A Study of Inhibition in Preschool Children At Risk of Developmental Language Disorder

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Abstract

Background: For many years, research and practice have noted the impact of the heterogeneous nature of Developmental Language Disorder (DLD - also known as language impairment or specific language impairment) on diagnosis and assessment. Recent research suggests the disorder is not restricted to the language domain and against this background, the challenge for the practitioner is to provide accurate assessment and effective therapy. The speech and language therapist (SLT) aims to support the child and their carers to achieve the best outcomes. However, little is known about the experiences of the SLT in the assessment process, in contrast to other childhood disorders, yet their expertise is central in the assessment and diagnosis of children with language disorder.

The overall aims of the research were; firstly, to understand the issues in the diagnosis and assessment of children with language impairment and to synthesize the knowledge of SLTs working directly with children in this field; secondly, to investigate whether executive function abilities (i.e. inhibition and prospective memory) may be impaired in children at risk of developing DLD in the preschool period and thirdly, to investigate whether executive function tests correlate with a test of nonword repetition suitable for use with bilingual children.

Study 1 aimed to gain an in-depth understanding of the experiences of speech and language therapists involved in the assessment and diagnosis of children with DLD including the linguistic and nonlinguistic aspects of the disorder. Three focus groups were used to provide a credible and rich description of the experiences of SLTs involved in the assessment of DLD. The analysis of the data showed three main themes relating to the SLTs' experience in assessment and diagnosis of DLD. These themes were the participants' experiences of the barriers to early referral, factors in assessment and the concerns over continued future support. These findings informed the design of Study 2 which compared the inhibition abilities of typically developing preschool children, with monolingual preschool children and bilingual preschool children who had already been referred to specialist language units and were therefore classed as "at risk" of developing DLD. Three inhibition tasks were used (motor inhibition, verbal inhibition and self-control) along with a prospective memory task and a nonword repetition test. The results indicated that children deemed "at risk" of DLD performed significantly worse than typically developing children on all tasks. Correlational analysis revealed significant relationships between the nonword repetition test and inhibition in the typically developing group but different relationships were seen in the "at risk" groups. For the monolingual at risk group the association was with nonword repetition and verbal

inhibition but in the bilingual group, nonword repetition was associated with nonverbal inhibition. These findings suggest that inhibition deficits can be observed in children who are “at risk” of DLD but the nature of the deficit may differ in monolingual children compared to bilingual children. The results are discussed in terms of theory and implications for therapeutic practice.

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List of Acronyms

- ASD – Autism Spectrum Disorder
- CATALISE – Criteria and Terminology Applied to Language Impairments: Synthesizing the Evidence
- CCC- Children's Communication Checklist
- COST – Co-operation in Science and Technology
- DLD – Developmental Language Disorder
- DSM- Diagnostic and Statistical Manual
- ICD – International Classification of Diseases
- PLI – Pragmatic Language Impairment
- RCSLT – Royal College of Speech and Language Therapists
- SCD – Social Communication Disorder
- SD - Standard Deviation
- SLI – Specific Language Impairment
- SLT – Speech and Language Therapist
- TROG – Test for Reception of Grammar
- WHO – World Health Organisation

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Publications and Presentations

This research has been disseminated in the following publications and presentations:

Publications

1. "Assessment and diagnosis of Developmental Language Disorder: The experiences of speech and language therapists" (Thomas, Schulz & Ryder, 2019) accepted for publication in Autism and Developmental Language Impairments.

2. "Inhibition in Preschool Children at Risk of Developmental Language Disorder" (Thomas, Shipp & Ryder, 2019) submitted for review and publication to Child Language Teaching and Therapy.

Presentations

1. Oral presentation given to the Clinical Linguistics Seminar in the Department of English Language and Communication, University of Hertfordshire on 22nd March 2019.

2. Poster presentation at the research conference held by the School of Health and Social Work at University of Hertfordshire, 2nd May 2019.

3. Poster presentation at the research conference "Advances in Neurodevelopmental Conditions Across The Lifespan" at University of Hertfordshire, 4th June 2019.

CHAPTER 1

An Overview of Developmental Language Disorder

Chapter 1 outlines the theoretical basis for our current understanding of Developmental Language Disorder (DLD) and explains how this has informed the work reported in this thesis. This includes research on the early conceptualisation of DLD, why it is important to identify children with the disorder, diagnostic criteria, risk factors, co-morbidity, theories of DLD and the assessment of DLD. The chapter begins by describing why it is important to identify children with DLD and the details of the current classification systems. The risk factors associated with DLD are considered and the incidence of co-morbidity. Various theories which have been proposed to explain DLD are discussed and the theoretical basis for current assessment procedures. The chapter concludes with a description of the rationale for using qualitative and quantitative methods in the research.

The aims of the research were: firstly, to understand the issues in diagnosis and assessment of children with language impairment and to synthesize the knowledge of clinicians, teachers and SLTs working directly with the assessment and diagnosis of children with DLD; secondly to investigate whether executive function abilities (i.e. inhibition, prospective memory) may be impaired in children at risk of developing DLD in the preschool period and thirdly, to investigate whether executive function tests correlate with a revised test of nonword repetition suitable for use with bilingual children.

The disorder which is now known as DLD was previously known as Specific Language Impairment (SLI) as it was thought to be an impairment which was specific to language. Since the introduction of DSM V (American Psychological Association (APA), 2013), the term “specific” has been removed and Developmental Language Disorder and Social Communication Disorder are now the terms used. Reilly, Bishop and Tomblin (2014) and Reilly et al. (2014a, 2014b) support this removal of the previously used term. They have argued that there is little empirical evidence which would support this description as being specific to language, given the mounting evidence that children’s difficulties are not exclusive to the language domain but can also impact significantly on nonverbal abilities. In addition, this label is considered to be disadvantageous to some children due to the use of exclusionary criteria to establish their eligibility to access speech and language therapy. For researchers and clinicians alike, the terminology caused considerable concern, particularly in relation to efforts to increase public understanding of this relatively prevalent disorder

(Bishop, 2014a; Reilly et al., 2014a, 2014b; Rice, 2014). Recent research aimed to reach a multinational and multidisciplinary consensus on appropriate criteria and suggested the term Developmental Language Disorder is a more appropriate descriptor which captures the heterogeneous nature of the deficits in children who would previously have been referred to as having SLI (Bishop, Snowling, Thompson, Greenhalgh & the CATALISE consortium, 2016, 2017). The CATALISE (Criteria and Terminology Applied to Language Impairments: Synthesizing the Evidence) group is comprised of a panel of 59 experts from different disciplines (e.g. education, speech and language therapy, child psychiatry) whose goal was to see whether it was possible to achieve agreement on terminology on the basis of the evidence and experience of a wide range of professionals. The term SLI is currently not widespread in its global usage and for the purpose of UK based research, the term Developmental Language Disorder as proposed by the CATALISE consortium (2016, 2017) will be used.

The study of Developmental Language Disorder (DLD) dates back to the first half of the 19th century. The earliest known published description of children whom we would identify as having DLD was by Gall in 1835 who wrote:

> *"There are many children … who do not speak the same degree as other children although they understand well or are far from being idiotic. In these cases, the trouble lies not in the vocal organs, as the ignorant sometimes insist and still less in the apathetic state of the subject. Such children, on the contrary, show great physical vivacity. They not only skip about but pass from one idea to another with great rapidity. If one holds them and pronounces a word in their ear, they repeat it distinctly."* (Gall, 1835, p.24).

Research has come a long way since 1835 and Gall's description is distinctly oversimplified by modern standards, even allowing for the insensitive use of language which reflects the time at which Gall was writing. However, it serves to illustrate the central problem with DLD, that it is a language disorder involving delayed or deviant language development in children who exhibit no cognitive, neurological or social impairment. Children may present as having difficulty in producing speech sounds, being delayed in grammatical understanding and production, in using spoken language to communicate or understanding what other people say but in all other respects the child is typical. For this reason, the diagnosis of DLD has been and continues to be based largely on the exclusion of all other explanations and has proven to be fraught with problems relating to validity and reliability. Early research in

language led to the assumption about the nature of DLD, a common feature being grammatical delay and/or difficulty and linguistic theory suggested this was due to an innate mechanism. Until the 1950's and 1960's there were no standardised language tests (Reilly et al., 2014a, 2014b) and the earliest assessment tests were informed by theories of language acquisition which stressed the contribution of an innate language acquisition device which enabled a young child to decode the mass of sound it is surrounded by. Such tests focused on the areas of language which appeared to be deficient such as grammar production and comprehension, semantic association, word finding etc. The complex nature of language itself adds to the problems of identifying and classifying language impairments and the different levels on which it operates –spoken, written and signed have led to distinctions being drawn between language as a multimodal means of communication involving all three levels, and speech which refers solely to the production of vocal sounds. Some of the linguistic tests which have been developed do show high levels of reliability and validity, but fail to encompass all the difficulties which need to be addressed in order to support the child appropriately. The prevalence of DLD is difficult to establish as a result of the problems with assessment and diagnosis and the estimates produced depend largely on the criteria adopted. Tomblin et al. (1997) quoted a widely used estimated prevalence of 7.4% in the US, but Norbury et al. (2016) have applied the new DSM V criteria, which remove the requirement for nonverbal IQ to be within normal limits and have produced a population prevalence estimate amongst 4 to 5 year olds in state primary schools of 9.92% (7.58% DLD of unknown origin and 2.34% DLD associated with intellectual disability or medical condition). This means that at school entry, approximately 2 out of every class of 30 children will experience language disorder serious enough to affect their academic progress. The assessment and diagnosis of DLD remains a highly problematical issue, but an overview of the progress made since Gall's original observations will serve to illustrate the issues involved in this disorder.

Early research studies on DLD aimed to distinguish children who have functional difficulties in using language (i.e., producing their own language constructions and comprehending the language used by other people), from children with neurological damage that impacts on their use of language. This led to an increasing focus on applying linguistic and psycholinguistic theories to the study of DLD (Cromer, 1978; Menyuk, 1964). The pioneering work of these researchers provided a firm foundation for establishing the links between theories of language acquisition and DLD. Indeed, it is still a requirement of speech and language therapists today that they maintain a research interest in order to keep up to date with the latest developments. The Chomskyan model (Chomsky, 1965) of an innate system

consisting of grammar, phonology and semantics led to a focus on these components as explanations of the language difficulties evident in children with DLD. Theories of phonological memory deficit, the identification of a sub-group with grammatical-DLD and the extended optional infinitive account of DLD were developed and these theories related the deficits found in children with DLD to the innate model of language.

It is generally acknowledged (Conti-Ramsden, 2008; Norbury, Tomblin & Bishop, 2008 Pickles, Anderson & Lord, 2014) that DLD is a heterogeneous disorder with some children presenting with expressive difficulties, others with receptive difficulties and some with both. Such heterogeneity has been a challenge for theory and has implications for assessment and diagnosis which this research seeks to address.

