that differences in parental input and differing socio-cultural contexts contribute to varied provision of linguistic models that, in turn, contribute to changes in narrative production (Cain, 2004; Hoff & Tian, 2005; Peterson, Jesso, & McCabe, 1999; Peterson & McCabe, 1994). Socio-cultural differences also contribute to varied provision of opportunities and contexts for using language in different ways and purposes that may contribute to broader differences such as choices for vocabulary and narrative style (Armstrong, 2005).

Summary

Evidence from this research largely supported a limited processing capacity account of LI, rather than the EOI account. However, the findings supported an EOI stage in both the SLI and NLI groups, as a focus of grammatical deficits. It may well be that the two processes of linguistic deficit and a limited processing capacity (in conjunction with working memory deficits) interact, and that some children are more affected by one mechanism than the other. This would explain the heterogeneity found in children with LI. This notion is consistent with van der Lely (1997) who proposed that “a modular language system can be differentially impaired from aspects of language which rely on the central system” (p. 247). It may also be that underlying processing capacity deficits may manifest LI in different ways.

The presence of deficits in narrative organisation also supports a limited processing capacity as an underlying deficit for both SLI and NLI. Comparisons with the LM group support the contribution of NVCA to processing capacity. The notion of LI as a narrow morphosyntactic deficit needs broadening to include a wider range of language-related tasks, such as discourse, where meaning is linked across sentences to form coherent text. Such a broadening of focus would fit well within a functional linguistic framework where syntax is considered part of the form used for the expression of meaning, rather than the entirety of linguistic capacity (Armstrong, 2005; Halliday & Matthiessen, 2004).

UNIQUE CLINICAL MARKER OR UNIVERSAL VULNERABILITY

The notion of a unique clinical marker for SLI is associated with the goal of defining phenotypes for genetic research (Crago & Gopnik, 1994; Rice & Wexler, 1996a; Tager-Flusberg & Cooper, 1999). The finding of no significant differences between children with SLI and NLI on many variables suggests that children with SLI and NLI may share many of the genetic features that contribute to their language impairments.

This research found little evidence for the proposition that finite tense deficits are a unique clinical marker of SLI (Rice, 2000; Rice & Wexler, 1996b). Difficulties with finite tense markers and other grammatical morphemes are as much a clinical marker for NLI, as they are for SLI. This concurs with others who have found common morphosyntactic features in children with Down syndrome (Eadie et al., 2002). Eadie (1999) concluded that "grammatical morphology deficits may best be viewed as a clinical marker of language impairment rather than specifically for SLI" (p. xi). Finite tense may be considered an area of vulnerability in the English language, irrespective of aetiology or associated factors.

Cross-linguistic studies have shown that the linguistic deficits in English-speaking children with SLI are not universal across languages. The features of a language that are vulnerable to deficit appear to differ from one language to another (Bortolini et al., 2002; de Jong, 2004; Leonard, 2000). In English, tense morphemes appear to be particularly vulnerable to deficit, but not exclusively. Leonard (1998) explains that "because the speed of processing limitation is assumed to be general rather than specific, its hazardous effects on grammatical morphology are due more to the fact that features such as morphology are quite fragile in languages such as English" (p. 249).

It also needs to be determined whether the characteristics of LI that have been identified are unique to LI or whether they are elements of the English language that are vulnerable to breakdown with a wide range of causes. Paradis and Crago (2000) raised some cautioning issues in relation to overlap in the features of LI and acquisition of English as a second language. There is evidence that tense marking in English is vulnerable for learners of English as a second language (ESL) (Paradis & Crago, 2000) and in speakers of some English dialects such as Aboriginal English (Dinos, 2001; Gould, 2004).

It is not known whether the linguistic characteristics of children with a LI can be differentiated from the linguistic characteristics of children acquiring English as a second language. In the Australian environment, it may be difficult for clinicians to differentiate between Indigenous children with and without a LI, when difficulties with tense morphemes may be characteristic of their Aboriginal English dialect. Anecdotal reports suggest that speech pathologists find it more useful to diagnose LI in Aboriginal children on the basis of lexical and semantic characteristics rather than morphosyntactic characteristics (SPPIN, 2005).

In summary, the findings from this thesis support a notion of 'universality' or 'commonality' in language impairment. That is, when language breaks down, it does so in similar ways across language impairments of different aetiologies. Certain aspects in linguistic competence may be merely more *vulnerable* to deficit (either linguistic or processing capacity deficits) than other aspects of language. For example, finite tense markers present as areas of high grammatical vulnerability for the English language that are generic to a range of causal factors including ESL, dialect, pidgin and Creole influences, in addition to language impairment. In keeping with the commonality of language characteristics among LI of different aetiologies, the terms developmental language disorders or developmental language impairment may be more appropriate than terminology such as SLI and NLI (Bishop, 1994b; Eadie, 2002).

EFFECTIVE MEASURES FOR ASSESSMENT AND DIAGNOSIS

Variability and Individual Differences

High variance, characteristic of heterogeneity, was a feature of both the SLI and NLI groups for many measures in this research. Variation in how linguistic and/or processing capacity deficits are manifested, as well as overlap of language abilities across ages and diagnostic groups, seems to be a strong characteristic of LI, identified by a range of researchers (Dethorne, Johnson, & Loeb, 2005; Hewitt et al., 2005; Lahey et al., 1992).

High variance was a feature of many narrative variables, for children with TDL as well as children with SLI or NLI. Some narrative skills are also not as 'absolute' as morphosyntactic skills, such as accuracy. There is not always a ceiling level of ability to reach and there is not always a clearly correct or incorrect way of structuring a narrative. In producing a narrative a speaker has many open-ended choices about how to express meaning, how to structure the organisation of a narrative, which cohesive strategies to use, what information to present, or which temporal context in which to embed the narrative (Armstrong, 2005). This means that variability for such measures, even in a normal population may be substantial. Because there are many such choices, the analysis of composite or broad measures of adequacy (e.g., cohesive adequacy) may often be more appropriate than a fine-grained analysis of strategies (e.g., type of cohesive device) that will be subject to greater variability.

The pattern of high variability for both the SLI and NLI groups sits well with the model which proposes that SLI is language ability at the low end of the continuum rather than a discrete categorical disorder (Dollaghan, 2004; Leonard, 1991b; Norbury & Bishop, 2003). That is, children with LI vary in the degree to which each language variable is affected, rather than it being a case of a variable (or set of variables) being totally affected or not affected.

Broad versus Narrow Measures

In this research, composite measures based on larger data sets were more useful for differentiating both impairment and development than fine-grained measures based on smaller data sets. This finding is consistent with others who argue that large differences are required to clinically identify LI (Fey et al., 2004; Spaulding, Plante, & Farinella, 2006). The grammatical composites of FTC, NTVC and NPC had sufficient obligatory contexts across tasks, whild the inflection composites did not. Measures of narrative organisation, structural levels and event scores were more reliable than measures of individual narrative components. The broader narrative organisation levels demonstrated differences between the NLI and LM groups that were not elicited with the structural levels. Cohesion measures based on the longer FROG narrative identified a greater number of impairment and development differences than the shorter CAT narrative that provided fewer instances of cohesive tie attempts. Measures that are effective across a range of contexts or narrative stimuli will also be more useful than measures that are selectively effective.

The broad measurements seem appropriate for tasks requiring creative generation of language, as there are many ways in which to converse about play or to tell a narrative, contributing to considerable variability. It is possible that the more specific, fine-grained measures are more suited to more highly structured tasks such as retell or sentence repetition. In these tasks there is greater predictability and restriction in the language produced (Boudreau & Hedberg, 1999). Broad narrative measures are useful, as whether a narrative is non-goal directed, goal directed or elaborated reflects significant stages of development (Hughes et al., 1997; Liles, 1987).

Two important factors must be considered, in determining which is the more useful narrative for the purposes of diagnosing LI. Firstly, the number of c-units needs to be sufficient to reduce error rates that may arise from too few contexts or instances of a measure. The longer FROG narratives provided a larger field of data than the CAT narrative from which to measure morphosyntax, narrative components, information content, character first mentions and cohesion. Secondly, the effectiveness of the narrative stimuli in distinguishing between LI and TDL must be considered. In this case, the FROG narrative elicited more group differences on a wider range of measures than the CAT narrative. The discriminant function analysis also revealed higher classification rates for the FROG than for the CAT narrative. The evidence suggests that the FROG stimulus was more useful and effective for diagnosing LI in both the SLI and NLI groups, than the CAT stimulus.

Variation in the effectiveness of different stimuli to elicit impairment and development differences may explain some of the different findings reported in the literature, and the varied levels of support for the extent to which narrative variables such as narrative structure are vulnerable to the effects of SLI (Boudreau & Hedberg, 1999; Gillam & Carlile, 1997; Liles et al., 1995; Manhardt & Rescorla, 2002; Merritt & Liles, 1987; Miranda et al., 1998; Olley, 1989; Paul et al., 1996; Ripich & Griffith, 1988; Shapiro & Hudson, 1991; Spinillo & Pinto, 1994; Wellhousen, 1993).

The findings suggest that, clinical judgments of narrative abilities in 5-year-olds are best made using a problem based wordless picture book and broad measures of narrative organisation and structure. This is particularly important for non-standardised narrative stimuli and procedures. It may be that fine-grained analyses of oral narratives are best reserved for retells of specific narratives for which standardised procedures and normative information have been provided. The predictive or cause and effect relationships between language variables are not clear

Strength of Multiple Variable Assessment

The findings of this research support the argument that it is important to base diagnosis of LI on a range of measures (covering morphosyntax, semantics, pragmatics and processing capacity) rather than rely on one variable alone (Paul, 2001). Assessment of morphosyntax must cover a range of measures, not only finite verb tense forms, as the findings support a broad range of deficits. In particular, syntactic and semantic (utterance level) errors require exploration as an area of possible difference from normal developmental patterns.

Language impairment may affect different aspects of the language system in individual children, evident in the high variance in many measures. Heterogeneity among children with LI suggests that attempts to distil the measurement and diagnosis of language impairment into one or two key variables are a fraught process. This is consistent with regular recommended clinical practise (Paul, 2001). The fact that available language ability tests differ in their identification of LI, suggests that the range of language characteristics being assessed differs across tests (Aram et al., 1993; Dunn et al., 1996; Krassowski & Plante, 1997; McCauley & Demetras, 1990; Merrell & Plante, 1997). To base identification of LI in children with either SLI or NLI, only on narrative features or morphosyntax is to risk misdiagnosis. Both aspects of language had greater power as identifiers when used together (Fey et al., 2004).

The question of how narrative structure, content, cohesion and morphosyntax interact within a narrative is also not perfectly clear, and a full examination of this was beyond the scope of this thesis. Eaton, Collis and Lewis (1999) indicated that structural coherence was possible without linguistic cohesion, and that linguistic cohesion is possible without structural coherence. A child with LI may have poor narrative structure and cohesion, yet better information and morphosyntax. Another child may have poor morphosyntax and cohesion, yet better information and narrative structure.

A functional linguistic approach would also argue that each child accesses a unique permutation of strategies across language domains in order to express meaning, appropriate to the context. For example, context influences the choice of strategy for cohesion. A future comparison of shared picture contexts and decontextualised contexts for narrative production across a wider age span would show whether use of exophoric reference was used less in decontextualised contexts and used less with more time at school.