1.1 Why it is important to identify children with DLD

The fact that DLD adversely affects the lives of children with the disorder and their families constitutes the most pressing reason to improve diagnosis. Also, given the current prevalence estimate of 9.92%, there is a clear need to address the issues in current assessment and intervention procedures. Children with DLD are at risk of lower academic attainment when they reach school and, for many children with DLD their difficulties persist into adulthood (Clegg & Ginsborg, 2006; Conti-Ramsden & Botting, 2008; Conti-Ramsden, Durkin, Simkin & Knox, 2009; Durkin, 2010). Gains in language ability may be seen over time, but weaknesses in language are often still apparent in late childhood, adolescence and adulthood. Both clinical experience and the research literature (Snowling, Adams, Bishop & Stothard, 2001;Conti-Ramsden et al., 2009; Durkin, 2010; Toseeb, Pickles, Durkin, Botting & Conti-Ramsden, 2017) suggest that the disorder does not disappear but the clinical picture changes. Longitudinal research studies (Bishop & Edmundson, 1987; Botting, 2005; Conti-Ramsden, St Clair, Pickles & Durkin, 2012; Law, Tomblin & Zhang, 2008; Tomblin, Freese & Records, 1992) have focused on the development of language skills from the preschool years through to adolescence and have found initial delays in language which can be followed by acceleration at least into the early years of school (Bishop & Edmundson, 1987) or a parallel trajectory with typically developing children (Law et al., 2008), but most indicate a plateauing of language skills in comparison to peers. The evidence for the development of nonverbal skills (Botting, 2005; Conti-Ramsden et al., 2012; Tomblin et al., 1992) indicates a general decline in performance from childhood through to adolescence and early adulthood, which may be the result of early language difficulties impacting on the ability to learn and practise nonverbal skills due to limited educational opportunities. These factors illustrate the importance of identifying children with DLD early, not only to aid their communication through

appropriate intervention but to overcome barriers to learning and to prevent social and emotional problems. Early intervention is key as the brain undergoes the most dramatic growth in the early childhood years, with many abilities developing alongside language such as reasoning, thinking, executive functions and the abilities relating to social and emotional interaction with others. The benefits of early intervention have led to the Early Identification Framework for Speech, Language and Communication Needs (The Communication Trust, 2012) and the Early Language Development Programme (Department of Education & ICAN, 2012) which highlight the importance of identifying children with language difficulties and supporting them and their parents. It is widely acknowledged that, by a process of early identification and effective intervention, a child's life chances may be significantly enhanced (Bowyer-Crane, Snowling, Duff & Hulme, 2011; McLean & Cripe, 1997; Parkinson & Humphrey, 2008; Stanton-Chapman, Bainbridge & Scott, 2002).

1.2 Definition and diagnostic criteria for DLD

The previous classification of SLI defined it as a failure to learn language despite average IQ and nonverbal ability and the absence of a number of problems, e.g. no known neurological, hearing, oro-motor, emotional or social issues and adequate opportunities to learn language. (Bishop, Carlyon, Deeks & Bishop,1999; McArthur, Hogben, Edwards & Heath, 2000). This classification has now been superseded by the DSM V (APA, 2013) and the ICD 11 (WHO, 2018).

The DSM V diagnostic criteria are as follows:

Language Disorder

A. Persistent difficulties in the acquisition and use of language across modalities due to deficits in comprehension or production.
B. Language abilities are substantially and quantifiably below those expected for age resulting in functional limitations.
C. Onset of symptoms is in the early developmental period.
D. Difficulties are not attributable to other medical or neurological reason.
E. Is not better explained by intellectual disability or global developmental delay.
(DSM V diagnostic code: 315.32)

A further category has been added as follows:

Social Communication Disorder

A. Persistent difficulties in the social use of verbal and nonverbal communication including
   - Deficits in using communication for social purposes.
   - Impairment in ability to change communication to match context.
   - Difficulties following rules of conversation.
   - Difficulties understanding what is not explicitly stated.

B. Deficits result in functional limitation.

C. Onset during early developmental period.

D. Deficits not attributable to other medical condition.

(DSM V diagnostic code: 315.39)

The ICD-11 Research Diagnostic Criteria for Developmental Language Disorders (World Health Organisation, 2018) includes the following criteria:

> *"Developmental language disorder is characterised by persistent difficulties in the acquisition, understanding, production or use of language (spoken or signed) that arise during the developmental period, typically during early childhood and cause significant limitations in the individual's ability to communicate. The individual's ability to understand, produce or use language is markedly below what would be expected given the individual's age and level of intellectual functioning. The language deficits are not explained by another neurodevelopmental disorder or a sensory impairment or neurological condition, including the effects of brain injury or infection."*
>
> Exclusions – Autism Spectrum Disorder, Diseases of the nervous system, Deafness not otherwise specified, Selective mutism. (Diagnostic code: 6AO1.2, ICD - 11 version, 04/2019)

The DSM V responded to the criticism of diagnosis by exclusionary criteria and this has been well received (Bishop et al., 2016, 2017; Reilley et al., 2014a, 2014b) as has the move away from the term "Specific Language Impairment", since the empirical evidence for the discrepancy between verbal and nonverbal IQ is largely absent and there is no indication that making this distinction has provided any benefits for children and their families (Bishop et al.,2016, 2017; Reilley et al., 2014a, 2014b). Over twenty years ago, Bishop (1997) observed that some children who clearly had DLD could fail to meet the criteria for classification if their nonverbal IQ was not at norm. In her study of identical twins (Bishop, 1994) found one twin met the criteria for SLI as they showed a large discrepancy between

verbal and nonverbal IQ while the other twin had equally poor language ability but did not meet the IQ discrepancy criteria.

The more concerning aspect of taking nonverbal IQ into account in diagnosis was that children with a nonverbal IQ of less than 85 were treated differently in terms of the provision of therapy. To date, there is no clear evidence that nonverbal abilities confer any advantage in focused language interventions (Adams et al., 2012; Boyle, McCartney, Forbes & O'Hare, 2007; Cole & Dale, 1986; Ebbels, Maric, Murphy & Turner, 2014; Wake et al., 2013).

The verbal/nonverbal ability discrepancy is not well supported by findings from epidemiology studies (Reilly et al., 2010; Tomblin, Records & Zhang, 1996) nor is it deemed to be conceptually sound (Karmiloff & Karmiloff-Smith, 2002). In the UK, Norbury et al. (2016) argue that the term "Specific Language Impairment" is an archaic term which took hold at a time when language was viewed as modular and could therefore be selectively impaired, yet the relationship between language and nonverbal abilities is now regarded as more complex since language is a problem-solving tool and, if language is affected, then problem-solving too will be affected, so it is conceptually misguided to regard language as "special".

With the advent of ICD-11 this discrepancy criterion between verbal and nonverbal IQ has been maintained which means that there are different diagnostic frameworks in the ICD compared to the DSM V which has removed any reference to nonverbal IQ.

1.3 Risk factors for DLD

DLD is known to be associated with a number of risk factors. Bishop (2002), De Thorne, Petrill, Hayiou-Thomas & Plomin (2005) and Kovas et al. (2005) estimate that the variation in low language ability is around 54% attributable to genetic factors for speech impairment generally. "Speech" is defined here as the production of vocal sounds i.e. a process which involves both motor (articulatory) and linguistic skills. "Language" involves the comprehension and use of words and sentences to convey ideas and information and can be spoken, written or signed. The situation with DLD is consequently less clear cut. Four twin studies reported heritability of 0.5 or more (Bishop, North & Donlan,1995; DeThorne et al., 2006; Lewis & Thompson, 1992; Tomblin & Buckwalter, 1998) but Hayiou-Thomas, Bonamy & Plomin (2005) found negligible genetic influence in a sample of 4 year old twins. Bishop and Hayiou-Thomas (2008) point out that this area of research is influenced by whether children have been included in samples on the basis of referral to clinical services or on the basis of their language test scores. Genetic studies are more likely to find high heritability if

they focus on cases who have speech difficulties and have been referred for intervention. Molecular genetics has identified significant linkage between the expressive component of DLD and variants in four specific genes on chromosome 7 and chromosome 16 (Newbury, Fisher & Monaco, 2010) but the exact pathways in which these genes are involved is as yet unknown. The heritability of the expressive and receptive components of DLD remains unclear, although several studies have found nonword repetition to be a reliable marker of a heritable phenotype in DLD (Barry, Yasin & Bishop, 2007; Bishop, North & Donlan,1996).

Children with DLD, by definition, develop language at a delayed rate and late–talking is a well-established risk factor but the picture here is complicated, since not all those who show subsequent language disorder have suffered the most severe delays in language emergence (Dale, Prince, Bishop & Plomin, 2003) and if used as a sole indicator it may lead to a significant number of false positives as many children grow out of their initial delay. Paul (1996) for example found that over 70% of children identified as late talkers aged 18 months had moved into the typically developing range by the age of 3. Nevertheless, between 17% and 38% of children with late language emergence do go on to develop language disorder (Moyle, Ellis Weismer, Evans & Lindstrom, 2007; Paul 1996; Rescorla, 2002). Haynes and Naidoo (1991) found that only 12 % of children with DLD had produced their first word by 17 months of age. The literature indicates that, in combination with genetic factors, late talking may be regarded as a significant predictor of DLD (Reilley et al., 2010).

In addition to the risk factors mentioned above, studies have examined other factors which may be useful in identifying children at risk of DLD. For example, Briscoe, Gathercole and Marlow (1998) found low birth weight was linked to DLD. They found low birth weight to identify a pre-term “at risk” group of 3 year olds who performed poorly on receptive vocabulary knowledge as measured by the British Picture Vocabulary Scale, (BPVS) and on expressive skills as measured by the Bus Story Information Score (Renfrew, 1997). The results which showed no significant deficits at 12 months but did at 24 months are supported by Jansson-Versakalo et al. (2010) who found that being pre-term or having a low birth weight can, but may not always, have a negative impact on a child’s language development.

It is clear that the identification of particular risk factors for DLD has moved away from the parsimonious approach of searching for different subtypes of DLD each with different single causes towards a more realistic approach which seeks to consider multiple risk factors and the role which these may play in the heterogeneous forms of the disorder. Bishop (2006) acknowledges that any genetic contribution to language difficulties is likely to be related

more to speech and severe language problems rather than general language impairment and there is still much for us to understand regarding the interplay of environmental and genetic factors in DLD. An interesting finding of the large scale study (591 twin pairs) by Bishop and Hayiou-Thomas (2008) was that experienced clinicians' identification of children who are at risk of developing DLD was more reliable than the use of various language assessments (Bus story test, Action Picture test, verbal comprehension, phonological awareness, word knowledge, verbal fluency opposite analogies, articulation and nonword repetition) and are more reliable than biological markers.

1.4. Co-morbidity

Co-morbidity relates to disorders which exist in conjunction with DLD rather than cases where DLD exists as the sole disorder, however the concept of comorbidity is problematic, in that it may be argued that "*our understanding of its nature varies according to the level of our understanding of the shared mechanisms underpinning each disorder – genetic, neurobiological or cognitive"* (Williams & Lind, 2013 p.1). The concept assumes that we can pinpoint the genetic, neurobiological or cognitive nature of such mechanisms. Myers (2013) recently commented that *"genes don't respect our diagnostic classification boundaries."* (p.1).

This is especially true in the case of DLD and it must be acknowledged that, as research uncovers more about the genetic, neurobiological and cognitive bases of neurodevelopmental disorders, the distinctions which the current classification systems draw between disorders will be the subject of re-evaluation. Indeed, in the DSM V, the move away from old terminology and classification towards an inclusionary model which puts the identification of service needs at the heart of the diagnostic process is a direct response to outmoded ways of regarding co-morbidity as a fixed state and represents an embracing of more sensitive approaches to the fluctuating nature of language development in the early years. It has been suggested that DLD may be the result of a co-morbid disorder (Mueller & Tomblin, 2012) and this reflects the changing perspective on this aspect of the impairment.

1.4.1. The relationship between DLD & ASD

The relationship between DLD and ASD has been a focus of research for many years and there are some relationships between the two disorders (difficulties with pronouns and other linguistic delays, delays in the social use of language) which has led to research suggesting that there is a strong relationship between the disorders (Tager-Flusberg & Joseph, 2003) and the suggestion of a sub-group of children who have autism and language impairment

(ALI). However, though there are similarities between the conditions, research has shown that the nature of ASD can lead to language difficulties, but that does not mean that the groups overlap (Bishop, 2014b).

The revised DSM V (APA, 2013) excluded autism from the diagnostic criteria for DLD, as ICD 11 (WHO, 2018) continued to do. The heterogeneous nature of both DLD and ASD means that different aspects of language may be more or less affected across individuals. The separation of DLD from SCD (Social Communication Disorder) allows classification of ASD with SCD and also DLD and SCD. It has long been reported that a sub-group of children with SLI had pragmatic difficulties (now SCD). These new classifications acknowledge that DLD and SCD may share characteristics but are separate disorders. An important issue is the longitudinal progression of DLD. For example, Conti-Ramsden and Botting (1999) found that from a sample of 242 seven year olds diagnosed with DLD, 45% of these moved across subtypes in the course of their development. In ASD too, the typical behaviours involving not looking at faces, not being interested in social interaction, being oversensitive to sensory input etc., is thought to influence language development and unresolved pragmatic difficulties are likely now to be captured under the diagnostic category of Social Communication Disorder rather than DLD. In both ASD and DLD there are problems with executive function which is known to impact language processing but there are discernible differences, particularly in the area of inhibition, where in ASD it remains largely intact but is impaired in DLD.

The evidence which has built up to suggest that language impairment in ASD and DLD are closely related comes from family studies which suggested a genetic link between vulnerability to ASD and vulnerability to a range of language-related developmental difficulties, including DLD (Bolton et al., 1994; Folstein et al., 1999; Szatmari et al., 2000). Other studies acknowledged that the linguistic profiles in ASD were closer to those seen in DLD than had previously been recognised (Rapin & Dunn, 2003; Roberts, Rice & Tager-Flusberg, 2004). In addition, evidence of shared neurobiology has lent support to this argument (De Fosse et al., 2004; Herbert et al., 2002, 2005). This accumulation of evidence led to the widely held conclusion that ASD and DLD are overlapping disorders, put forward by Botting and Conti-Ramsden (2003), Conti-Ramsden, Simkin and Botting (2006), Kjelgaard and Tager-Flusberg (2001) and Roberts et al. (2004). However, whilst acknowledging similarities between the two conditions, there is also support for the view that the ASD and DLD are essentially separate disorders. Williams, Botting and Boucher (2008) agree that the dimensions on which children with each disorder are most clearly impaired are not the same,

even though the linguistic problems seen in ASD during the pre-school years, show many of the characteristics of those seen in DLD. These would include, for example, problems with receptive and expressive phonology, grammar and semantics. Whitehouse, Barry and Bishop (2007, 2008) draw attention to the performance differences which they observed in the areas of oromotor ability, verbal short-term memory and patterns of errors on nonword repetition tests between children with ASD and DLD. The findings from this study would point to linguistic deficits in ASD arising when the individual has significant impairment in more than one of the three domains of the triad. The triad of impairments in ASD comprises impaired communication, impaired social skills and a restricted and repetitive range of behaviours. Using narrative methods, Manolitsi and Botting (2011) found observable differences between the skills of ASD and DLD children, with autistic children showing much poorer pragmatic skills and narrative abilities. Research carried out on language loss (Pickles et al., 2009) would also point to a clear divergence between the conditions, with language loss being highly specific to ASD and not DLD. Language loss is defined as a reduction or regression in language skills after what appears to be typical language development and in ASD it is generally observed before the age of two. Similarly, the misuse of pronouns which is common to both disorders tends to resolve in children with ASD, as their understanding of themselves in relation to others improves, whereas this is not the case for children with DLD. Tomblin (2011) questions how useful it is to continue to argue about whether ASD and DLD are truly distinct disorders, when it is clear that they both emerge from highly complex developmental pathways and there may very well be some shared aetiological pathways which will be uncovered by future research.

The evidence outlined above relating to the problems in delineating the issues arising from co-occurring disorders serves to emphasize how pressing the need is to be able to identify children with DLD at an early stage and to address the current issues in the array of assessment tools available. As will be discussed in Section 1.6., though ASD and DLD may share some language delays and deficits, in particular SCD, the origin of these deficits are not common.

1.4.2. Other developments in classification and use of terminology

In the UK, Bishop has been instrumental in setting up the CATALISE project which aims to address the issues springing from the use of terminology applied to language impairments (Bishop et al., 2016, 2017). This project is in agreement with Reilly et al. (2014a, 2014b) on the matter of exclusionary criteria, arguing that they can be misused in a number of ways: first, the presence of a risk factor can be taken to mean it is the whole explanation for poor

language, (e.g. poor social background) when there is no real evidence that this is the case; second, the presence of risk factors may be used to deny services to children and third, criteria may be extended from factors that reliably affect language learning to include others with a more tenuous link to language, e.g. motor impairment. There is widespread agreement too on the need to move towards a situation in which the terminology is used accurately.

There is agreement with Reilly et al. (2014a, 2014b) on the need to move away from exclusionary factors towards differentiating factors which would indicate a different interaction pathway such as ASD, hearing loss and brain injury and associated factors which commonly co-occur with language problems, but whose causal effects are unclear such as social disadvantage, motor impairment and attentional problems. The debate around the classification change of the DSM V centres on inclusion criteria and the importance of multinational and multidisciplinary agreement, because for the child with DLD, it is crucial that diagnosis is reliable and straightforward to enable early intervention to achieve the best outcomes.

The whole area of classification and terminology is fraught with issues which go to the heart of what we understand by 'Developmental Language Disorder', and this debate has huge implications in terms of the recognition and funding available to support children and families.

The assessment and diagnostic process for children with DLD is clearly in need of review following the changes in classification and terminology and needs to reflect the developments in our understanding of both the linguistic and nonlinguistic aspects of the disorder.

1.5. Theories of DLD

Despite years of research, there is little general agreement on the basic mechanisms underlying DLD. Over the years, the suspected causes have changed as theories of language development have changed. The early modular views of language which focused on phonology and grammar led to research which centred on those areas. Consequently, different models place emphasis on specific language deficits e.g. grammatical and semantic issues and the search for an innate grammar module (Gopnik & Crago, 1991; van der Lely, 1994), phonological memory (Gathercole & Baddeley, 1990) and working memory (Montgomery, Magimairaj & Finney, 2010), while others attribute the problems with language

to a more general issue with children's information processing abilities (Corriveau, Pasquini & Goswami, 2007; Park, Miller & Mainela-Arnold, 2015).

1.5.1 General aspects: delayed talking and DLD

One of the major debates in DLD research is whether language delay is a robust feature of DLD. The picture is clouded by the fact that many children with delayed language development do catch up with their peers, provided their language delay is not associated with other developmental difficulties (Fischel, Whitehurst, Caulfield & DeBaryshe,1989; Moyle et al., 2007; Rescorla & Schwartz, 1990). Nevertheless, a significant number of late-talking children (approximately 25%) will not move into the range for typically developing children on standardised language measures by the ages of three (Paul & Roth, 2011) or seven (Rice, Taylor & Zumbrick, 2008) although other large-scale epidemiological studies (Henrichs et al., 2011; Reilly et al., 2010) have shown that the specificity and sensitivity of late-talking status was a very poor predictor of later language problems. It is currently unclear why some late-talking children go on to have DLD whereas others do not, although researchers have identified factors such as poor comprehension and use of gesture (Thal,1991) and a family history of language problems (Bishop et al., 2012; Zubrik, Taylor & Rice, 2007) as being possible predictors, although the precise mechanisms remain poorly understood.

1.5.2. Theoretical explanations of DLD

A number of theories were originally developed in the 1970's when the prevailing view was that language development was a modular process and the focus was therefore on identifying particular elements of language which seemed to be defective in language impaired children such as phonology, grammar and semantics. These theories have been largely superseded but they have informed the assessment process and a brief overview is given here.

1.5.3. Grammar based theories

In the 1970's, Chomsky's LAD (Language Acquisition Device) theory suggested that language developed as a result of an innate universal grammar which enabled a child brought up under normal conditions to apply structural rules and learn language with certain properties such as distinguishing nouns from verbs. The subsequent views on language impairment focused on grammatical deficits (e.g. van der Lely, 1994, 1996; van der Lely & Stollwerck, 1996; van der Lely, Rosen & McClelland, 1998). These suggest that it is possible to identify a homogeneous sub-type of DLD which is characterised by a 'representational

deficit for dependent relationships' in the computational syntactic system. This is a controversial stance, since it points to the existence of an innate grammatical subsystem in the brain and consequently supports a genetic basis for the disorder. The evidence for this account comes largely from case study research and family studies (e.g. van der Lely & Stollwerck, 1996) and has been challenged by research which would point to a genetic aetiology (Bishop et al., 1995; Lewis & Thompson, 1992; Tomblin & Buckwalter, 1998) but does not distinguish a grammatical subtype of SLI and by research which takes issue with the 'all-or-nothing' character of "grammatical SLI" (DLD) (Bishop, Bright, James, Bishop & van der Lely, 2000) and proposes as an alternative that there may be rare cases of children who show the highly selective and consistent patterns of deficits described in "grammatical SLI" (DLD) but it is not possible to apply this model to the vast majority of children with DLD whose deficits are much more heterogeneous.

Many of the assessment tests (e.g., The Clinical Evaluation of Language Fundamentals - CELF (Wiig, Secord & Semel, 2013) and the Test for Reception of Grammar – TROG (Bishop, 2003a) which are used today, are based on grammatical tasks which measure the child's ability to apply syntactic rules, so this group of theories is not without application, however it has long been felt that by taking such a limited view of language, important aspects of the whole process are ignored and theories which have sought to identify the precise nature of language representations in memory are regarded now as much more relevant in explaining the precise nature of DLD.