A functional linguistic model of language impairment also argues for a holistic examination of a child’s attempts to make meaning, rather than a fragmented approach to assessment (Armstrong, 2005). Morphosyntax, lexical choices, semantic linkages throughout a text and pragmatic choices relating to the social contexts all work together to produce an effective act of communication. Too great a focus on one aspect provides the risk of neglecting other important areas of deficit as well as failing to recognise the total effect of communication failure. In addition, the way in which one aspect of language is used will have an impact on, or be influenced by, another aspect of language. For example, a productive expressive vocabulary provides ample material for building longer utterances; or a reluctance to communicate with a stranger contributes to a shorter MLU (Dethorne et al., 2005).

The findings also argue that comparison with age peers is more reliable as a method of identifying language impairment than making comparisons with younger children. Comparison with LM groups is rarely important in the clinical context and merely points out extreme degrees of difference for variables strongly vulnerable to LI. Chronological age comparison is the standard in clinical practice (Bortolini et al., 2002).

Progress over Time

On many measures, the NLI group performed more poorly than the SLI group, although the difference between the groups was not significant. This raises questions about what the future progression and outcomes would be for the two LI groups in the future. Will the course of development continue in the same fashion for both groups? Alternatively, will the groups diverge and follow different courses of development, with the gap in linguistic abilities widening between them?

Longitudinal comparisons of progress between diagnostic groups are few. Rice et al. (2004) found that over a period of four years, children with SLI and NLI progressed differently in their development of accurate finite tense use. The NLI group initially progressed more slowly but progressed more rapidly later on, so that outcomes for the two groups were similar by ten years of age. On the other hand, (Fey et al., 2004) compared the progress of children with SLI and NLI between second and fourth grade. The SLI and NLI groups made similar gains in narrative production on measures of length, lexical diversity, clausal complexity, grammatical accuracy and narrative structure. Outcomes for a range of language characteristics need to be explored further in children who have been well matched at the outset of the research, which was not the case for the two studies described.

Reilly et al. (2004) compared children with Williams Syndrome to children with SLI and found that the influence of intellectual disability on narrative structure was more apparent in older than in younger children. This suggests either, that a dissociation between linguistic and cognitive functions emerges with age, or that narrative structure measures are not sensitive to cognitive differences at a young age. At young ages, it appears that experience and linguistic ability may have a stronger role in influencing narrative structure than non-verbal cognition, while older children may have more complex organisational demands placed on their narrative skills. However, this effect needs to be explored further through longitudinal comparative studies of children with a range of diagnostic profiles.

INTERVENTION

Since the psychometric distinction between SLI and NLI, based on NVCA, does not carry through to consistent differences in language characteristics, the distinction is of limited use for the purposes of clinicians with a focus on language. The findings suggest that clinically, children with NLI have similar needs to children with SLI, with respect to the range of language deficits that require attention. Therefore, children with NLI and SLI are likely to benefit from intervention focussing on similar goals.

There is little evidence, based on language characteristics, for determining that children with SLI will benefit more from intervention than children with NLI and consequently precluding children with NLI from similar levels of intervention. As stated by Bishop (1994a), “In terms of practical policy, there seems little justification in continuing to place heavy reliance on IQ-language discrepancies in determining who should receive extra help at school” (p. 108). While poorer non-verbal cognition suggests a broader range of learning needs requiring attention, there is no reason why this should be at the cost of intervention for language learning needs. However, it is possible that the extra learning needs of children with NLI across a broader range of cognitive domains will impede language learning or require different intervention strategies. While research has shown similar benefits from intervention for children with SLI and NLI (Cole et al., 1990; Fey et al., 1994), the impact of different strategies on long term outcomes still requires comprehensive investigation.

The wide range of language areas affected in the participants with SLI and NLI, suggest that intervention needs to address a broad range of language characteristics. It is important that one aspect is not focussed on to the detriment of others. As urged by Rescorla and Roberts (2002) it is important that “In targeting verb morphology for intervention, clinicians should therefore be careful not to neglect other aspects of language that may also need remediation and that may be more likely to show a positive therapeutic response” (p. 1230). Unfortunately, not enough is known about which language targets or intervention strategies will result in the greatest change in language functioning, or for which diagnostic group.

A functional linguistics perspective would argue that a comprehensive approach to language intervention could be best implemented by placing the language expected of the child with LI in a functional context (Armstrong, 2005). The demands of the communicative context require meaningful integration of morphosyntax, lexical choices, cohesion and text organisation. It is likely that addressing a wide range of language features, one by one, would be a slow process resulting in limited generalisation to real life communicative contexts. For instance, rehearsal of recounts of past personal events may result in more rapid learning of past tense forms, than production of past tense verbs in response to presentations of picture sequences. The continuum of naturalness (Fey, 1986; Paul, 2001) provides a model for varying intervention approaches from the highly structured and adult-directed, to the more functional child-directed. Comparisons of structurally focussed, and contextually functional intervention approaches to language impairments are needed to determine the most efficacious intervention methods for differing diagnostic groups and language ability profiles.

The finding that children with SLI and NLI had less difficulty with narrative structure than with morphosyntax implies that children with LI may need more help with how to use morphosyntax for the expression of tense and cohesion, than in how to structure their narratives. Working with different types of narrative structure may be a tool for language intervention, providing a context in which to apply linguistic skills, rather than a goal in itself.

A better understanding of the similarities and differences among different diagnostic groups will provide a basis for further research into the efficacy of different intervention approaches. While children with SLI and NLI present with similar language characteristics it may be that children with SLI and NLI will respond differently to intervention approaches. Children with SLI may be able to draw more on general cognitive skills for learning, than can children with NLI.

An investigation of the most efficacious intervention strategies across diagnostic groups and differing language ability profiles would also inform theories accounting for LI. Leonard (1998) contends that “different accounts of SLI suggest different areas of emphasis for treatment” (p. 285). For example, broad improvements to language abilities, including narrative structure and cohesion, following intervention focussed on development of finite tense forms would support an EOI account of LI. On the other hand, broad improvements to language abilities, including morphosyntax and lexical access, following intervention focussed on production of narrative structures would support processing and functional accounts of LI. Differing results from interventions for children with SLI and NLI would suggest contributions from non-verbal cognition and support diagnostic differentiation.

LIMITATIONS OF THE RESEARCH

Several limitations in this study suggest caution in drawing conclusive interpretations from the findings. They suggest that results need to be replicated with different populations by other researchers, before drawing firm conclusions.

Sample Selection and Size

The effects of different methods of selecting and matching research groups are not clear and require further investigation. Other studies of NLI have been drawn from epidemiological samples (Fey et al., 2004; Rice et al., 2004) or twin studies (Bishop, 1994b) and not matched the SLI and NLI groups on any language variables. Epidemiological sampling by Fey and Rice has shown that populations of children with NLI produce language that is less complex than the language of age-matched populations of children with SLI. In contrast, this research recruited participants from the caseloads of speech pathologists and matched the SLI and NLI groups on MLU and a standardised language assessment.

Participants were referred by speech pathologists who regularly prioritise and work with children with severe LI. Service provision from government health and education agencies for children with mild to moderate impairments are limited in Australia (DECS, 1996; Education-Queensland, 2003). In South Australia, where the samples for this research were drawn, SLI is primarily defined as a severe LI. This clinically ascertained sample may have differed from epidemiological samples that do not place constraints on the severity of the impairment. However, a clinical sample that reflected the caseloads of Australian clinicians was useful for exploring differential diagnosis that is applicable to the clinical context. Matching of the SLI and NLI groups on general measures of language ability also enabled examination of whether qualitative differences existed, a frequently used strategy in LI research (see Chapters one and two).

Standardised tests may differ in the population they define as having a LI. Recent research identifies that the CELF-P may not be as sensitive to LI as other tests of language ability (Spaulding et al., 2006). However, this may be compensated by the fact that children with moderate to severe impairments were selected to participate, rather than children with mild to moderate impairments. On the other hand, the examination of children with severe LI, that is, at the low end of the LI continuum, may increase the possibility of the sample being at variance from the larger population of children with LI.

The age range explored in this thesis was narrow, which assisted comparisons, because the children were at similar levels of development. Expansion beyond the 5-year-old age group is necessary to determine whether the findings hold across age groups, or as the children progress over time.

The small sample sizes available for this research may have reduced its power, limiting the ability to identify differences on some variables. Small numbers increase the risk of failing to fully represent the target populations due to sampling variations. There is also an increased risk of failing to detect small significant differences. This may explain the lack of differences in morphosyntax between the LI and LM groups that was evident in the research conducted by Rice and colleagues (Rice et al., 2004; Rice & Wexler, 1996b). It is also possible that the Holm adjustment for multiple comparisons may have masked significant developmental and impairment effects for some variables that would have been identified using a universal .05 level of significance. That is, in controlling for a Type 1 error (finding a difference between groups when in fact there is no difference), a Type 2 error may have been committed (finding that groups do not differ when in fact they do differ) (Munro, 1997; Pallant, 2001). However, this error is less likely for any SLI and NLI comparisons as their significance levels were generally well beyond .05.

The results of this thesis require further validation through replication with larger numbers of participants. Investigations of a larger population sample might elicit differences that were not evident for this research. Larger numbers may also provide the opportunity to explore whether there are different sub-types of LI, such as grammatical LI.

The literature abounds with differing methodologies and results that are not always easy to reconcile. The two narrative stimuli used in this research also produced varied results. This lack of consistency suggests that the field is currently some distance from the position of being able to make clear recommendations about approaches that will elicit consistent and definitive diagnostic answers in a clinical or research context. A different stimulus and procedures, or a different kind of discourse task may elicit differences between the SLI and NLI groups that were not evident in this research. In addition, this research investigated variables identified frequently in the literature as areas of deficit for children with SLI. Children with SLI and NLI may therefore differ on variables not investigated in this research. Further research is needed to determine which narrative stimuli and procedures are most effective at eliciting developmental and LI differences for different age groups, and which variables are most consistent at eliciting these effects.

Reliability

Interpretation of the results is challenged by difficulties in achieving high levels of reliability for some narrative measures. However, low reliability for narrow narrative measures is consistent with the findings of other researchers (Hedberg & Westby, 1993; Hughes et al., 1997; James, 1999; Jordan et al., 1991; Saliba & James, 2002; Strong & Shaver, 1991). Generic criteria for narrative level lack specificity and are open to differences in interpretation. Without clear guidelines for every eventuality (a tall order for a task that is inherently creative), each individual examiner must make their own evaluation. Training and practise in coding is also needed to ensure a consistent approach.

Reliability was poor for narrow measures, such as narrative components, but excellent for broader measures such as narrative organisation. This is consistent with Strong and Shaver (1991) who suggested that greater reliability may be obtained from composite rather than highly specific measures (e.g., percentage of all complete cohesive ties, rather than for each type of cohesive device). They also suggested that reliability is improved by increasing the length of the narratives examined (e.g., by combining results for several narratives).

Most discrepancies for coding of the narrative components or narrative structural level were within organisational level or close in level of complexity (e.g., *attempt* versus *behavioural response*; *label* versus *external state,* or *action sequence* versus *descriptive sequence*). This is consistent with comments from Hedberg and Westby (1993) who find it acceptable that “although you may differ from other scorers … you will be in the ballpark – either slightly above or below our scorings.” (p. 11) and with similar comments from Hughes et al. (1997).

SUMMARY

In summary this research has implications for diagnostic and intervention practices for clinicians and researchers. The findings suggested that NVCA has limited influence on morphosyntax, but some influence on narrative structure. Greater support was found for a limited processing capacity explanation of LI than a narrow linguistic account. A comprehensive assessment model was supported over assessment of a narrow range of language characteristics. The NLI group were identified as having similar intervention needs as the SLI, although conclusions cannot be drawn on whether they benefit from similar intervention strategies.