1.5.4. Slow processing speed (generalised slowing hypothesis)

Another much debated issue is the way in which children with DLD process information. The term "process" was originally described by Lahey and Bloom (1994) to refer to the ability to construct and maintain "mental models" in "consciousness". The "mental models" are essentially representations of the ideas on which the language system functions and "consciousness" would be the coming together of current experiences and stored knowledge. The ability to "process" therefore depends on the mental resources needed to construct and maintain the mental model and to apply stored knowledge to the current experience (e.g. lexical and phonetic knowledge). This theory can therefore be seen as linking with the linguistic view of language since the slow processing affects how the various components of language are processed.

Subsequent research (Adams & Gathercole, 2000; Just & Carpenter, 1992) took this further by highlighting the slow processing in children which may be responsible for the omission of

certain morphemes which are more time-dependent i.e. requiring more cognitive resources in a short space of time. Slow or erroneous processing of certain morphemes may use up resources needed to compute the words required to produce a response. Importantly, not all children with DLD have limited processing speed (Miller, Kail, Leonard & Tomblin, 2001; Windsor & Hwang, 1999) and there appears to be no direct linear relationship between the speed of processing by children with DLD and the severity of the disorder (Lahey, Edwards, & Munson, 2001).

This theory has received a number of criticisms, the first of which is that not all children with DLD demonstrate slow processing speeds. Miller et al.(2001) found that on both linguistic and nonlinguistic tasks, children with DLD performed on average more slowly that their typically developing counterparts but this did not apply to all the participants. This was also borne out by Windsor and Hwang (1999) who found that the reaction times of the DLD children were approximately one fifth slower than those of the typically developing children but there was far less slowing in a sub-group of children with expressive DLD than for children with both expressive and receptive DLD and again, not all children with DLD showed slowing of any kind. This theory has been superseded to a large extent by theories linking processing to working memory abilities (Archibald & Gathercole, 2006; Leonard et al., 2007) as verbal working memory i.e. the ability to store and manipulate phonological representations is providing a more meaningful way to explain the processing deficits in children with DLD, rather than focusing on the speed of processing as a single factor.

The areas of phonological memory, working memory and prospective memory are now the focus of much research and these are yielding a considerable body of evidence which supports the view that children with DLD experience problems on a number of levels.

1.5.5. Phonological memory in language

Children with DLD have been shown to have poor phonological memory (Botting & Conti-Ramsden, 2001;Gathercole & Baddeley, 1990), in particular they have difficulty in tasks which require immediate, verbatim recall such as in digit span tests (Gathercole & Baddeley, 1990). Bishop et al. (1996) even found phonological memory deficits in children whose language difficulties had resolved. The precise mechanisms underlying this deficit have been a matter of conjecture and a number of theories have been advanced as to why phonological memory might affect language development:

One view is that phonological memory may affect the accuracy and efficiency of forming phonological representations in long term memory and for these representations to be used they need to be stable and accessible. This would include the representations of new words (Baddeley, Papagno & Vallar, 1988; Baddeley, Gathercole & Papagno, 1998; Gathercole & Baddeley, 1990). According to Speidel (Speidel, 1989,1993; Speidel & Herreshoff, 1989), this would also apply to grammatical constructions. In Speidel's view, the imitation of adult like speech and language depends on interdependent phonological and articulation processes which leads to the long term storage of language and phonological patterns. These form a bank of stored language knowledge which the child can draw on when needed; the patterns do not have to be reconstructed every time they are used. According to this account, there would inevitably be a relationship between a child's phonological memory abilities and their vocabulary, the complexity and length of their spoken language and the range of grammatical forms they use. It would therefore follow that if a child has poor phonological memory abilities this may result in DLD.

An alternative view is that performance limitations place restrictions on the complexity of speech that a child can attain and this would also account for the range of individual differences seen in children (Valian,1991). According to this view, errors that a child might make in speech would arise because the accumulated complexity of the language construction exceeds the child's production resources (Crystal, 1987; Gerken, 1991; Valian, 1991).

A further interpretation is the Template Model of Speech (Gerken, 1991) which assumes that the child has a finite set of resources available in order to produce utterances. If the child draws on stored phonological templates (e.g. stored vocabulary items or canonical forms) then this type of utterance will require fewer resources than sentences which need grammatical rules (e.g. verb tenses) to be applied. According to this model, as more resources are used at earlier stages of production, fewer resources are available for later stages such as articulation and so the child has to revert to using stored templates. This would lead to the child being more likely to omit weak syllables if they are trying to use unfamiliar words. This would also explain individual differences, as children will differ in the processing resource capacity which may be indicated by the amount of working memory they have available.

An alternative view is that the ability to process and reproduce combinations of syllables may have an effect on phonological memory rather than phonological memory ability affecting this

ability. This has been brought out most clearly by Howard and van der Lely (1993) who are of the view that this is especially evident in tests of nonword repetition as a measurement of phonological memory, as poor language processing skills in the child with difficulties may specifically affect their ability to assemble and articulate polysyllabic nonwords and give prosodic structure to them. This “mutual output constraints” hypothesis (Howard & van der Lely,1993) maintains that previous associations between nonword repetition and spoken language in both disordered and typically developing populations reflects the phonological processing and the output requirements of both tasks. This is reiterated by Adams and Gathercole (2000) who maintained that the ability to process language itself determines achievement in tests of phonological memory. They found that the association between language competence (measured by word repertoire, average length of utterance and complexity of syntactic constructions) and memory span was still observable even when the memory task answer did not require verbal response (participants could simply point rather than verbalise an answer). They argue that theories of poor memory capacity would apply to all components of language processing since their study also found associations between language performance (using the same measures as described above) and visuo-spatial short-term memory (measured by replicating a pattern of tapping on blocks and reproducing patterns in matrices).

Nevertheless, it is widely acknowledged that nonword repetition as a measure of phonological memory has proven to be a robust indicator of language difficulties (Bishop et al.,1996; Conti-Ramsden, Botting & Faragher, 2001) even in a range of languages such as Italian (Casalini et al., 2007), Dutch (de Bree, Rispens & Gerrits, 2007), Spanish (Girbau & Schwartz, 2007), Russian (Kavitskaya, Bayonyshev, Walls & Grigorenko, 2011), Swedish (Sahlen, Reuterskiold-Wagner, Nettelbladt & Radeborg, 1999), French (Elin Thordardottir & Brandeker, 2013) and Icelandic (Elin Thordardottir, 2008). The only language in which a significant difference between language impaired children and typically developing children has to date not been found on this measurement is Cantonese (Stokes, Wang, Fletcher & Leonard, 2006). It is incorporated into the most widely used diagnostic instrument, the CELF (Clinical Evaluation of Language Fundamentals -Wiig et al., 2013) which is supported by the American Speech-Language-Hearing Association. The CELF is a multiperspective assessment of childrens’ language skills, incorporating a battery of tests covering morphology and syntax, semantics, pragmatics, phonological awareness and includes observation and interaction-based tasks to identify a child’s strengths and weaknesses for the purpose of appropriate intervention. The phonological deficit is characterised by the

simplification of multi-syllable structures (Marshall, Harris & van der Lely, 2003) and by syllabic and segmental errors.

The usefulness of nonword repetition as a test of phonological memory is that it can be used with older age groups. Conti-Ramsden and Durkin (2007) found striking longitudinal stability of phonological STM over a three year period in young adults aged 11-14 with DLD which was consistent for the 80 strong sample group as a whole, for sub-groups and at the individual level. In addition, strong reciprocal relationships could be identified between phonological STM abilities and language and literacy measures. Indeed, it can be argued that the association between spoken language development and phonological memory abilities arises because both tasks tap into the same set of cognitive processes. Phonological memory may be closely linked to long term knowledge and it would appear therefore to lie at the heart of language impairment.

1.5.6. Working memory in language

Working memory has been the focus of much research in DLD in an effort to determine to what extent processing capacity (i.e. the ability to hold information in memory in order to compute a response) is or is not distinct from language knowledge. It is important to understand that, although children with DLD may show deficits in both short term memory and working memory, more recent research studies (Archibald & Gathercole, 2006; Marton, Kelmenson & Pinkhasova, 2007) have found differences between the two. Archibald and Gathercole (2006) point out that both involve temporary storage but are distinguished by "whether or not significant processing activity is required concurrently" (Archibald & Gathercole, 2006, p.676). In relation to language, this would mean that, in order to produce language, words are first selected for meaning and subsequent planning of speech and articulation are also implicated. According to this view, working memory plays an active role in processing and storing information in cognitively complex tasks such as language processing.

The models of working memory with a focus on phonological and verbal aspects of memory have been particularly influential in investigations on the processing deficits in DLD. Baddeley and Hitch's (2000) three part model comprising a central executive, phonological loop and visuo-spatial scratchpad has undergone numerous revisions since its original conception in 1974 and now includes 'crystallised' systems, one of which is long-term language knowledge. This system accounts for the impact of language knowledge on the wording of memory tasks, e.g. the finding that nonwords which resemble English words are

more easily repeated by English speakers than non-English speakers (Gathercole, 1995a, 1995b) but sees language knowledge and processing essentially as separate systems (Baddeley & Logie,1999).

If Archibald and Gathercole's (2006) view is taken, short term memory for verbal material should involve the phonological loop, while working memory for verbal material should involve the phonological loop and the central executive. Support for the claim that short term memory and working memory are two separate systems comes from studies of academic attainment which suggest that this is linked to working memory and not short term memory (Gathercole, Pickering, Knight & Stegmann, 2003; Lee Swanson, 1994). This has implications for the use of nonword repetition as an indicator of language impairment, as it is thought that this task taps into verbal short term memory. This is based on the evidence of performance being linked to more traditional measures of short term memory, such as digit span measures, and the advantage of wordlikeness and familiar words over unfamiliar words in repetition tests, since the repetition of unfamiliar words must rely on short term memory. Poor verbal working memory in DLD would involve a general information processing inefficiency which constrains language development. According to this view, language development depends on being able to maintain and activate linguistic knowledge within working memory. As the demands of the language task increase, so the working memory becomes overloaded and this can lead to the types of errors seen in DLD.

1.5.7. Executive functions in language

The central executive included in Baddeley and Hitch's (2000) working memory model referred to above has been the focus of much research in language development although the precise nature of its role has yet to be fully understood. Some researchers have considered executive function to be a single entity which could be compared on a conceptual level to 'intelligence' (Duncan, Burgess & Emslie, 1995). In contrast, later researchers have preferred to take a more fragmentary approach in describing it as being comprised of sub-functions which may be independent to different degrees (e.g. Baddeley, 1996; Burgess et al., 2006). In a review of the literature, Miyake et al. (2000) proposed that three basic functions can be identified within 'executive function' which may be labelled slightly differently by different researchers but may be broadly described as shifting, updating and inhibition.