CHAPTER 10: CONCLUSION

THEORETICAL IMPLICATIONS

The lack of differences in language characteristics between SLI and NLI supports the notion that language is modular in the sense that language is relatively independent of non-verbal cognition. If aspects of language ability were in some way depended on non-verbal cognition, then these aspects would show greater deficits in children with NLI. This was not the case.

Linguistic accounts, such as the extended optional infinitive (EOI) account (Rice, 2000; Rice & Wexler, 1996b), are insufficient in explaining the full range of grammatical and non-grammatical deficits found in LI. This is because children with LI (both SLI and NLI) show evidence of a broader range of linguistic deficits and processing deficits. As well as the difficulties with finite tense morphemes described by the EOI account, children with SLI and NLI experienced significant difficulties with non-tense verb and noun phrase morphemes, and with syntax complexity and error rates.

The broad pattern of deficits supports a ‘dynamic interactional’ model of LI, whereby functional language relies on both a linguistic capacity and a processing capacity, within which both innate and learned contributions are acknowledged. The model accommodates both linguistic and processing explanations of language impairment rather than excluding one in favour of another. The model also provides scope for accommodating the impact of varied learning experiences on the presentation of LI. The findings of this research suggest that learning experiences may contribute to development of oral narrative features, in a greater way than found with morphosyntax. Children with SLI showed the benefits of experience and maturation in producing oral narratives with better structure and cohesion than the younger LM group.

The model of LI as language ability at the low end of the continuum was also supported, as there was considerable variation and overlap of ability evident in the identification of large amounts of variance and low identification of LI for individual variables. The differences between groups were not characterised by bimodal divergence, absolute or categorical differences. This was particularly evident for grammatical morpheme accuracy.

The EOI account suggests that difficulties with finite tense morphemes constitute a unique clinical marker of SLI. However, evidence from this research and from the literature suggests that finite tense difficulties more likely represent an area of particular vulnerability in the English language, rather than a unique clinical marker of SLI. Vulnerability is used in this context to suggest a problem space in the English language that is applicable to a range of situations and causal factors. Firstly, this is seen in extended optional infinitives (EOI) being a strong feature of NLI as well as SLI. Secondly, this seen in applicability to LIs associated with other aetiologies described in the literature, such as Down syndrome (Eadie et al., 2002). Thirdly, the literature suggests that reduced use of finite verb tenses may also be a strong feature of second language learning and of certain English dialects (e.g., Singaporean English, Aboriginal English) (Brebner, 2001; Dinos, 2000; Gould, 2004). Finally, difficulties with a range of language characteristics and the high levels of variance for finite tense morpheme accuracy indicate that difficulties with finite tense morphemes are not a clinical marker for all cases of SLI or NLI.

IMPORTANCE OF THE FINDINGS

The findings of this thesis contribute to a more comprehensive understanding of the construct of LI, particularly the construct of SLI and NLI. They are consistent with a holistic view of LI, in the sense that the nature of LI has broad and diverse forms of expression that cannot be instilled into a small number of key variables. It is inappropriate to assume differences in language characteristics between diagnostic groups if this premise has not been tested or subjected to appropriate research.

Some accepted theories are not supported by this research. The cognitive hypothesis (which has shaped much thinking about LI) was not supported by this research because the findings show that a differential diagnosis of SLI from NLI relies solely on non-verbal cognitive assessment, not on assessments of language abilities. Differing aetiologies and differences in other skill areas do not necessarily result in differing expressions of the LI. Importantly, non-verbal ability differences are not indicative of differences in language characteristics.

The findings of this research have implications for diagnosis and effective assessment that are of major importance for clinicians and researchers. A broad assessment approach is argued for in order to maximise identification of LI. Clinicians need to use a broad assessment approach that investigates a wide range of language features in several relevant contexts including targeted elicitation tasks and functional discourse genres such as conversation and narrative. A wide, rather than narrow, range of language features including the domains of morphosyntactic accuracy and complexity, and textual organisation and cohesion require assessment. Selection of assessment batteries, particularly non-standardised naturalistic assessment, needs to be based on sound evidence of the methods and measures that are most effective at identifying development and impairment.

This research has demonstrated that certain measures, combinations of measures and contexts are more effective than others at identifying LI. It is important for clinicians to choose methods that are shown to be effective. The impact of task and context on performance may be considerable; such as lower accuracy of tense morphemes in elicited versus naturalistic tasks; or the use of exophoric reference when pictures are shared. For example, use of exophoric reference in a shared book narrative by 5-year-olds is normal pragmatic effect, and not an indicator of poor cohesion. Structured elicitation tasks may be more effective at identifying LI, but present a risk of underestimating the ability of children to use tense forms in conversation and narration.

It is important that clinicians consider these effects when evaluating assessment results. This research shows that clinicians also need to select narrative elicitation tasks and stimuli that will be effective in showing differences due to development and impairment. Not every narrative stimulus will be as effective as another, as shown in differences between the FROG and CAT narratives.

The results of this research also have implications for intervention practices. The practice of allocating differing levels of language intervention to children with SLI and NLI is not supported by the similarities in their presenting language characteristics. Similar areas of language deficit suggest that the intervention needs of children with SLI and NLI are similar. Greater difficulties with morphosyntax and lexical access suggest that children with LI may benefit more from intervention focussed on the linguistic aspects of narrative than on structural aspects of the discourse genre. On the other hand, children with NLI may need greater assistance with oral narrative structure and cohesion than children with SLI. This is suggested by the finding that a younger LM group had similar narrative structure and cohesion to the NLI group, but poorer narrative features than the SLI group. It must be recognised though, that other factors, such access to cognitive learning processes may require differing intervention strategies between the SLI and NLI groups. Exploration of this issue was beyond the scope of this thesis.

FUTURE DIRECTIONS

A clearer understanding of LI would be gained from further research that systematically compared language characteristics across a broad range of diagnostic groups with LI, in well-controlled studies (Rice et al., 2005). Large studies that consider a number of diagnostic groups with LI and explore a wide range of variables in a range of contexts will provide a more consistent approach and sufficient scale to recognise similarities and differences, universal features and subtypes. Such diagnostic groups could include, but not be restricted to SLI, NLI, Down syndrome, autism spectrum disorders, traumatic brain injury, hearing impairment, William syndrome and intellectual disability. The comparison of long-term outcomes across diagnostic groups will also inform our understanding of LI as different diagnostic groups may have different outcomes over time, including differing interactions among language domains and features. Comparisons of different types of working memory in children with SLI and NLI, as well as other diagnostic groups, will develop understanding of causal or concomitant factors in LI. An exploration of the effectiveness of varied intervention strategies across diagnostic groups and language profiles will inform understanding of the underlying construct of LI, as well as lead to appropriately targeted and effective intervention strategies.

It is important to explore how a range of language domains, strategies and choices are used (or not used) by individual children to express meaning, as argued for in a functional linguistic approach. For example, an exploration of the influence of context and education on the use of reference in children's oral narratives may reveal differences in how different LIs affect the ability to interpret context and benefit from learning experiences. Systematic comparisons of different narrative stimuli and methodologies, such as narrative retells versus generations, may reveal more effective contexts for eliciting differences between children with SLI and NLI, or the effects of processing demands.

It is important to explore how LI may be differentiated from language difference arising from acquiring English as a second language in the Australian context, or from acquiring a dialect such as Aboriginal English. This is important to ensure that children from other language backgrounds are not inappropriately diagnosed with a LI, but are directed to learning opportunities appropriate for second language learning.

There is also a need to compare the effects of different sample selection and sample matching methods. For example, well-matched groups may result in different findings from epidemiologically selected samples. Matching of groups on variables other than MLU may reveal further patterns of language characteristics. Above all, the results of this research require replication with a larger sample, and across a wider age range.

Finally, in conclusion, it is quite clear from the results that children SLI and NLI possess a similar range of language deficits. They could not be distinguished diagnostically on measures of morphosyntactic accuracy and complexity or measures of narrative characteristics. The need to distinguish between these two groups in a clinical context is not necessary on linguistic grounds. They are all children with language impairments that require assessment and identification of their individual linguistic profiles across language domains and modalities, and determination of individual intervention plans.

APPENDICES

APPENDIX A: LITERATURE SUMMARY

Table A-1. Participant details in studies investigating accuracy of grammatical morphemes

Researcher(s)	*TDL Age-matched*	*TDL MLU matched*	*SLI*	*NLI/ (DS)*
(Bedore & Leonard, 1998)	Age: 3;7 – 5;9 MLU = 5.0 LA > -1.0 NVCA > -1.0 n = 19		Age: 3;7 – 5;9 MLU = 3.5 LA < -1.0 NVCA > -1.0 n = 19	
(Beverly & Williams, 2004)		Age: 1;10 –2;7 MLU – 2.66 LA > -1.0 n = 14	Age: 3;6 – 4;10 MLU = 2.65 LA < -1.0 n = 8	
(Eadie et al., 2002)		Age: 3;3 MLU = 3.5 – 4.5 NVCA > -1.0 n = 10	Age: 5.3 MLU = 3.5 – 4.5 NVCA > -1.0 n = 10	Age: 7.2, DS MLU = 3.5 – 4.5 NVCA? n = 10
(Ingram & Morehead, 2002)		Age: 1;7 – 3;0 MLU = 3.22 n = 6	Age: 4;9 – 7;4 MLU = 3.02 n = 6	
(Leonard et al., 1992)	Age: 3;5 – 5;7 MLU = 4.2 – 6.2 LA > -1.0 NVCA > -1.0 n = 10	Age: 2;11 – 3;4 MLU 2.9 – 4.2 LA > -1.0 NVCA > -1.0 n = 10	Age: 3;8 – 5;7 MLU = 2.7 – 4.2 LA < -1.0 NVCA > -1.0 n = 10	
(Leonard et al., 1997)	Age: 3;6 – 5;8 MLU? LA > -1.0 NVCA > -1.0 n = 9	Age: 2;5 – 3;3 MLU = SLI LA > -1.0 NVCA > -1.0 n = 9	Age: 3;7 – 5;9 MLU = 2.8-4.8 LA < -1.0 NVCA > -1.0 n = 9	
(Rice et al., 2004) Longitudinal	Age: 5;11 MLU? LA? NVCA? n = 117 K/4th grade n = 24		Age: 6;0 MLU? LA < -1.25 NVCA > -1.0 n = 130 K/4th grade n = 57	Age: 6;0, NLI MLU? LA < -1.25 NVCA < -1.0 n = 100 K/4th grade n = 54
(Rice & Wexler, 1996b)	Age: 4;4 – 5;7 MLU = 3.2 – 7.4 LA > -1.0 NVCA > -1.0 n = 45	Age: 3;6 – 3;10 MLU = 2.8 – 4.8 LA > -1.0 NVCA > -1.0 n = 40	Age: 4;4 – 5;8 MLU = 2.3 – 4.6 LA < -1.0 NVCA > -1.0 n = 37	
(Rice, Wexler et al., 1998)	Age: 4;11/8;0 MLU = 4.18 LA > -1.0 NVCA > -1.0 n = 23	Age: 3;0/6;2 MLU = 3.66 LA > -1.0 NVCA > -1.0 n = 20	Age: 4;9/8;1 MLU = 3.49 LA < -1.0 NVCA > -1.0 n = 21	
(Rice et al., 2000)	Age: 4;11/8;0 MLU = 4.18 LA > -1.0 NVCA > -1.0 n = 23	Age: 3;0/6;2 MLU = 3.66 LA > -1.0 NVCA > -1.0 n = 20	Age: 4;9/8;1 MLU = 3.49 LA < -1.0 NVCA > -1.0 n = 21	
(Steckol & Leonard, 1979)		Age: 2;10 – 3;11 MLU = 3.5 – 4.9 n = 10	Age: 4;5 – 6;5 MLU = 3.5 – 4.9 n = 10	

Note: LA = standardised assessment of language ability; NVCA = standardised assessment of non-verbal cognitive ability

APPENDIX B: BACKGROUND INFORMATION

Table B-1. Conventions for calculating MLU

1	In cases of stuttering, reformulation or false starts, each word is counted only once. These are marked as mazes by enclosing them in parentheses (e.g., revisions such as "(he went) they all went to the shop"). This excludes them from the MLU count by the SALT software. Normally the earliest occurrences are marked as mazes with the last occurrence of the word or phrase considered the successful production. For example: He gave me (the book um the book) the book.
2	Where repetitions are made for emphasis, each word is counted as a separate morpheme (e.g., climb, climb, climb).
3	Fillers and interjections (e.g., um, on, oops) are not counted in MLU so they are enclosed in parentheses (if within utterances) or marked as nonverbal (if stand-alone utterances) by enclosing in brackets.
4	Compound words (e.g., ironing-board), proper names (Mrs Brown, Father Christmas), ritualised reduplications (e.g., bye bye) and stereotyped phrases (e.g., "once upon a time"; "wait a minute") count as single words. These are transcribed as one word without any spaces or hyphens (e.g., nightnight, mrsbrown).
5	Each free morpheme or word is counted as one morpheme.
6	All inflections count as separate morphemes. Inflections are separated from the free morpheme by a slash (e.g., walk/ing) with root spelling of the free morpheme is preserved (e.g., love/ed) thus enabling data collation about word roots. Further conventions for transcribing inflectional morphemes are described later.
7	All catentatives count as single morphemes (e.g., gonna, wanna).
8	Irregular past tense forms (e.g., got, went, came) are counted as one morpheme. However, overgeneralisations (e.g., goed or comed) are counted as two morphemes.
9	Irregular plural forms (e.g., children, men) are counted as one morpheme.
10	All diminutives (e.g., doggie, horsie) are counted as one morpheme.
11	Auxiliary and modal verbs are counted as one morpheme. Contracted forms are also counted as separate morpheme and separated from the free morpheme by a slash (e.g., he/'s). Contracted negatives are counted as a separate morpheme (e.g., are/n't).
12	Vocatives are transcribed on the same line as the rest of the utterance when the vocative is spoken in close temporal proximity to the utterance or within the same intonation contour. (Klee et al., 1989)
13	Verb forms that undergo an internal vowel change when they take an inflection are transcribed as single words (e.g., does, don't, won't ain't, can't). (Caygill, 1998; Miller et al., 1996)
14	Nouns, adjectives and gerunds formed with an inflection are counted as single morphemes (e.g., swimming pool; I am tired; Swimming is fun; I can do the ironing.).
15	All 'yes', 'no' and 'okay' responses are excluded from the final MLU count (Eadie, 1999). This was achieved by transcribing them as separate utterances, coding them [yn], then later excluding responses with this code from the SALT Analysis Set before calculating MLU.

Note: The above reflect conventions for transcription and calculation of MLU suitable for the SALT software, described by Miller and colleagues (Leadholm & Miller, 1992; Miller, 1981; Miller et al., 1996), with some details and modifications described by other researchers (Caygill, 1998; Klee et al., 1989; Paul, 1995).

Table B-2. Group effects for participant characteristics

Variable	*K-Ws* χ^2	*df*	*p*
Age	42.681	3	< .001
MLU	29.789	3	< .001
CELF-P Expressive Language Standard Score	36.970	2	< .001
CELF-P Receptive Language Standard Score	35.042	2	< .001
Raven's Coloured Progressive Matrices Raw Score	49.172	3	< .001

Table B-3. Pairwise comparisons for participant characteristics

		Group Comparisons					
		LI	LI & LM		LI & AM		Dev.
Measure	Value	NLI-SLI	NLI-LM	SLI-LM	NLI-AM	SLI-AM	LM-AM
Age	Z	-.694	**-4.802**	**-5.014**	-.160	-1.065	**-5.488**
	p	.504	**< .001**	**< .001**	.880	.300	**< .001**
MLU	Z	-.069	-1.142	-1.367	**-4.324**	**-4.508**	**-3.678**
	p	.964	.268	.183	**< .001**	**< .001**	**< .001**
CELF-P Expressive Language SS	Z	-2.164	n/a	n/a	**-4.846**	**-5.064**	n/a
	p	.031			**< .001**	**< .001**	
CELF-P Receptive Language SS	Z	-.511	n/a	n/a	**-4.833**	**-5.017**	n/a
	p	.625			**< .001**	**< .001**	
RCPM Raw Score	Z	**-4.464**	-.520	**-4.653**	**-4.814**	**-2.226**	**-5.295**
	p	**< .001**	.617	**< .001**	**< .001**	**.025**	**< .001**

Table B-4. Pair-wise comparisons for language domain indexes

Measure	*Group*	*NLI-SLI*	*NLI-AM*	*SLI-AM*
Memory Index	Z	-.791	**-4.845**	**-5.013**
	p	.445	**< .001**	**< .001**
Vocabulary Index	Z	-1.278	**-4.801**	**-5.070**
	p	.213	**< .001**	**< .001**
Morphosyntax Index	Z	-.669	**-4.767**	**-5.068**
	p	.513	**< .001**	**< .001**

Table B-5. Pairwise comparisons between language domain indexes

Variable Comparisons	*Value*	*Group*	
		SLI	***NLI***
Vocabulary - Memory	Z	**-3.188**	**-2.763**
	p	**< .001**	**.004**
Morphosyntax - Memory	Z	-1.140	-.681
	p	.311	.563
Morphosyntax - Vocabulary	Z	**-2.866**	**-2.347**
	p	**.002**	**.014**

Table B-6. Pair-wise comparisons for socio-economic status

Measure	*Value*	*LI*	*LI & LM*		*LI & AM*		*Dev.*
		NLI-SLI	*NLI-LM*	*SLI-LM*	*NLI-AM*	*SLI-AM*	*LM-AM*
Advantage Index	*Z*	-2.215	-2.251	-.451	**-2.912**	-.145	-.339
	p	.024	.024	.663	**.003**	.890	.741
Economic Resources Index	*Z*	-2.169	-2.288	-.251	**-2.876**	.112	-.091
	p	.027	.020	.809	**.004**	.916	.936
Education and Occupation Index	*Z*	-2.031	-2.177	-.451	**-2.770**	-.305	-.248
	p	.040	.028	.662	**.005**	.766	.811

APPENDIX C: LANGUAGE SAMPLE ELICITATION

Table C-1. Toys for play sessions

farm house	mother	inflatable raft with sails
3 horses	father	spiderman doll
3 cows	car	
3 pigs	several small ‘people’	for older children:
2 dogs	tractor	rocks
cat	trailer	2 workers
2 chickens	wash basket	
fence	vacuum cleaner	for younger children:
drinking trough	ironing board & iron	Bob the builder
ladder	tablecloth	several large lego blocks
girl	small pump	wheelbarrow
baby		

Note: listed in general order of presentation

Figure C-1. FROG Narrative Pictures (Frog, Where Are You? Mayer, 1969)

Figure C-1. FROG Narrative Pictures (Frog, Where Are You? Mayer, 1969)

Figure C-1. FROG Narrative Pictures (Frog, Where Are You? Mayer, 1969)

Figure C-1. FROG Narrative Pictures (Frog, Where Are You? Mayer, 1969)

Figure C-2. CAT Narrative Stimulus

Table C-2. FROG narrative prompts:

1	Encourage the child to turn the pages when they are ready.
2	Provide the child with encouragements, as necessary, such as: “Keep going”, “Tell me more”, and “You’re doing a good job”
3	For children who refuse or say “I can’t…” or “I don’t know…” say “Look at the picture. Tell me what happened here”. Turn to the next page if the child still refuses and continue with prompts as required.
	Scoring: Include responses to prompts. Exclude meta-narrative comments and questions, and any extraneous comments.

Table C-3. CAT narrative prompts

	Prompts for getting started: For children who refuse to start or say “I can’t…” or “I don’t know…” do the following:
1	Say “Tell me a story about what you see in the picture” or “Tell me what happened”.
2	If a child still refuses, say “Tell me how the cat got down from the tree”.
	Prompts for continuing: If a child stops, without indicating that they have ended the narrative, (or has described the picture up to the point of the “problem”, of the cat being stuck in the tree and then seems not to be able to go on further) do the following, in order:
1	Wait for 3 seconds.
2	If there is no additional information offered, say “Tell me more!”
3	If they offer no further information, say “Tell me what happened next?”
4	If they do not offer any more say something like “Tell me how the cat got down from the tree” or a similar relevant comment.
5	If they offer more and then stop without indicating that they have ended the narrative, say “Keep going, and remember to tell me when you’ve finished the story”. (Some children may need to be asked if they have finished.)
6	Congratulate all children on their narrative (e.g., “Terrific! You told me a lovely story.”)
	Scoring: Exclude all utterances in response to and following the 2nd “Getting started” prompt or the 3rd “Continuing” prompt. Exclude meta-narrative comments and questions, and any extraneous comments.

Note: CAT prompts adapted from James (1999).

Table C-4. Background information sheet

This information may be completed by a speech pathologist or teacher together with the parent/ guardian. This information will be used for making appointments and interpreting the research data only. Complete confidentiality is assured.

Name of Child: ______________________________________ DoB: ________________________
Home address: ____
Phone: ____
Parent/Guardian Names: ____

Preferred appointment time: (please tick)

Wednesday	am	Thursday	am	Friday	am
	pm		pm		pm
	after school		after school		after school

Preferred Location: ☐ School/Preschool ☐ Home ☐ FMC
Preschool/School: ____ Phone: ________
Address:____
Director/Principal: ____

Age of first words (if known): ___________________ (Other than mum, dad)
Age of first simple sentences, combining two words (if known): _____________________

Date of first assessment from a speech pathologist: _________________ (any agency)

Previous assessment with CELF-P:
[ ] Within previous six months Results attached: [ ] Yes [ ] No
[ ] More than six months ago [ ] Not ever administered

Previous IQ or ability test:
[ ] Yes Name of test: ____
Results of test: Non-verbal Ability ________ Verbal Ability _________
Date of test: ___________________________
[ ] No

Hearing status:
[ ] Normal hearing [ ] Normal hearing with history of fluctuating conductive loss
NB Children with a permanent loss of more than 25 dB cannot be included in this research.