Shifting refers to an ability to change between mental tasks and is commonly measured using the Wisconsin Card Sorting test (Grant & Berg, 1948). Updating is a term which

Miyake et al. (2000) use to denote an ability, closely related to working memory which involves monitoring and updating the representations held in working memory and, as such, this may be thought of as the central executive and storage components (visuo-spatial scratchpad and phonological loop) in Baddeley and Hitch's (2000) working memory model. Inhibition comprises the ability to withhold prepotent responses when necessary and to resist interference from a distractor and is of particular interest in the development of executive function, as this is seen by a number of influential researchers (e.g. Baddeley, 1997) to be primary to the development of other executive functions. Whilst acknowledging that these different components of executive function can operate as entities, it has nevertheless been evidenced by numerous researchers (Baddeley, 2000; Duncan, Johnson, Swales & Freer, 1997; Lehto, Juujarvi, Kooistra & Pulkkinnen, 2003) that executive function exhibits both unity and diversity simultaneously.

It is now widely recognised that the developmental trajectory of executive function begins with rudimentary abilities (e.g. object permanence) developing around the age of one, with further progress being made as a result of frontal lobe development between the ages of 1-2. The pre-school period has attracted particular research attention since this is a time of rapid growth and change in neural organisation (Clark, Pritchard & Woodward, 2010; Hughes, White, Sharpen & Dunn, 2000; Hughes & Ensor, 2007) and such studies have put forward compelling evidence for the foundation role which the development of the executive function plays in social and behavioural competence. For example, Hughes et al. (2000) found highly significant correlations between poor executive function performance on tests and observations of antisocial behaviour and negative emotion. The surge in executive functioning during this period is supported by further physiological development of the prefrontal and frontal cortices. The neural circuitry established during this period continues to become much more efficient and improvements in executive functioning continue in typically developing individuals through to adolescence.

Deficits in various aspects of executive functioning have been the focus of much research on a range of psychopathologies, most notably ASD and ADHD as well as language disorders (see Pennington & Ozonoff, 1996 for a review). This research suggests that aspects of executive function may be useful in discriminating such disorders. For example, Bishop and Norbury (2005) found that deficits in 'generativity' i.e. the ability to generate novel ideas distinguished children with ASD, and those with Pragmatic Language Impairment (Social Communication Disorder) from those diagnosed with DLD. They qualified Turner's (1997) findings which suggested that difficulties in generating relevant ideas may be a cause of

stereotyped behaviours in autism and proposed instead that deficits in generativity may be a cause of autism with communicative abnormalities. Using, two tasks based on ideational fluency involving naming as many possible uses for an object such as a brick and giving as many interpretations as possible for a meaningless pattern, Bishop and Norbury (2005) found that, contrary to Turner's study, the ASD children and those with PLI (SCD) produced at least as many responses as the control children but were much less likely to be correct, whereas the children with DLD did not differ from controls either in the number of responses or the percentage of correct responses, which would appear to suggest that poor pragmatics and lack of flexibility of thought is at the root of weak generativity rather than DLD per se.

Other research studies such as Russell, Jarrold and Hood (1999) have found that when children with ASD are tested on executive functions using tasks which do not require the child to follow arbitrary and novel rules, nor to make a verbal response, their performance is unimpaired compared to controls which leads to the conclusion that children with ASD are challenged by classic executive function tasks, as they are unlikely to encode rules in a verbal form. Indeed, both Russell et al. (1999) and Liss, Fein, Allen and Dunn (2001) found no evidence of deficits in inhibition in children with ASD, a finding also supported by Bishop and Norbury (2005). This aspect of executive function may therefore be a useful discriminator between children with ASD and DLD.

In the case of children with DLD, the deficits in executive function have been shown to take various forms, and the research to date has been far from conclusive in a number of areas. Furthermore, it is difficult to design tasks which measure only one aspect of executive function, given its simultaneous unitary and diverse nature. Attempts have been made by Miyake et al. (2000) to tap executive function skills separately, using tasks such as the Wisconsin Card Sort (Grant & Berg, 1948), the Tower of Hanoi and Random Number Generation to test shifting, inhibition and updating respectively. The Tower of Hanoi task consists of three rods and a number of disks which can slide onto any rod. The puzzle begins with all the disks stacked on one rod I ascending order of size and the objective is to move the entire stack to another rod following the rules that only one disk may be used at a time and a larger disk cannot be placed on top of a smaller disk. However, the researchers acknowledge that while these tasks certainly relate to these specific executive functions, it is important to recognise that they are not totally separable. Zelazo, Carter & Reznik (1997) even reject the idea of different components of executive function and prefer to ground the construct as a macroconcept which covers four stages of problem solving – representation, planning, execution and evaluation.

A further problem is that the research which does exist on the nonlinguistic deficits in DLD does not necessarily refer to the constructs of executive function. The DLD studies which have addressed the ability to sustain attention (Noterdaeme, Amorosa, Mildenberger, Sitter & Minow, 2000; Spaulding, Plante & Vance, 2008; Schul, Stiles, Wulfeck & Townsend, 2004) have used direct measures involving selective auditory and nonverbal visual tasks and the findings have shown that performances tend to vary with attention load, working memory load and the speed of presentation of the stimuli. All these studies found reduced attention to auditory stimuli by children with DLD compared to visual stimuli. This is broadly consistent with the findings of Ebert and Kohnert's (2011) meta-analysis of 28 effect sizes in studies of attention in children with DLD, with the effect sizes for auditory stimuli being consistently larger than those for visual stimuli. Studies which have used indirect measures such as child behaviour checklists (Dopfner, Schmeck, Berner, Lehmkuhl & Poustka,1994; Parigger & Baker, 2005) found higher rates of attentional problems in children with DLD compared to controls and a high comorbidity of ADHD and DLD. Specific executive functions such as shifting, planning, updating and inhibition have been the focus of much research and a review is given below:

Shifting in children with DLD appears to be largely unimpaired according to the studies by Im-bolter, Johnson & Pascual-Leone (2006) and Marton (2008) using classic tasks such as the Trail-making test (Tombaugh, 2004), the Set-shifting test and the Wisconsin Card Sorting test (Grant & Berg, 1948). In the latter two tests, the performance of children with DLD was weaker than controls but not significantly so. It is also suggested that these two tests require an element of inhibition compared to the purer Trail-making test and it may be that this is where the deficit exists.

Planning as an executive function was found to be used less effectively in children with DLD by Marton, (2008) compared to controls, both in terms of the total scores obtained on the Tower of London task (Shallice, 1982), the initiation time and rule violation. However, it could be argued in this case too, "planning" as tested by the Tower of London task requires an element of inhibition and this may be the deficit which is being detected. The Tower of London task requires the child to move a number of beads placed on three wooden poles so that their set of beads mirrors those of the experimenter. The task therefore requires the ability to maintain the goal of copying the examiner's bead layout whilst also inhibiting the distraction of other stimuli. The children with DLD tended to have a shorter initiation time in beginning the task but made more incorrect moves and more rule violations (e.g. it is not

permitted to place a larger bead on top of a smaller bead) which would indicate an inability to process the rule and solve the problem simultaneously, again showing a weakness in the complex interaction of working memory, attention and inhibition.

Updating, defined as the ability to replace old irrelevant information by incoming relevant information has been found to be impaired in children with DLD (Bavin, 2005; Im-Bolter et al., 2006; Marton et al., 2007). Using the visual N-back task (Kirchner, 1958), children with DLD were found to perform worse than controls under moderate memory load conditions and similar comparisons were found using pair-associate learning and listening span tasks with children with DLD showing a much higher rate of perseveration. However, it is in inhibition tasks that children with DLD appear to show the clearest deficits (Im-Bolter et al, 2006; Kohnert, Windsor & Ebert, 2009; Marton et al., 2007; Spaulding, 2010). On antisaccade tasks, listening span tasks, mental rotation tasks and stop signal tasks, children with DLD consistently perform below the levels of controls.

Inhibition may be seen as being closely linked to working memory (Friedman & Miyake, 2004; Marton et al, 2007; Spaulding, 2010; Wilson & Kipp, 1998) and language development (Baldwin & Moses, 2001; Bishop & Norbury, 2005; Champagne, Desautels & Joanette, 2004; Lalonde & Werker,1995; Wolfe & Bell, 2004). Marton et al. (2007) suggest that children with DLD have “inefficient inhibition” which affects their ability to keep things out of their working memory to free up capacity for language processing. Complex language tasks demand high levels of working memory ability and therefore high levels of inhibition in order to prevent irrelevant information overburdening the working memory system. This can be seen in children with DLD who do not show the typical primacy-recency effect in recalling serial information (Marton, 2006; Marton, Schwartz, Farkas & Katsnelson, 2006) and this would again point to the observation that the problem is not simply one of storage of information but of (potentially) slow processing. Using listening span tests, children with DLD in these studies showed a weakness in processing new incoming stimuli while rehearsing the old information at the same time. The direction of causality between inhibition and working memory capacity and the implications for language development are not yet fully understood and are the subject of current research.

There are differing views on the role of working memory and language. For example, Just and Carpenter’s (1992) model of verbal working memory focuses on the short-term storage for the intermediate and final products of the listeners’ verbal computations and is equivalent in some regards to the central executive of Baddeley’s model. Verbal working memory span

consists according to this model of a fixed *"pool of operational resources that perform the symbolic computations"* (Carpenter, Miyake & Just, 1994, p. 1075). The model states that limitations in verbal capacity constrain language processing and they ascribe differences in verbal working memory span to differences in total capacity or the efficiency with which linguistic information is processed. In this view, the working memory contains limited resources with which to comprehend language and these are different to nonverbal resources.

There is extensive evidence to suggest that children with DLD experience problems with verbal working memory (Archibald & Gathercole, 2006; Montgomery et al., 2010; Vugs, Knoors, Cuperus, Hendriks & Verhoeven, 2016). Poor inhibition can be seen as being central to these problems, since the child has no mechanism for holding information out of working memory and it can therefore be easily overloaded. This may manifest itself as poor memory for sequences both auditory and visual, poor immediate recall of single items and poor repetition of sounds (Nickisch & von Kries, 2009). The evidence for deficits in visual working memory is mixed, with some studies (Archibald & Gathercole, 2006; Ellis Weismer et al., 2017) finding no significant differences between language impaired children and typically developing children and others (Hick, Botting & Conti-Ramsden, 2005; Nickisch & von Kries, 2009) finding significant deficits in language impaired children compared to controls. Studies have shown a direct relationship between language abilities and an individual's efficiency and accuracy on immediate recall tasks (Engle, Nations & Cantor, 1990; Gathercole, 1995a, 1995b) and these findings are consistent with connectionist models (MacDonald & Christiansen, 2002; Seidenberg & MacDonald, 1999) which suggest that processing capacity is a result of an interaction between language input features (e.g. frequencies and regularity of patterns) and innate biological systems. MacDonald and Christiansen (2002) agree that it is the strength of the representations of linguistic knowledge which determines the capacity of working memory – i.e. high frequency information is processed more efficiently than low frequency information.

However, poor working memory has not been found to be a robust discriminator and its role in current diagnostic tools such as the CELF is minor. This is reflective of the fact that, on its own, poor working memory does not discriminate children with DLD (Conti-Ramsden et al., 2001) since it comprises a much broader set of abilities e.g. visual working memory than simply those related to the verbal domain (Archibald & Gathercole, 2006). Despite the widely held view that it may contribute to DLD, as far as the verbal component is concerned, its ability to distinguish typically developing children from language impaired children has not

been widely implemented in practice. Research has therefore investigated more robust indicators and inhibition is suggested to be a potential one.

The concept of inhibition like that of the umbrella term, executive function, has long been regarded as a vague term and efforts have been made to break it down into the different processes of which it is comprised. It has come to be recognised as playing a significant contributory role in the aetiology of a number of disorders and this has led to efforts being made to produce a taxonomy of inhibitory processes (Nigg, 2000). It is known to develop at the same time as the child acquires language and it has therefore been linked with this process.

Pauls and Archibald (2016) subdivide inhibition into:

a) prepotent response inhibition (Friedman & Miyake, 2004) which is the suppression of a dominant or entrained response as in withholding a response.
b) interference control which is resistance to distracting stimuli and involves the suppression of internally generated thoughts or memories (Diamond, 2013; Friedman & Miyake, 2004).
c) resistance to distractor interference which is resistance to distracting stimuli and involves the suppression of stimuli external to the individual.

The findings from studies of children with DLD on tasks claiming to measure different types of inhibition have shown some inconsistency. For example, in the case of response inhibition some studies have reported deficits in children with DLD compared to typically developing peers (Dodwell & Bavin, 2008; Marton, Campanelli, Scheuer, Yoon & Eichorn, 2012; Tropper 2009) and others not (Finneran, Francis & Leonard, 2009; Henry, Messer & Nash, 2012). Various reasons have been put forward as to why this should be the case and these have included variation in the type of stimuli (visual, nonverbal or auditory), the clarity of the stimuli, specifically if the stimuli were affected by surrounding noise (Spaulding et al., 2008). In the case of studies on interference control, the limited range of studies which have been carried out (Lorsbach, Wilson & Reimer, 1996; Marton, Campanelli, Eichorn, Scheuer & Yoon, 2014; Norbury, 2005) have reported weaker performance by children with DLD, but these studies have used largely verbal stimuli which may have increased the possibility of advantaging the typically developing control children and increasing the demands for the DLD children. Studies on distractor interference (Arbel & Donchin, 2014; Das & Aysto, 1994; Marton et al. 2007; Marton et al., 2012) have shown a mixed picture, with children with DLD

showing an overall weaker performance than their typically developing peers, but the results across the studies seem to be task dependent, with visual stimuli and responses eliciting a higher performance in DLD children compared to more linguistically based tasks. Nevertheless, Pauls and Archibald (2016) report a moderate group effect for inhibition tasks in their meta-analysis of 46 studies and their analysis further suggests that this deficit is present in children with DLD throughout development, irrespective of the severity of their language impairment, whereas shifting, planning and other executive function deficits were not reliably found in DLD.

The link between deficits in inhibition and DLD have been theorised by Marton et al. (2007) as being closely connected to working memory. According to Marton et al. (2007), encoding distinguishes prepotent inhibition and the resistance to external or internal interference from stimuli or thoughts, as the process of prepotent inhibition involves firstly encoding information into working memory, then determining if it is relevant or not and if not, then dispelling it from working memory. In contrast, resistance to interference occurs before the interfering item can enter working memory, so the interfering item is not encoded. Consequently, only inhibition of a prepotent response interacts with the concept of limited cognitive resources, as greater inhibition means that irrelevant information is kept out of working memory and "inefficient inhibition" means that irrelevant information is left to overload the working memory, thereby overwhelming it with demands. In terms of language development, this would mean that the child with DLD who has any delay or limitation in working memory and short term verbal memory is not able to prevent their limited resources from being overwhelmed by the complex tasks demands of language tasks and as a result, errors occur. Therefore, although working memory on its own has not been shown to be a robust discriminator for children with DLD, inhibition may be a useful measure.

Neuropsychological evidence suggests inhibition is primary to other executive functions i.e. updating, planning, shifting etc. In addition, neuropsychological theories of inhibition have sought to explain inhibitory control in relation to the multiple brain circuits connecting parallel regions of the prefrontal cortex and basal ganglia (Alexander, Crutcher & Delong, 1991; Cummings, 1993). The most influential model of inhibition in developmental psychopathology is that of Barkley (1997) which has been widely used in ADHD research and which sees inhibition as being primary to other executive functions i.e. the first action must always be to inhibit a response and so produce a delay during which other executive functions can come into play. This is not to say that inhibition 'causes' the other executive functions but as

Barkley describes it, it "*sets the occasion for their performance"* and protects that performance from interference (Barkley, 1997, p.68).

In this model, Barkley also addresses the effect of inhibition on internalization of speech and regards this as comprising what many researchers refer to as verbal working memory and equivalent to the articulatory loop slave system and central executive of Baddeley and Hitch's (2000) working memory model. In typical development, overt private speech should emerge between the ages of 3 to 5 and serves a problem-solving function. If this process is delayed or dysfunctional, Barkley's model would predict that the child would have difficulties in following instructions, especially where an immediate reward is available.

In terms of language impairment, it is thought that poor inner speech/language means that it cannot be used effectively as a tool for thought. Executive function tasks require inner speech in order to solve the problem and guide behaviour, therefore a child who has problems with the primary executive function, i.e. inhibition, is likely to also have problems with language (Russell et al., 1999). This has in fact been borne out by research which has charted the developmental trajectory of children from the pre-school period such as Pritchard and Woodward's (2011) study which found that children's language ability at age 4 was strongly predictive of their performance on an inhibition task (Shape School). This task involved firstly naming a set of 15 colourful characters according to their colour (Control Condition) and in the Inhibiton Condition withholding the naming response by only naming those characters with happy faces. Those children with standardised language test scores in the mild to severe range (using the CELF) had completion scores of more than 2 SDs below the mean of the typically developing comparison group and inhibition efficiency scores 1 SD below the comparison group. The authors noted the strong predictive validity of inhibition measurement (using the Shape School task), as a lack of inhibition aged 4 was strongly associated with academic achievement at the age of 6.

Clark et al. (2013) aimed to understand the possible link between inhibition and language and they found rapid gains in inhibition (measured using the Shape School) between the ages of 3 to 3.75 in typically developing children were associated with good levels of language competence at school entry compared to children who failed to complete the inhibition tests at age 3 which was prognostic of language and academic delays at age 5.

In the case of DLD, several studies (Bishop & Norbury, 2005; Reiter, Tucha & Lange, 2005) have shown that deficits in inhibition seem to be related to language delay or impairment,

whereas dyslexic children and those with ASD demonstrate largely intact inhibitory abilities. For example, Bishop and Norbury's (2005) study found that any inhibitory deficits shown by children with ASD were associated, not with their autistic symptomatology, but with poor verbal skills and they posited the view that poor inhibition reflects a failure in the spontaneous use of language as a tool for thought, rather than a lack of linguistic knowledge. Similarly, in the case of dyslexia, Reiter et al. (2005) found that children with dyslexia were unimpaired on simple tasks of inhibition but were impaired on more demanding tests. This is in line with other studies such as Everatt, Weeks and Brooks (2008) and van der Sluis, de Jong and van der Leij (2004) who failed to find evidence of inhibition difficulties in children with dyslexia. For example, van der Sluis et al. (2004) tested 21 children with reading problems and 19 control children on various measures of inhibition and found no differences between the groups. In a meta-analysis of executive function problems in dyslexic children, Booth, Boyle and Kelly (2010) found a medium overall effect size of 0.57 which reflected a combination of many kinds of executive function and it is thought that the role which individual components of executive function play in dyslexia still requires a great deal of further clarification.

Current research is also focusing on the contribution of other memory tasks related to executive function, in particular the role which the ability to remember to do something in the future (prospective memory) may have in language processing. This aspect of executive function has been widely studied in adults and, though comparatively less is known about this ability in children, there is increasing evidence of the developmental trajectory of prospective memory in children and its importance which is sometimes referred to as everyday memory.

1.5.8. Prospective memory in language

Prospective memory is very important in children's daily lives and combines aspects of executive function and working memory. It is defined as the 'memory for activities to be performed in the future' (Einstein & McDaniel, 1990). It is essential to everyday tasks (e.g. remembering to post a letter when you come across a post box) and, as it pertains to events which must be carried out in the future, it also involves the ability to carry through one's intentions despite the presence of ongoing distractions. It is thought that it involves aspects of executive function, for example the ability to hold the future intention in memory or retrieve it easily so that when the appropriate cue appears, the intention can be acted upon. A second aspect is the monitoring of the environment for appearance of the cue so that the intended action can be initiated. Working memory, inhibition and shifting, are all important

components implicated in this. Firstly, retrospective memory is needed to encode and store the original instruction and working memory is required to maintain an intention in mind and retrieve it, so that it can be executed at a later time. Inhibition is required to suppress the pre-potent response when the cue appears in order to carry out the intended response. The level of inhibition needed may vary according to the task and it may also be used as part of internal cognitive monitoring in order to ignore other distractions and refresh the original intention. Research using adult participants has found links between better inhibition control and better selection of information to maintain in working memory (Awh & Vogel, 2008; Vogel McCollough & Machizawa, 2005) so it would seem reasonable that children with better inhibition would be better at prospective memory tasks and conversely, children with poor inhibition would perform badly on prospective memory tasks.

Prospective memory is important for language development, as it links to executive functions and self-projection both of which are thought to be implicated in language processing (Ford, Driscoll, Shum & Macaulay, 2012; Mackinlay, Kliegel & Mantyla, 2009; Rendell, Vella, Kliegel & Terrett, 2009). Self-projection is especially important for pragmatic language, an aspect which is not picked up on effectively in many language tests. Brewer and Marsh (2010) have suggested that prospective memory may be linked to the capacity for “episodic future simulation” i.e. projecting oneself into the future and imagining performing the intended task, which involves moving one’s perspective from the immediate present to alternative perspectives. This has been linked with the development of theory of mind. Interestingly, children on the autistic spectrum have been shown to have impaired time-based prospective memory but undiminished event-based prospective memory and they are also known to have deficits in theory of mind (Williams, Jarrold, Grainger & Lind, 2014). The role of theory of mind in language development in aiding the understanding of the thoughts of others and the rules of social interaction is critical during the early years and prospective memory is thought to be closely linked with this ability (Ford et al., 2012).

In children, prospective memory begins to develop around the age of 3 and by 4 most typically developing children perform at ceiling on simple tasks (Kliegel & Jager, 2007). This would be in line with the development of inhibition abilities. Shifting is also involved in prospective memory, as the child must shift between the ongoing task and the prospective memory task. This is useful as better shifting enables the monitoring of the environment to be carried out and for switching to occur when the prospective memory task is required and switching back to the ongoing task once it has been completed.