____
Signature of referring teacher or speech pathologist Date

____
Name of referring teacher or speech pathologist Phone contact

____
Signature of parent/guardian Date

APPENDIX D: CODING CONVENTIONS FOR MORPHOSYNTAX

Table D-1. Transcription entry conventions

Issue	*Resolution/Example*
Discourse markers, calling etc	well, mum - when not followed by a pause are attached to the following utterance, as a word.
Affirmations	‘yeah’ & ‘yep’ transcribed as ‘yes’, on separate utterance lines. ‘mm’, ‘aha’ transcribed as non-verbal
Negations	‘nah’ & ‘nup’ transcribed as ‘no’, on separate utterance lines ‘uhuh’ transcribed as non-verbal
and then	transcribe as one word of two morphemes - she jumped and/then she fell over.
I don’t know	Transcribed as one word when used as a single response. Transcribed as separate words when part of a longer utterance, eg, “I don’t know where that is.”
Compound words and phrases	Transcribed as one word, e.g., mrsbrown, seeyalater

Table D-2. Additional bound morpheme transcription and coding conventions

Code	*Explanation*	*Example*
/’m[COP]	contracted first person copula;	I/’m happy
/’s[COP]	contracted singular copula;	he/’s a monkey
/’re[COP]	contracted plural copula;	they/’re silly
/’m[AUX]	contracted first person auxiliary BE;	I/’m eating it all.
/’s[AUX]	contracted singular auxiliary BE	he/’s running
/’re[AUX]	contracted plural auxiliary BE;	they/’re staying here.
/’sD[AUX]	contracted singular auxiliary DO	where/’sD this go?
/’dD[AUX]	contracted past auxiliary DO	where/’dD it go?
/’ve[AUX]	contracted auxiliary HAVE	I/’ve put it away
/’sH[AUX]	contracted 3rd person auxiliary HAVE	he/’sH got two
/’dH[AUX]	contracted past auxiliary HAVE	he/’dH gone already.
/’ll[MOD]	contracted modal *will*	she/’ll eat it
/’dW[MOD]	contracted *would*;	I/’dW like to.
/’sU	contracted *us*;	eg let/’sU go

Note: Adapted from Caygill (1998)

Table D-3. Word level morphosyntactic coding conventions

Code	*Explanation*	*Example*
[EP:__]	pronoun error;	him[EP:he] went away.
[EV:__]	verb error	The man felled[EV:fell] down.
[EW:__]	other word level error;	a[EW:the] children are coming.
[AUX]	auxiliary	he was[AUX] jumping high.
[COP]	copula	that is[COP] awful.
[MOD]	modal	he will[MOD] come tomorrow.
[VERB]	lexical verb	eat[VERB]; think/ing[VERB]
[DET]	determiner, articles only coded	the[DET] ball is dirty.

Table D-4. Utterance level morphosyntactic coding conventions

Code	*Explanation*	*Example*
[EU]	utterance error: unclear which word(s), unusual syntactic errors, unusual use of inflections	
[EU:IR]	no interrogative reversal, when required	he can come?
[EU:SEM]	error of semantics or vocabulary or topic maintenance;	'he saw aeroplane writing' when talking about a picture of a dog falling out of a window.
[EU:SEQ]	clearly a word order error	
[S1]	Single main clause (exclude single words, fragments and separated phrases). Commands of two or more words also counted as a single main clause.	I like to eat potatoes and gravy every night. Look at the ball!
[S2]	Main plus one embedded or subordinate clause	I like the vase that's on the top shelf.
[S3]	Main plus two embedded or subordinate clauses	The boy who went outside was feeling sick because he had eaten mouldy tomatoes.
[ELIPS]	Utterance with appropriate ellipsis – i.e., response to a question or follow-on from a previous utterance	E Where did it go? C over there [ELIPS]. E so it's~ C in there [ELIPS].
[FR]	Utterance of two or more words that is not a complete clause, and is not elliptical	Going in the car.
[YN]	Yes, no or okay	

APPENDIX E: CODING CONVENTIONS FOR NARRATIVE STRUCTURE

Table E-1. Non-goal directed narrative components

Component	*Description*	*Examples*
Unclassifiable [U]	Utterance does not fulfil a definable function: Yes/no responses Unintelligible or abandoned utterances with insufficient information.	well, now he is> boy x x.
Labels [L]	Nominal references to characters and objects that do not fulfil a setting function or are very limited in their descriptive function. Often superfluous to the narrative.	cat leaves naughty dog a boy
External States [ES]	Descriptions of the narrative environment, such as weather or location. Descriptions of characters and their locations. Character questions reflecting Labels or External States	there are leaves on there are they branches? they have yellow hair the cat is on it here it was night time
Internal States [N]	Descriptions of characters' thoughts, desires, emotions, or physiological states, such as hunger or sickness. Character questions reflecting Internal States.	I wanna get down he wants a drink that boy very cross boy say "why you sad cat?"
Actions [AC]	Descriptions of the actions of a character.	he find some milk cat comes down they fell in the water he said "sh"
Natural Occurrences [T]	Changes in the environment, such as a violent thunderstorm.	the branch fell down it smelled yukky
Question Identity [QL]	Character question reflecting Label	who's there?
Question Location [QP]	Character question reflecting location, physical environment, external states.	where are you? where is it?
Question Action [QA]	Character questions reflecting Actions.	what was he doing?

Note: Modified from Hedberg and Westby (Hedberg & Westby, 1993). The above apply when the element can not be attributed the status of a true narrative component (e.g., some questions and yes/no responses may constitute narrative components in a conversational style narrative; "Is the frog in here? No." may imply a search attempt and a consequence of not finding the frog.)

Table E-2. Goal directed narrative components

Component	*Description*	*Examples*
Setting : (S)	Introduction of the narrative context:	
Character [SC]	Introduction of the character(s), by lexical label or given names. Descriptions of the character(s). Usually at the beginning of the narrative or as their roles emerge during the narrative.	once the boy had a frog and a pet dog. OUAT there was a little grey cat.
Social/Physical [SP]	The social and/or physical context where the narrative and its events take place.	the owl lived there. the boy was sleeping in his bed. he found a frog and put in a jar. he had supper ready
Temporal [ST]	The time when the narrative and its events take place.	one day…. when he was asleep…. that night…..
Initiating Event (IE)	The situation or problem to which a character must respond:	
Natural Occurrence [IEN]	A change in the physical environment, usually not caused by animate beings – storms, floods, earthquakes.	
Action [IEA]	An activity by a character that provokes a response from another character.	the cat climbed the tree. the cat was stuck in the tree. the frog hopped out. the frog escaped.
Internal Event [IEI]	A character's perception of an external event (seeing or hearing), desire, or change in physiological state.	he didn't see the frog in the jar. he wanted to get down.
Response:	The psychological state of the character after the initiating event:	
Internal State [IRA]	Affective Response. Any type of emotional response – happiness, sadness, anger, despair.	the boy was cross he was scared he might fall
[IRG]	Goal. Reference to the character's intended behaviour.	the moose tried to take him away the girl said "I will help you" "we need to look behind the bridge" he wanted his frog.
[IRC]	Cognition. Reference to the character's thoughts and suppositions – verbs such as 'knew, remembered, thought, realised'.	"I wish my frog was here." "it might be in here." he thinked his frog might be in there.

Table E-2. Goal directed narrative components (cont)

Component	*Description*	*Examples*
Internal Plan (IP)	A character's strategy for attaining a goal:	(Possible examples)
[IPC]	Cognition. Thoughts about the situation or possible obstacles to the main goal, hypothesised activity, or consequences of behaviour.	They thought dad might help. The boy and his dog decided they would look for the frog in the forest.
[IPS]	Subgoal. Secondary goals leading to a main goal (may include if-then concepts).	The children got a ladder so they could get high enough to reach the cat.
Behaviour [B]	A non-goal directed behaviour or action in response to the initiating event.	The boy and the girl looked at the cat. They were walking. The boy jumped out of bed.
Attempt [A]	What the character does to reach the goal.	they called "help". daddy climbed up the tree. he looked in the hole. he called "frog, where are you"?
Consequence (C)	The character's success or failure in achieving a goal, (may be a direct result of an initiating event):	
Natural Occurrence [CN]	A change in the physical environment, usually not caused by an animate being.	the branch broke.
Action [CA]	Physical activities carried out by animate characters that attain the goal.	the cat fell down. it climbed down. they couldn't find it.
End State [CE]	The final state of the environment or characters.	it's still up in the tree. there was a beaver in the hole.
Obstacle [O]	An interruption to attempts to resolve the problem or attain the goal, leading to further attempt(s).	but they couldn't get it down then a reindeer came and took him away. An embedded Action or Reaction Sequence may be an interruption.
Reaction (R)	The character's feelings, thoughts or actions in response to the consequence of attaining or not attaining a goal:	
Affect/Internal State [RA]	The character's emotional or physiological state.	she was too scared to move
Cognition [RC]	The character's thoughts.	they thought they were going to sink.
Behaviour [RB]	Actions that result from the consequence or emotional response to it.	the boy took the frog home.

Table E-2. Goal directed narrative components (cont)

Component	*Description*	*Examples*
Ending [E]	A statement announcing the conclusion of the narrative.	
Simple	A brief statement announcing that the narrative has ended.	“the end”; “that’s it” that’s the end of the narrative.
Expanded	A summary of the narrative, a moral or general principal.	they lived happily ever after.

Note: Modified from Hedberg and Westby (Hedberg & Westby, 1993).

Table E-3. Narrative levels and descriptors

Level		*Essential Characteristics*
0	Refusal	Child refuses to attempt narrative-telling task.
1	Isolated Description	Labelling (or description) of characters, objects, environment and/or actions but there are no relationships between them. No story grammar elements.
2	Descriptive Sequence	Content of statements is thematically related to characters, objects, environment or actions but there is no temporal order. No story grammar elements.
3	Action Sequence	Actions are described chronologically (may be an unplanned temporal sequence) but are not causally related or ordered. There may be a central character or theme but there are no relationships among the characters. No story grammar elements.
4	Reactive Sequence	Events begin to be chained, with an action or event automatically causing other changes, but there is no planning or goal directed behaviour. Narrative has at least an Initiating Event (IE) and a Consequence (C). May have a setting and an ending.
5	Fragmented Episode	Evidence of goal directed behaviour but the narrative is not resolved, the resolution is unrelated to the goal or the initiating event is not stated. Narrative has an IE and Attempt (A) or; A or Internal Goal and C.
6	Abbreviated Episode	Central character(s) engage in goal directed or intentional behaviour (centring and chaining; cause and effect relationships are evident). Planning is not explicit and must be inferred. Narrative has an IE, Internal State (IS) or A, and C. May also have a Setting (S), Reaction (R) to Consequence and an Ending (E).
7	Complete Episode	Includes all elements of an abbreviated episode and also includes evidence of character internal planning (IP).
8	Complex Episode	Narrative includes Obstacles and multiple attempts to reach a goal, entailing more than one consequence.
9	Multiple Episodes: RS	Two or more sequentially ordered episodes: One episode is either an abbreviated or complex episode, with one or more chained reactive sequences.
10	Embedded Episode: RS	Two or more episodes: The first episode is interrupted by a second episode, and then resumes, after the second episode is completed. One episode is either an abbreviated or complex episode, with one or more reactive sequences.
11	Multiple Episode: EP	Two or more sequentially ordered episodes: A chain of episodes at the abbreviated or complex episode level.
12	Embedded Episode: EP	Two or more episodes: The first episode is interrupted by a second episode, and then resumes, after the second episode is completed. All episodes are either abbreviated or complex episodes.
13	Multiple Episode: Plan	Two or more sequentially ordered episodes, with evidence of IP.
14	Embedded Episode: Plan	Two or more episodes, first interrupted by a second which resumes, with evidence of IP.
15	Interactive Episode	Describes a set of events from the perspective of two or more characters, with the characters goals, plans, attempts and/or reactions influencing each other. Two or more of the following story grammar elements are present for each of two or more characters: IS, A or R.
16	Interactive Episode: Plan	Perspective of two or more characters includes an IP.