The links between prospective memory performance and language impairments have been made in four broad areas:

1) the role of prospective memory in self-projection and theory of mind
2) the role of prospective memory and executive function
3) the conceptual role of prospective memory, and
4) the role of the prefrontal cortex
5)

1) Prospective memory and self-projection / theory of mind

Brewer and Marsh (2010) proposed that there may be an element of 'episodic future stimulation' in prospective memory, since to set up a prospective intention in the first place, a person needs to project into the future and imagine performing the intended task. Evidence from neuroimaging studies (Spreng, Mar & Kim, 2009) indicates that the same brain areas which are activated when participants are asked to imagine themselves in the future, i.e. the frontal, medial and temporal-parietal lobe systems, overlap considerably with the regions activated by theory of mind tasks and this has led to links being made between self-projection and disorders which involve episodic memory impairments such as ASD (Lind & Bowler, 2008). Most recently, Ford et al. (2012) have found links between theory of mind performance in 4 to 6 year olds and prospective memory performance and, given the overlaps, which exist in this young age group between children diagnosed with ASD and those diagnosed with DLD in terms of their pragmatic abilities, it is reasonable to posit the proposition that prospective memory performance may be an indication of language impairment.

2) Prospective memory and executive function

Evidence of the involvement of executive functions comes from numerous studies which have focused on the raising of cognitive load for example by a delay between the appearance of a cue and the chance to give a response (Rendell et al., 2009) or involving interruption of a task in order to carry out the intended response (Kliegel, Mackinlay & Jaeger, 2008; Shum, Cross, Ford & Ownsworth, 2008). The results indicated that age differences in the efficiency of carrying out prospective memory tasks were exacerbated significantly when the requirement to respond to the cue required interruption of the ongoing activity. Kliegel et al. (2008) put forward the speculative proposition that prospective memory execution in preschool children (aged 3, 4 and 5) is heavily dependent on the ability to withdraw attention from the ongoing activity which requires high levels of inhibition – a skill

which develops rapidly between the ages of 3 and 4 (Sheppard, Kvavilashvili & Ryder, 2016). The connection between prospective memory performance and inhibitory control has been further demonstrated by Kerns (2000) who showed that the two abilities correlated positively even after controlling for age. Additional evidence comes from Ward, Shum, McKinlay, Baker and Wallace (2007) who found significant links between young children's poor performance on a Stroop Colour Word Interference task (Stroop, 1935) and a high demand prospective memory task (interrupting an activity to give something to the researcher). In this study a link is made between these findings and the early stage of maturation of the prefrontal brain region. The most convincing support for this connection comes from Sluszarczyk and Niedwienska (2013) who found that children aged 4 years and younger performed poorly on prospective memory tasks which required interruption of an on-going task, which would be in line with the previous research and a systematic improvement in performance was shown after this age. Given the recognition of inhibition as an indicator for language impairment, the contribution of this executive function to prospective memory performance is an area requiring investigation in the current study.

3) The conceptual role of prospective memory

McDaniel, Robinson-Riegler and Einstein (1998) considered the perceptually or conceptually driven nature of prospective memory and their research indicated that it is largely conceptually driven, implying that there is a semantic element in it. They see prospective memory as being a process in which a person experiences a sense of familiarity when encountering an environmental event (via perception) which prompts a conscious search for the significance of the event (conceptual). Their findings support Moscovitch (1994) who saw prospective memory as being mediated by a memory module subserved by neuropsychological components which rapidly sends to consciousness, the information associated with the cue. The encoding which is thought to facilitate interaction of a cue with a memory trace are those which produce semantic information. Interestingly, children with ASD appear to have unimpaired event based prospective memory, which is the ability to respond to the occurrence of a particular specified event by carrying out an intended action (Williams et al., 2014) whereas their deficits seem to be in time-based prospective memory which requires the individual to do something at a particular future point in time and is therefore dependent on self-initiation in the absence of an external cue.

4) The role of the prefrontal cortex in prospective memory

Research in this area has focused on the neural mechanisms underpinning the processes involved in prospective memory and there is general consensus that, whatever strategies are

used, similar neural substrates are likely to be implicated (Burgess, Scott & Frith, 2003; Cohen & O'Reilly,1996; Okuda et al., 2007; Volle, Gonen-Yaacovi, de Lacy Costello, Gilbert & Burgess, 2011). The prefrontal cortex is probably involved in both monitoring and spontaneous retrieval strategies and the relatively underdeveloped cortices of young children may not be sufficient to find the target item or context with new actions. Due to this immaturity of the neural substrate it is thought that prospective memory performance in young children is likely to depend more on external factors such as motivation (e.g. if the task is for a desired reward) or familiarity with the required action (e.g. giving something to someone). The studies in this area which have led to these findings have a number of methodological issues such as variations in the difference in the time delay between the intention and the cue, whether the study was carried out in a naturalistic or laboratory setting and some studies have included no visual, verbal or perceptual cue, for example simply the instruction "Give the letter to your mum when you get home" (Guajardo & Best, 2000; Mahy & Moses, 2011, Nigro, Senese, Natullo & Sergi, 2002; Somerville, Wellman & Cultice, 1983). Einstein (2014) argues in favour of an automatic unconscious process, the precise development of which remains unclear. However, given the recognised involvement of the prefrontal cortex in inhibitory processes and language impairment, this research would seem to lend support to identifying deficits in prospective memory as an indicator of potential language impairment in young children.

1.6. Theoretical explanations and the assessment of DLD

Although children with DLD have been studied for over 150 years, the assessment tests which have been developed in the past decades have failed to provide a valid and reliable measure and the heterogeneous nature of the disorder means that several measures of the precise deficits are necessary. Both receptive and expressive language may be affected. The theoretical underpinning of many of these tests was linguistic theory and, as a consequence, the focus of many of the tests is on the linguistic impairments which can be detected in tests of grammar. Comparatively little attention has been paid to the production and comprehension of non-tangible referents which would be required in social contexts. The tests currently available tend to measure this aspect by asking teachers and caregivers for feedback on the frequency and type of pragmatic behaviours observed in children.

The purpose of assessment is to (a). identify a potential impairment; (b). describe the child's communicative systems, including the nature and severity of the impairment as well as mitigating factors; (c). plan a course of action and predict long term outcomes of this plan and (d.) evaluate the effects of the implemented action plan over time (Kohnert, 2013). The

assessment must therefore be evidenced based and this has led to the development of a range of standardised assessment tools over the years. Though the tests overviewed below are widely used in research since the 1990's, it is not clear how used the various assessments are by speech and language therapists and clinicians either in their entirety or selectively. To the best of the researcher's knowledge, there is no universally accepted standard for this process. In the UK, the choice of assessment test is dependent on the expertise of the practitioner and requires detailed knowledge of the tests and their limitations as set out by the professional body for language clinicians, The Royal College of Speech and Language Therapists (RCSLT guidelines, Taylor-Goh, 2017).

1.6.1. Assessment tools – theoretical basis and practice

A variety of assessment tools exist and are reportedly widely used by practitioners (Roulstone et al., 2015). Given the heterogeneous nature of the disorder, the tests need to assess both expressive and receptive language. The early signs of impairment would generally include delay in learning grammar and an inability to repeat nonwords and most of the tests include these elements. The pragmatic or social use of language is less well catered for. The tools reflect the changes that have taken place in the theoretical approaches to DLD, moving from those with a purely linguistic focus to those which include aspects of memory and those which attempt to include some measure of pragmatic ability. In order to understand the aims of the assessments and their limitations, an overview is provided below of the tools commonly used in research and therapeutic practice.

A language-based approach is offered by the GAPS (Grammar and Phonology Screening) test. Developed by van der Lely and Gardner, GAPS (2006) is based on linguistic theory and the aim of this test was to provide a short screening test which could be administered cheaply and quickly (approximately ten minutes duration) to all children between the ages of 3.5 years and 6.5 years. The focus is on nonword repetition and repetition of grammar as diagnostic measures and the child is required to repeat sentences as directed by the practitioner. It uses a character "Bik" who only understands when children speak to him. The child repeats sentences to Bik so that he can understand them and all these sentences incorporate key elements in detecting early evidence of language impairment such as requiring the repetition of nonsense words such as "klest".

As a pre-school screening test, it typically identifies 10% of children as requiring further testing, full assessment and referral and up to 15% of children as requiring testing in the next six months.

The major drawback of GAPS, in addition to its limited use a screening rather than a diagnostic tool, is that it does not correlate well with other grammar tests (e.g. the correlation between GAPS and TROG is only 0.74). This highlights the central problem in the assessment process, which is that different tests tap into different components of the impairment and therefore select different children as being impaired.

Another tool which focuses on linguistic structures is the TROG (Test for Reception of Grammar). The diagnostic aim of this test is to measure the deficits in grammar, specifically the comprehension of sentences. Developed by Bishop (2003a) and now in its second version, the TROG assesses grammatical comprehension by measuring the understanding of 20 constructions, presented four times each using different stimuli. It is based on multiple choice answers, requiring a child of 4 years and upwards to select a picture to match a sentence spoken by the tester. The grammatical complexity of the sentences increases as the test proceeds. A block of four items is scored as “passed” if all four items are responded to correctly and as “failed” if one or more errors occur.

The major problem with this test is that it is possible to make errors which arise from choosing the wrong lexical item rather than because of grammatical difficulties (Bro, Eriksson, van Doorn & Vikstrom, 2006). The test also includes only a limited number of grammatical structures which makes discrimination between older children problematic (Andelkovic et al., 2007). The test does provide a lexical screen to check the child’s knowledge of lexical items, although in practice this is not often used. The underlying assumption of this test is that grammar is innate and that a child with DLD will have language problems based on grammar, hence there is no attempt within the test to tap into the child’s pragmatic behaviour or to test their phonological awareness.

Another grammar-based test is the TOLD-4 (Test of Language Development). Developed by Newcomer and Hammill (1997). This test is designed to measure oral language proficiency in children from the age of 4 upwards and is based on a number of subtests such as Picture Vocabulary, Syntactic Understanding, Sentence Imitation, Morphological Completion. The major drawback is the omission of a pragmatic assessment (Hammer, Pennock-Roman, Rzasa &Tomblin, 2002). An alternative test which also focuses on grammar is the VATT (Verb Agreement and Tense Test) which was developed by van der Lely (2000), and is a specific test of morphology and syntax. It concentrates on the marking of present tense and agreements, together with the use of the past tense for regular and irregular verbs. It is

extremely limited in its scope, since it does not test memory or phonological awareness and is therefore of limited diagnostic value.