Note: Modified from Hedberg & Westby (1993), Hughes et al. (1997), James (2001), Owens (1996), and Saliba (2001)

Table E-4. Narrative level decision tree

Are there relationships between the labelled items?	NO →	Isolated Description
YES ↓		
Does the narrative have a temporally related sequence of events?	NO →	Descriptive Sequence
YES ↓		
Does the narrative have a causally related sequence of events?	NO →	Action Sequence
YES ↓		
Does the narrative imply goal-directed behaviour?	NO →	Reactive Sequence
YES ↓		
Is planning explicit?	NO ↓	
YES ↓	↓	

Can each of IE, IR or A, and C be identified?	NO →	Incomplete Episode	Can each of IE, IR or A and C be identified in the main plot?	NO →	Fragmented Episode
YES ↓			YES ↓		
Does the narrative have an obstacle?	NO →	Complete Episode	Does the narrative have an obstacle?	NO →	Abbreviated Episode
YES ↓			YES ↓		
Does the narrative have more than one episode?	NO →	Complex Episode	Does the narrative have more than one episode?	NO →	Complex Episode (no plans)
YES ↓			YES ↓		
Does the narrative have an embedded or interactive episode?	NO →	Multiple Episode	Does the narrative have an embedded or interactive episode?	NO →	Multiple Episode (no plans)
YES ↓			YES ↓		
Is an episode interrupted by a second episode and then resumed?	YES →	Embedded Episode	Is an episode interrupted by a second episode and then resumed?	YES →	Embedded Episode (no plans)
Does the narrative describe a set of events from the perspective of two or more characters?	YES →	Interactive Episode	Does the narrative describe a set of events from the perspective of two or more characters?	YES →	Interactive Episode (no plans)

Note: Modified from (Hedberg & Westby, 1993; Hughes et al., 1997; James, 2001; Saliba, 2001)

APPENDIX F: CODING CONVENTIONS FOR CONTENT

Table F-1. Information score guidelines for FROG narrative

Page	Item	Score
1.	night	
	boy	
	dog	
	bedroom	
	frog	
	in a jar	
	SubTotal	/ 6
2.	boy/he } they	
	dog }	
	sleep/asleep/in bed	
	frog	
	climb/hop/got	
	out	
	SubTotal	/ 6
3.	morning	
	boy/he } they	
	dog }	
	woke up	
	frog	
	gone/not see/not there	
	SubTotal	/ 6
4.	boy/he } they	
	dog }	
	look	
	frog	
	boot	
	jar/container	
	SubTotal	/ 6
5.	boy/he } they	
	dog }	
	look out	
	window	
	call/said/shout	
	"where are you?"	
	SubTotal	/ 6
6.	dog	
	fell out/jumped	
	jar on (his) head	
	SubTotal	/ 3
7.	jar smashed/broke	
	boy/he	
	pick up/hold/cuddle	
	dog	
	cross/ naughty	
	SubTotal	/ 5

Page	Item	Score
8.	boy/he } they	
	dog }	
	went/walk	
	forest/wood/outside	
	look for/search	
	frog	
	call/said/shout	
	"where are you?"	
	SubTotal	/ 8
9.	boy/he	
	look	
	hole	
	ground	
	SubTotal	/ 4
10.	gopher (*)	
	jump/came out	
	scare	
	dog	
	bark	
	beehive/bees	
	tree	
	shook/jump	
	SubTotal	/ 8
11.	beehive	
	fell/down	
	ground	
	bees	
	flew out	
	boy/dog	
	look	
	tree	
	hole	
	SubTotal	/ 9
12.	owl (*)	
	jump/came out	
	scare/chase	
	boy/he	
	fell	
	dog	
	ran	
	bees	
	chase	
	SubTotal	/ 9

Table F-1. Information scoring guidelines for FROG narrative (cont)

Page	Item	Score
13.	owl	
	flew (away)/chase	
	boy	
	hiding/bottom	
	rock	
	SubTotal	/ 5
14.	boy/he	
	climb	
	rock	
	call/said/shout	
	"where are you"?	
	SubTotal	/ 5
15.	boy/he	
	caught/hang	
	deer (*)	
	antlers	
	SubTotal	/ 4
16.	deer	
	carried/ran (away)	
	boy/him	
	dog	
	ran	
	SubTotal	/ 5
17.	deer/moose	
	threw/drop/push	
	boy/him } them	
	dog }	
	fell/off/down	
	cliff/hill	
	SubTotal	/ 6
18	boy/he } they	
	dog }	
	fell/into/landed	
	pond/water	
	SubTotal	/ 4
19.	dog	
	on boy's/his head	
	listen/heard	
	sound of frog	
	SubTotal	/ 4
20.	boy/he	
	said	
	"shh"/quiet	
	SubTotal	/ 3
21.	boy/he } they	
	dog }	
	look/climb	
	over/behind	
	log/wood	
	SubTotal	/ 5
22.	boy/he } they	
	dog }	
	saw/found	
	frog(s)	
	SubTotal	/ 4
23.	happy	
	mum/dad/big	
	little/baby/family	
	frog(s)	
	SubTotal	/ 4
24.	boy/he	
	took/got/carry/pickup	
	frog	
	home	
	"bye"	
	SubTotal	/ 5
	TOTAL	/ 130

Note: Cohesive pronominal reference to dog, frog and others gain an information score. Inclusion of dog with boy as 'they' gains an in formation score. Adapted from Pomper et al. (1995)

Table F-2. Information scoring guidelines for CAT narrative

Category	Item	Score
Character	cat	1
	boy/man	1
	girl/lady	1
	children/people (2)	1/2
	mum	1
	dad	1
	other person(s) (e.g., fireman, neighbour)	1
	names	1
	relationships (e.g., brother, friends, twins)	1
	SubTotal	/10
Object	tree	1
	branch	1
	drink/milk	1
	bottle	1
	bowl	1
	food	1
	hand	1
	SubTotal	/ 7
Place	in the yard } or other appropriate place	1
	in/to the park/forest }	
	into the girl's/boy's hand/arm(s)	1
	went home/inside	1
	SubTotal	/ 3
Time	once upon a time	1
	one day/morning/afternoon	1
	after/before (relevant event)	1
	SubTotal	/ 3
Description	description of tree (e.g., didn't have many leaves; old)	1
	height of tree/branch or difficulty of tree for climbing	1
	description of branch (e.g., big brown branch)	1
	description of cat (e.g., little grey cat)	1
	description of girl (e.g., pigtails, yellow/blonde hair)	1
	description of boy (eg., blue t-shirt)	1
	hands up in the air	1
	other description (e.g., a sunny day)	1
	SubTotal	/ 8
Event/Action *Natural:*	the tree broke	1
	branch broke/ cracked/ about to break	1
	other relevant event	1
	SubTotal	/ 3
Event/Action *Cat as Agent:*	in the tree/ on the branch	1
	stuck in the tree/branch	1
	climbed/ran up a tree	1
	wobbled/ nearly fell	1
	drank (the milk) (or couldn't)	1
	ate (the food) (or couldn't)	1
	tried to get/climb down	1
	SubTotal	/ 7

Table F-2. Information scoring guidelines for CAT narrative (cont)

Category	Item	Score
Event/Action	were walking/ went past the tree	1
	lost their cat	1
Boy/Girl as	saw/ heard the cat	1
Agent:	waving hands	1
	calling/shouting/talking to cat	1
	holding (food, drink)	1
	got the cat some food	1
	(trying to) feed/offered/gave food to the cat	1
	(trying to) feed/offered/gave drink/milk to the cat	1
	tried to get the cat (down)	1
	(tried to) climbed up the tree	1
	didn't have a ladder	1
	obtained a ladder	1
	climbed up a ladder	1
	jumped down	1
	obtained/called a parent (e.g., shouted to mum)	1
	SubTotal	/ 16
Event/Action	were walking/ went past/to the tree	1
	lost their cat/ put cat in the tree	1
Other Person as	heard the cat	1
Agent:	holding (food, drink)	1
	got the cat some food	1
	(trying to) offered/gave food to the cat	1
	(trying to) offered/gave drink/milk to the cat	1
	(tried to) get the cat (down)	1
	(tried to) climbed up the tree	1
	didn't have a ladder	1
	obtained a ladder	1
	climbed up a ladder	1
	obtained/called another agent (e.g., fire brigade)	1
	SubTotal	/ 13
Goals/Desires/	wanting to get/climb down	1
Thoughts	not wanting to climb down/ move (e.g., she didn't want to	1
Cat as Agent:	move)	1
	wanting food or drink	
	SubTotal	/ 3
Goals/Desires/	tried to help	1
Thoughts	want to feed (the cat)/ the cat to eat/drink	1
	want the cat to come down	1
Boy/Girl as	want a pet	1
Agent:	thought the cat might fall down	1
	SubTotal	/ 5
Feelings	scared/worried	1
Cat as Agent:	upset	1
	sad	1
	thirsty	1
	hungry	1
	other appropriate feeling	1
	SubTotal	/ 6
Feelings	scared/worried	1
Boy/Girl/Other	upset	1
Person as Agent:	sad	1
	love/like	1
	other appropriate feeling	1
	SubTotal	/ 5

Table F-2. Information scoring guidelines for CAT narrative (cont)

Category	Item	Score	
Plans	decisions – decided to climb up/down	1	
Cat as Agent:	methods – thought/know how to get down/ if…then…	1	
	SubTotal		/ 2
Plans	decisions – decided to climb up/down	1	
Boy/Girl/Other	decisions – decided to get help/ladder	1	
Person as Agent:	methods – thought/know how to get down/ if…then…	1	
	SubTotal		/ 3
Dialogue	response (e.g., "miaw")	1	
Cat as Agent:	attempt (e.g., "help"; "can you get me down?")	1	
	SubTotal		/ 2
Dialogue	instructions to cat (e.g., "come down"; "move over", "slide down here", "jump")	1	
Boy/Girl as	response to cat (e.g., "no"; "you'll fall down")	1	
Agent:	offer food to cat (e.g., "here's your food cat")	1	
	response/request to parent/other person (e.g., "mum, the cat's stuck in the tree")	1	
	instruction/response to other child	1	
	SubTotal		/ 5
Dialogue	other person response/request/instruction to cat	1	
Other Person as	other person response/request/instruction to child (e.g., "I'll get him down"; "he can stay in the tree")	1	
Agent:			
	SubTotal		/ 2
Consequence	didn't/couldn't/wouldn't get down	1	
	climbed/jumped down	1	
Cat as Agent:	fell (down) out of the tree	1	
	was down/out of the tree	1	
	(still/stuck) in the tree	1	
	climbed (back) up the tree	1	
	scratched	1	
	SubTotal		/ 7
Consequence	didn't/couldn't/wouldn't climb	1	
	didn't/couldn't/wouldn't get the cat down	1	
Boy/Girl as	got the cat down	1	
Agent:	jumped/climbed down	1	
	fell down	1	
	found cat	1	
	catch cat	1	
	SubTotal		/ 7
Consequence	didn't/couldn't/wouldn't climb	1	
	didn't/couldn't/wouldn't get the cat down	1	
Other Person as	couldn't come/help (& reason)	1	
Agent:	got the cat down	1	
	jumped/climbed down	1	
	fell down	1	
	catch cat	1	
	SubTotal		/ 7
Reaction	pat/cuddle the cat	1	
	take cat home/inside/to bed	1	
	cared/gave food/milk (after getting cat down)	1	
	SubTotal		/ 3
	TOTAL		/ 127

Note: Each information item may be scored only once. That is, only novel information is scored, not repeated information. However, Objects may be scored in addition to their reference in another scorable context.

Table F-3. Key event score guidelines for FROG narrative

Narrative Component	Event	Score	
Initiating Event:	Frog leaves jar	1	
	Protagonists discover that frog is gone	1	
	SubTotal		/ 2
Attempt/Search:	Indicate that they are looking for frog inside the house	1	
	Indicate that they are looking for frog outside of the house	1	
	SubTotal		/ 2
Consequence:	Boy finds/sees frog(s)	1	
	Frog is the same frog as originally lost; or a substitute	1	
	SubTotal		/ 2
	TOTAL KEY EVENTS		/ 6

Note: Asking "frog, where are you" accepted as looking for frog. Key events are italicised. Adapted from Boudreau and Hedberg (1999)

Table F-4. Key event score guidelines for CAT narrative

Narrative Component	*Event*	*Score*	
Initiating Event:	Cat in tree; children see cat in tree	1	
	Cat stuck in tree; can't get down	2	
Attempt:	Indicate general attempts to get cat down: by cat, child or other person (e.g., tried to get it down, called out)	1	
	Attempt action to get cat down is specified (e.g., climbed the tree/ladder; called/coaxed the cat)	2	
Consequence/ Resolution:	Cat remains in tree/ can't get down	1	
	Cat gets/is brought down from tree	2	
	TOTAL KEY EVENTS		/ 6

APPENDIX G: CODING CONVENTIONS FOR COHESION

Table G-1. Conventions for coding cohesive devices

Type	*Validity*	*Cod e*	*Description*	*Example*
Lexical	Correct	L	Lexical reiteration of previously introduced character (including synonyms, superordinates, hyponyms).	'the *boy* had a frog. the *boy* went to sleep',
	Problematic	LD	Delayed lexical naming of character previously introduced only by pronoun.	'he's in a tree. he …. he ….. the *cat* was stuck'
		LU	Unclear, inconsistent, illogical or ambiguous lexical item	'*dog'* later referred to as '*frog'*
		LE	Lexical error – consistent misnaming	'*reindeer'* called a '*horse'*
Article Reference	Correct	AD	Use of definite article (with lexical item).	'*the* cat couldn't get down'
	Problematic	AI	Use of indefinite article (with lexical item).	'a boy call a frog' 'then *a* boy climb'
		AO	Omission of article, inappropriately.	'cat in tree.' 'cat can't get down.'
Pronoun Reference	Correct	PA	Pronoun reference to character previously introduced by lexical item (anaphora)	'the *cat's* stuck in a tree'. '*he* couldn't get down'
	Exophoric	PM	Pronoun reference to character previously introduced by pronoun, that is implicit in the shared picture context and associated actions or states (exophora).	'he …. *he* picked up the dog'
	Problematic	PU	Unclear, inconsistent or ambiguous pronoun reference that cannot be retrieved from the text or implied from the context.	'h*e* looking for him. *I* can't find him. *he* look in there'
		PE	Pronoun errors - gender confusions or switching; incorrect marking of number, gender, person or case	'the cat... 's*he* can't get down. h*e* said miaw.'
Demonst. Reference	Correct	D	Use of demonstrative.	'get *that* cat down'
	Exophoric	DM	Use of demonstrative where the identity of the character is implied from the picture context	
	Problematic	DU	Inappropriate or unclear use of demonstrative	'*that* his friend'
Compar. Reference		C	Us of a comparative	'the *other* frogs stayed behind'
Substit'n	Correct	S	Use of a nominal substitution for character previously introduced by lexical item.	'he saw the frogs. he picked *one* up'
	Correct	SM	Use of a nominal substitution where the identity of the character is implied from the picture context.	
	Problematic	SU	Unclear substitution	'that *one* going up'

Table G-1. Conventions for coding cohesive devices (cont)

Character Identity - Cohesive Ties (cont)				
Type	*Validity*	*Code*	*Description*	*Example*
Ellipsis	Correct	E	Ellipsis of character name/reference from clause, including attached clause following identity establishment earlier in the c-unit.	'the boy looked in the hole and []called "frog"…. 'he picked up the smallest [].'
	Problematic	EU	An ellipsis strategy is used, but the character identity is unclear because the identity was ambiguous or omitted from the previous clause.	'he go in and [] fall off again'
Omission	Problematic	RO	Character reference or agent of proposition is omitted.	'* jump out the bottle'

Note: Adapted from Halliday and Hasan (1976)

Table G-2. Adequacy for type of cohesive tie opportunity

	Complete	*Exophoric*	*Erroneous*
Lexical	Use of consistent lexical item to name or identify character, that may include use of a synonym (e.g., boy, kid).	n/a	Character is incorrectly named or identified. Character identified is not depicted and is unclear, too general, ambiguous or illogical for the textual context.
Pronominal	Use of pronoun that refers to a lexical identification made earlier in the text.	Use of pronoun reference for an identity that is implicit from the picture context and proposition.	Use of pronoun whose identity is unclear or ambiguous.
Article	Use of definite article with lexical item.	n/a	Use of indefinite article with lexical item; omission of article or demonstrative.
Substitution	Use of substitution that refers to a lexical identification made earlier in the text.	Use of substitution for an identity that is implicit from the picture context and proposition.	Use of substitution where the identity is unclear or ambiguous.
Ellipsis	Ellipsis of character identity that is clear from previous clause	n/a	Use of ellipsis strategy in the second clause, without identification in the first clause.
Omission	n/a	n/a	The c-unit omits identification of character who is agent of the proposition.

Note: Adapted from Halliday and Hasan (1976) and Liles (1985)

Table G-3. Acceptable animal names for FROG narratives

Page	Animal	Acceptable Names	Unacceptable Names
11.	gopher	animal, gopher, mole, wombat, rat, possum, squirrel, any small animals	dog, bear, frog
14	owl	bird, owl, eagle, cocky, any medium-sized-flying-tree-dwelling bird	emu, sparrow
18.	deer	deer, reindeer, moose, goat, any antlered animal	cow, horse

APPENDIX H: STATISTICAL TABLES FOR RESULTS

Table H-1. Pairwise comparisons for number of utterances

Measure	*Value*	*Group Comparisons*					
		LI	*LI & LM*		*LI & AM*		*Dev.*
		NLI-SLI	*NLI-LM*	*SLI-LM*	*NLI-AM*	*SLI-AM*	*LM-AM*
NAR Combined no. of c-units	*Z*	-.808	-1.949	-.907	**-3.619**	**-2.601**	-1.954
	p	.429	.053	.373	< **.001**	**.007**	.048
FROG no. of c-units	*Z*	-1.476	-2.343	-.634	**-3.635**	-2.120	-2.192
	p	.147	.018	.532	< **.001**	.033	.027
CAT no. of c-units	*Z*	**-2.677**	-1.184	-1.610	-.766	**-3.248**	-2.001
	p	**.007**	.244	.110	.451	**.001**	.049

Note. Values, in this and all subsequent tables, entered in bold were statistically significant. The group comparisons are clustered, from left to right: LI = comparison between the SLI and NLI groups; LI & LM = comparisons between the LM group and each LI group; LI & AM = comparisons between the AM group and each LI group; Dev. = comparison between the AM and LM groups.

Table H-2. Median number of obligatory contexts (OCs) for grammatical morpheme composite measures in conversations and narratives

Variable	*Group*							
	SLI		***NLI***		***AM***		***LM***	
	CON	*NAR*	*CON*	*NAR*	*CON*	*NAR*	*CON*	*NAR*
FTC	64	19	91	16	112	31	87	23
	(44)	(17)	(69)	(10)	(86)	(15)	(56)	(12)
FTIC	10	5	10	1	22	11	12	2
	(10)	(6)	(13)	(3)	(18)	(8)	(13)	(3)
NTVC	32	5	40	6	50	6	40	7
	(22)	(9)	(15)	(7)	(45)	(7)	(33)	(6)
NPC	63	26	82	22	112	42	85	28
	(66)	(25)	(40)	(17)	(65)	(26)	(65)	(14)
NPIC	12	4	11	1	21	5	13	3
	(15)	(4)	(12)	(4)	(15)	(4)	(14)	(3)

Note: Interquartile ranges are shown in parentheses.

Table H-3. Pairwise comparisons of accuracy for grammatical morpheme composite measures in conversations and narratives

		Group Comparisons					
		LI	*LI & LM*		*LI & AM*		*Dev.*
Measure	*Value*	*NLI-SLI*	*NLI-LM*	*SLI-LM*	*NLI-AM*	*SLI-AM*	*LM-AM*
CON FTC	*Z*	-1.866	-1.584	-.100	**-3.881**	**-4.653**	**-4.669**
	p	.093	.187	.960	**< .001**	**< .001**	**< .001**
CON NVTC	*Z*	-.576	-1.271	-1.867	**-4.541**	**-4.411**	**-4.808**
	p	.427	.213	.107	**< .001**	**< .001**	**< .001**
CON NPC	*Z*	-.760	-1.547	-.600	**-3.126**	**-3.481**	**-3.365**
	p	.466	.130	.561	**.001**	**< .001**	**< .001**
NAR FTC	*Z*	-1.613	**-2.430**	-.208	**-4.661**	**-3.274**	**-3.993**
	p	.112	**.012**	.845	**< .001**	**.001**	**< .001**
NAR NTVC	*Z*	-.180	-.324	-.500	**-3.389**	**-3.079**	**-3.625**
	p	.874	.762	.634	**.002**	**.004**	**< .001**
NAR NPC	*Z*	-2.237	-.963	-1.455	**-4.885**	**-2.981**	**-5.097**
	p	.023	.349	.149	**< .001**	**.003**	**< .001**

Table H-4. Pairwise comparisons of clausal complexity measures and utterance errors for conversations and narratives

		Group Comparisons					
		LI	*LI & LM*		*LI & AM*		*Dev.*
Measure	*Value*	*NLI-SLI*	*NLI-LM*	*SLI-LM*	*NLI-AM*	*SLI-AM*	*LM-AM*
CON Fragments	*Z*	-.990	-1.032	0	**-3.384**	**-3.353**	**-3.052**
	p	.333	.316	1.0	**< .001**	**< .001**	**.002**
CON Single clause	*Z*	-1.175	-.111	-1.433	-1.683	**-3.449**	**-2.504**
	p	.253	.932	.162	.092	**< .001**	**.011**
CON Two clauses	*Z*	-.898	-.497	-.667	**-2.605**	**-3.449**	**-3.130**
	p	.386	.638	.517	**.009**	**< .001**	**.001**
NAR Fragments	*Z*	-1.221	-1.758	-2.813	**-3.810**	**-3.257**	**-5.006**
	p	.232	.086	.004	**< .001**	**.001**	**< .001**
NAR Single clause	*Z*	-.991	-1.277	-2.813	**-2.767**	**-2.262**	**-4.169**
	p	.336	.211	.003	**.006**	**.023**	**< .001**
NAR Two clauses	*Z*	-.492	-1.189	-.801	**-2.554**	**-3.165**	**-4.203**
	p	.631	.239	.427	**.010**	**.002**	**< .001**
NAR Subordination index	*Z*	-.350	-.260	-.291	**-2.412**	**-2.794**	**-2.256**
	p	.742	.808	.772	**.014**	**.005**	**.023**
CON utterance errors	*Z*	-1.498	-2.301	**-3.213**	**-3.121**	**-3.881**	**-.898**
	p	.143	.019	**.001**	**.002**	**< .001**	**.360**
NAR utterance errors	*Z*	-1.255	-.923	-2.103	-1.298	**-2.684**	-.512
	p	.214	.377	.032	.210	**.007**	.570

Table H-5. Pair-wise comparisons for narrative structural and organisation level and key event and information scores

Measure	*Value*	*LI*	*LI & LM*		*LI & AM*		*Dev.*
		NLI-SLI	*NLI-LM*	*SLI-LM*	*NLI-AM*	*SLI-AM*	*LM-AM*
FROG structural level	*Z*	-1.308	-1.335	**-3.672**	**-4.505**	**-3.510**	**-5.552**
	p	.201	.183	**< .001**	**< .001**	**< .001**	**< .001**
FROG organisation level	*Z*	-.347	**-2.965**	**-3.051**	**-3.709**	**-3.184**	**-5.475**
	p	.781	**.005**	**.002**	**< .001**	**.001**	**< .001**
FROG key event score	*Z*	-.764	**-2.544**	-1.523	**-3.581**	**-4.055**	**-5.069**
	p	.462	**.009**	.131	**< .001**	**< .001**	**< .001**
FROG information score percentage	*Z*	-1.912	-.756	**-2.720**	**-4.484**	**-3.483**	**-5.140**
	p	.058	.464	**.005**	**< .001**	**< .001**	**< .001**
CAT structural level	*Z*	-.071	-1.408	-1.448	**-3.437**	**-3.926**	**-4.662**
	p	.942	.163	.153	**< .001**	**< .001**	**< .001**
CAT organisation level	*Z*	-.730	-1.646	-1.288	**-3.389**	**-4.033**	**-4.575**
	p	.583	.216	.305	**.001**	**< .001**	**< .001**
CAT key event score	*Z*	-.719	-.044	-.981	**-2.635**	-2.247	**-2.972**
	p	.464	.970	.345	**.006**	.024	**.002**
CAT information score percentage	*Z*	-.515	-.657	-.173	**-3.537**	**-4.235**	**-4.172**
	p	.630	.528	.876	**< .001**	**< .001**	**< .001**

Table H-6. Median number of cohesive ties per c-unit (interquartile range in brackets)

Variable	*Measure*	*Group*			
		SLI	***NLI***	***AM***	***LM***
FROG cohesive ties per c-unit	Median	1.53	1.33	1.54	.98
	IQR	.67	.51	.54	.44
CAT cohesive ties per c-unit	Median	.59	.80	1.0	.50
	IQR	.50	.37	.99	.48

Table H-7. Pair-wise comparisons for adequacy of cohesive ties

Measure		*LI*	*LI & LM*		*LI & AM*		*Dev.*
		NLI-SLI	*NLI-LM*	*SLI-LM*	*NLI-AM*	*SLI-AM*	*LM-AM*
	Z	-1.705	-.682	**-2.717**	**-3.937**	**-3.034**	**-4.749**
FROG percentage complete ties	*p*	.097	.511	**.007**	**< .001**	**.002**	**< .001**
	Z	-1.635	-.497	-2.20	**-4.454**	**-4.193**	**-5.430**
FROG percentage erroneous ties	*p*	.114	.628	.026	**< .001**	**< .001**	**<.001**
	Z	-1.498	-1.419	**-2.850**	-1.311	-.433	**-3.130**
FROG complete lexical ties	*p*	.141	.163	**.003**	.198	.684	**.001**
	Z	-.208	-2.088	**-2.423**	**-4.237**	**-3.530**	**-5.271**
FROG complete pronominal ties	*p*	.843	.036	**.011**	**< .001**	**< .001**	**< .001**
	Z	-.139	-.018	-.400	**-2.650**	**-3.082**	**-4.042**
FROG erroneous pronominal ties	*p*	.896	.992	.704	**.009**	**.002**	**< .001**
	Z	-1.922	-.352	-2.054	**-2.719**	-.040	**-2.896**
CAT percentage complete ties	*p*	.055	.739	.042	**.006**	.977	**.003**
	Z	**-2.974**	-.799	**-3.086**	**-2.995**	-1.069	**-3.099**
CAT percentage erroneous ties	*p*	**.003**	.431	**.002**	**.003**	.294	**.001**
	Z	-.575	-1.147	-.596	-2.273	**-2.632**	**-3.295**
CAT complete pronominal ties	*p*	.587	.266	.585	.024	**.008**	**.001**

APPENDIX I: DISCRIMINANT FUNCTION ANALYSIS

Table I-1. Percentages and total number of children correctly classified from individual conversation sample variables

Variable(s)	*LI*	*TDL*
Morphosyntactic accuracy		
FTC	67.6% (23/34)	95.2% (20/21)
NTVC	73.5% (25/34)	95.2% (20/21)
Morphosyntactic complexity		
MLU	79.4% (27/24)	85.6% (18/21)
FRAG	64.7% (22/34)	76.2% (16/21)

Table I-2. Percentages and total number of children correctly classified from individual narrative sample variables

Variable(s)	*LI*	*TDL*	
Morphosyntactic accuracy			
FTC	67.6% (23/34)	95.2% (20/21)	
NTVC	38.5% (10/26)	100 (20/20)	
Morphosyntactic complexity			
FRAG	64.7% (22/34)	85.7% (18/21)	
Narrative			
FROG Organisation (ORG)	88.2% (30/34)	90.5% (19/21)	*
FROG Information score percentage (INFO)	91.2% (31/34)	85.7% (18/21)	*
FROG Percentage erroneous cohesive ties (ERRCOH)	73.5% (25/34)	95.2% (20/21)	
CAT Organisation (ORG)	88.2% (30/34)	76.2% (16/21)	
CAT Information score percentage (INFO)	91.2% (31/34)	85.7% (18/21)	*
CAT Percentage erroneous cohesive ties (ERRCOH)	46.7% (14/30)	80.0% (16/20)	

Note: * effective classification with at least fair specificity and sensitivity

Table I-3 Percentages and total number of children correctly classified for combinations of morphosyntactic variables from conversation and combined narrative samples

Variables	*LI*	*TDL*	
Conversation FTC & MLU	79.4% (27/34)	95.2% (20/21)	
Conversation FTC & FRAG	70.6% (24/34)	95.2% (20/21)	
Conversation FTC & NTVC	76.5% (26/34)	100% (21/21)	
Conversation MLU & FRAG	82.4% (28/34)	90.5% (19/21)	*
Narrative FTC & MLU	82.4% (28/34)	90.5% (19/21)	*
Narrative FTC & FRAG	73.5% (25/34)	90.5% (19/21)	
Narrative FTC & NTVC	76.9% (20/26)	95.0% (19/20)	
Narrative MLU & FRAG	73.5%(25/34)	81.0% (17/21)	

Note: * effective classification with at least fair specificity and sensitivity;

Table I-4. Percentages and total number of children correctly classified from combinations of narrative variables

Variable(s)	*LI*	*TDL*	
FROG ORG, INFO & ERRCOH	94.1% (32/34)	90.5% (19/21)	**
FROG ORG & INFO	91.2% (31/34)	85.7% (18/21)	*
FROG ORG & ERRCOH	85.3% (29/34)	90.5% (19/21)	*
FROG INFO & ERRCOH	91.2% (31/34)	95.2% (20/21)	**
CAT ORG, INFO & ERRCOH	93.3% (28/30)	80.0% (16/20)	*
CAT ORG & INFO	94.1% (32/34)	76.2% (16/21)	*
CAT ORG & ERRCOH	90.0% (27/30)	80.0% (16/20)	*
CAT INFO & ERRCOH	90.0% (27/30)	85.0% (17/20)	*
FROG & CAT ORG, INFO & ERRCOH	96.7% (29/30)	95.0% (19/20)	**
FROG & CAT INFO & ERRCOH	96.7% (29/30)	90.0% (18/20)	**

Note: * effective classification with at least fair specificity and sensitivity; ** very effective classification with good specificity and sensitivity

Table I-5. Percentages and total number of children correctly classified from combinations of conversation sample variables and FROG narrative measures

Variable(s)	*LI*	*TDL*	
Conversation FTC, NTVC, MLU & FRAG; FROG ORG, INFO & ERRCOH	91.2% (31/34)	95.2% (20/21)	**
Conversation FTC, NTVC; FROG ORG, INFO & ERRCOH	88.2% (30/34)	95.2% (20/21)	*
Conversation MLU & FRAG; FROG ORG, INFO & ERRCOH	94.1% (32/34)	95.2% (20/21)	**
Conversation FTC, MLU; FROG ERRCOH	79.4% (27/34)	100% (21/21)	
Conversation FTC, MLU; FROG INFO	91.2% (31/34)	90.5% (19/21)	**
Conversation FTC, MLU; FROG ORG	91.2% (31/34)	95.2% (20/21)	**

Note: * effective classification with at least fair specificity and sensitivity; ** very effective classification with good specificity and sensitivity

Table I-6. Percentages and total number of children correctly classified from combinations of conversation and CAT narrative contexts

Variable(s)	*LI*	*TDL*	
Conversation FTC, NTVC, MLU & FRAG; CAT ORG, INFO & ERRCOH	96.7% (29/30)	95% (19/20)	**
Conversation FTC & NTVC; CAT ORG, INFO & ERRCOH	93.3% (28/30)	100% (20/20)	*
Conversation MLU & FRAG; CAT ORG, INFO & ERRCOH	96.7% (29/30)	90.0 (18/20)	**
Conversation FTC, MLU; CAT ERRCOH	83.3% (25/30)	95% (19/20)	*
Conversation FTC, MLU; CAT INFO	94.1% (32/34)	95.2% (20/21)	**
Conversation FTC, MLU; CAT ORG	91.2% (31/34)	85.7% (18/21)	*

Note: * effective classification with at least fair specificity and sensitivity; ** very effective classification with good specificity and sensitivity

Table I-7. Percentages and total number of children correctly classified from combinations of narrative sample variables (inclusive of both FROG and CAT stories).

Variable(s)	*LI*	*TDL*	
Narrative FTC, ORG, INFO, & ERRCOH	96.7% (29/30)	100% (20/20)	**
Narrative FTC & ERRCOH	76.7% (23/30)	95.0% (19/20)	
Narrative FTC and INFO	91.2% (31/34)	90.5% (19/21)	**
Narrative FTC and ORG	85.3% (29/34)	90.5% (19/21)	*
Narrative MLU and ERRCOH	86.7% (26/30)	85.0% (17/20)	*
Narrative MLU and INFO	97.1% (33/34)	85.7% (18/21)	*
Narrative MLU and ORG	94.1% (32/34)	85.7% (18/21)	*

Note: * effective classification with at least fair specificity and sensitivity; ** very effective classification with good specificity and sensitivity

Table I-8. Percentages and total number of children correctly classified from combinations of conversation sample variables and both FROG and CAT narratives

Variable(s)	*LI*	*TDL*	
Conversation FTC, NTVC, MLU, FRAG; Narrative ORG, INFO, & ERRCOH	100% (30/30)	95% (19/20)	**
Conversation FTC, NTVC, MLU; Narrative ORG, INFO, & ERRCOH	100% (30/30)	100% (20/20)	***
Conversation FTC, NTVC; Narrative ORG, INFO, & ERRCOH	93.3% (28/30)	100% (20/20)	**
Conversation FTC; Narrative ORG, INFO, & ERRCOH	100% (30/30)	95% (19/20)	**
Conversation FTC, MLU; Narrative ORG, INFO, & ERRCOH	100% (30/30)	100% (20/20)	***

Note: ** very effective classification with good specificity and sensitivity; *** extremely effective classification with excellent specificity and sensitivity.

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