A reliable test of pragmatic language or social communication abilities has been elusive. Tests which have attempted to address the gap in the assessment of pragmatic abilities which are clearly linked to cognition include the TOPL-2 (Test of Pragmatic Language). Developed by Phelps-Terasaki and Phelps-Gunn (1992) and now in its second version, this test requires a child of 6 years and above to respond to pictorial situations. It tests six core sub-components of pragmatic language including: physical setting, audience, topic, purpose (speech acts), visual – gestural cues and abstraction. It has proven effective in differentiating children with pragmatic language disorders and its usefulness is generally supported, but its validity has been limited by small sample sizes, the lack of relevance of the pictures to all children and the weak links between actual test items and the defined areas of assessment (Alduais, Shoeib, Al-Hammadi, AlMalki & Alenezi, 2012).

The CCC (Children's Communication Checklist) (Bishop, 2003b) was designed as a screening test to identify children from the age of 4-16. Now in its second edition, the purpose behind its development was to identify pragmatic abnormalities which would not necessarily be evaluated in a formal language assessment. It comprises a 70-item questionnaire which can be hand or electronically scored and takes 5-15 minutes to complete. It may be completed by parents or teachers.

It initially aimed to distinguish children with Pragmatic Language Impairment (Social Communication Disorder) from children with more typical language impairment (Bishop & Baird, 2001). However in later versions the pragmatic composite was removed, as it proved to be unreliable. The CCC includes sub-codes to assess social relationships and to probe for unusual interests which were intended to investigate the relationship between Pragmatic Language Impairment (Social Communication Disorder) and ASD. The CCC is thought to work well in identifying children with ASD..

This test is widely available and has been well received by clinicians. It can be used with any children, but one could argue that the ratings may be prone to subjective interpretation. However, it takes little time to administer and, if completed by someone who knows the child well and has observed them for a prolonged period of time, they would be in a position to give a representative account of the child's typical behaviour. Although limited in its scope and effectively a screening rather than a diagnostic tool, it does enable the assessment of

behaviours which are extremely difficult to elicit in test situations and may be rare in occurrence. As it is simply a checklist, it is easy to administer. It provides standard scores and percentiles for ten scales which include speech, syntax, semantic, coherence, inappropriate initiation, stereotyped language, use of context, nonverbal communication, social relations and interests. Two composite scores are derived firstly, the General Communication Composite (GCC) which is used to identify children likely to have significant communication problems and the Social Interaction Deviance Composite (SIDC) which is used to identify children who may have a communication profile characteristic of an ASD.

The most widely used tool is the CELF Clinical Evaluation of Language Fundamentals (Wiig et al., 2013) which is an individually administered test for detecting language disorders in children from 3-16. There are two versions: the CELF pre-school 2 which covers ages 3-6, and the CELF 5 which covers 5-21. The CELF pre-school 2 takes 30-45 minutes to administer and comprises 11 subtests, while the CELF5 takes 30-45 minutes to administer and comprises 18 subtests which can be selected according to age. The pre-school 2 version contains the following subtests which cover sentence structure, word structure, expressive vocabulary, concepts and following directions, recalling sentences, basic concepts and word classes while the supplementary tests cover recalling sentences in context, phonological awareness, pre-literacy rating scales and a descriptive pragmatics profile.

The CELF provides composite scores based on Language Structure, Language Content, Memory and Working Memory and an effort has been made in its latest revision to provide culturally diverse contexts for the stimuli. The tasks include ordering words in a sentence (a test of understanding of grammar), a test of vocabulary both receptive and expressive (which tests verbal comprehension and production, following instructions (which tests nonverbal understanding as well as verbal) such as “touch the black square and then the white circle” and recalling sentences (which is a test of memory and production of language). Phonological awareness is also tested in tasks such as identifying rhymes and producing rhyming words as well as repeating nonwords.

The CELF is widely used by language professionals and has recently undergone its latest revision with CELF-5 published in the UK in 2018. The most recent version has shown specificity and sensitivity of 0.97, using a cut offpoint of 1.35 SD below the mean, which is considered good and means that only 3% of children with language impairment would not be identified correctly and only 3% of typically developing children would be incorrectly

identified. However, there has been some debate (Leadersproject, 2014) regarding the small sample sizes used and the degree of severity of the participants' language impairment in arriving at these figures.

It has been shown to have good discriminatory power in differentiating between groups of children with DLD, ASD and SCD as illustrated by the finding that the 'Recalling Sentences' subtest was a significant psycholinguistic marker in the studies by Botting and Conti-Ramsden (2003) and Lloyd, Paintin and Botting (2006). Both studies found that the DLD children had the lowest scores of all three groups on the subtest.

Additionally, CELF assessments have been used to provide valuable information about some of the possible reasons for social, behavioural or emotional difficulties in children who are being considered for a diagnosis of ASD. However, the test still requires a level of experience in the assessor as it remains difficult to determine whether it is a child's actual performance on a specific subtest or whether it is their performance on a subtest relative to their performance and the test as a whole which is of importance. A further criticism is that, while the CELF aims to offer a global measurement of a child's language abilities, it is widely felt amongst language clinicians that it fails to take any pragmatic impairment fully into account.

1.6.2. Overview of assessment tools

This is not an exhaustive list of the tools available, but it can be seen how theory has underpinned their development, resulting in the great variety available. Little is known about how they are used in clinical practice and in some areas they may not be freely available to speech and language therapists (SLTs). The summary illustrates that there is no ideal test for DLD. If one considers the purpose of assessment as described earlier in terms of identifying a potential impairment, describing a child's communicative systems including their nature and severity, as well as planning a course of action, predicting the long term outcomes and evaluating the effects of the implemented action plan over time, it is apparent that the current tools fall short in a number of areas.

This situation is the result of changing theoretical stances and differing views on the practicality and viability of tests. It can therefore be seen how SLTs, faced with the significant shortcomings of the diagnostic tools and limited availability are required to draw on their own expertise and detailed knowledge in order to arrive at a decision which will enable interventions to be made available to the child. Furthermore, in the light of new research on

the role which executive function deficits may play in DLD, aspects of these should be built into the assessment procedure.

1.7. Rationale for the current research

There appears to be little research in relation to the way research informs the SLT in practice. A multitude of assessments exist but these are often not based on current theory or in some cases (such as the CELF) only incorporate current theory in a limited way. It is clear from the literature that the current situation regarding the assessment and diagnosis of children with DLD is unsatisfactory. The research focus to date has been on theoretical explanation and seeking to identify differences between language impaired children and other groups, but the rapid changes have to be incorporated by SLTs who are faced with the challenge of diagnosis. Greater understanding of the needs of SLTs in diagnosis is required to address the difficulties they face. The rationale was initially to consult with practitioners involved in assessment and diagnosis of children in order to gain understanding of current practice and issues to inform the research which would go some way to addressing this situation and identifying, in particular, the early, linguistic and nonlinguistic predictors of DLD.

The aims of the research were as follows:

1) To understand the issues in diagnosis and assessment of children with language impairment and to synthesize the knowledge of clinicians, teachers and SLTs working directly with the assessment and diagnosis of children with DLD.
2) To investigate whether executive function abilities (i.e. inhibition, prospective memory) may be impaired in children at risk of developing DLD in the preschool period.
3) To investigate whether executive function tests correlate with a revised test of nonword repetition suitable for use with bilingual children.

A mixed method design used both qualitative and quantitative methods. The qualitative method (using focus groups and questionnaires) was used in order to understand the assessment and diagnostic process and issues for front line SLTs and the quantitative method was used to investigate the possibility that executive function abilities such as inhibition may be indicators for children at risk of developing a language disorder.

1.8. Rationale for use of qualitative methods

The ontological and epistemological position taken in this part of the research is constructivist as the most important aspect is that the perceptions and understandings of the participants are deemed to be knowledge. Their understanding of their own experience is regarded as constituting the knowledge which informs the researcher's understanding of their experience. The subjective views of the participants are considered to be of paramount value and "truth" is regarded as something which is derived by the participants making sense of their experience in the world. Qualitative methods are therefore considered to be the most appropriate to understand context and meaning in their full complexity.

Given the rapid developments in the research and changes in the diagnostic criteria for DLD, it was important to understand the nature of any issues in the referral, assessment, diagnosis and therapeutic treatment of children. The role of the SLT is central to these processes and their clinical experience is based on direct observation, reflection and judgements. The decision to use qualitative methods to investigate this aspect was based on Green and Britten (1998) who noted that the value of qualitative methods is in their ability to systematically assess research questions which do not lend themselves to experimental methods. They also maintain that the question of how evidence is turned into practice, is best addressed by qualitative research examining the beliefs, attitudes and preferences of practitioners. There is a paucity of qualitative research exploring the knowledge and experiences of SLTs and the challenges they face in assessment practice and it was thought that this data would not only inform the current research, but would also contribute to the limited body of knowledge which currently exists in this area. To the researcher's knowledge there have to date been only a small number of qualitative studies of the experiences of SLTs (Collis & Bloch, 2012; Roulstone et al.,2015; Watson & Pennington, 2015) and there has been only one study of SLTs working with bilingual children (O' Toole & Hickey, 2013) which was carried out in the Republic of Ireland, on a small sample. The findings from these studies which covered a range of speech conditions, indicated a lack of comprehensive assessment tools and a low level of standardisation of procedures. The current research is the first study to consult practitioners working with children who have DLD.

A qualitative study using a combination of focus groups and an online questionnaire provided a means to understand the views and experiences of SLTs. Qualitative research has basic orientations including naturalism (a natural setting in which the research is conducted), interpretation (the researcher builds a holistic picture of the detailed views of participants) and relativism (acknowledging the different explanatory systems) which are adhered to in

this study. Qualitative studies have been used effectively to provide greater understanding and avenues for further research in other disorders, most notably Autism Spectrum Disorder (Bargiela, Steward & Mandy, 2016; Cridland, Jones, Caputi & Magee, 2015; Tint, Weiss & Lunsky, 2017; Tomlin & Swinth (2015); Trevisan, Roberts, Lin & Birmingham, 2017) and these researchers have argued for the full inclusion of qualitative research as a source for evidence of relevant and effective therapy practice. The SLT is primarily concerned with early assessment and the provision of appropriate interventions for children with DLD and individual experiences may inform judgements and views. From a constructivist ontological and epistemological perspective, such judgements and views are essential to a full understanding of the reality they experience.

In line with the advice of Vogt (2010), it was important to consult members of the target population, i.e., front-line SLTs, since this process would inform the conceptualisation of key constructs in the development of any future preschool screening or assessment tool. It was expected that the participants would be keen to express their opinions in these forums and would interact to produce a large amount of vibrant and dynamic data. To achieve this, a focus group method was considered suitable because this would enable the researcher to gather naturalistic data. To ensure that the aims of the study were met, a semi-structured group interview was planned and to enable rich discussion, the participants would be able to act as facilitators themselves by challenging each other's statements or asking each other questions in the focus group. The online questionnaire method provided an effective means of accessing a wider range of SLTs who may be working individually in clinical settings and would not therefore be involved in a focus group, but who may make meaningful contributions. This would yield mainly qualitative data, although some quantitative data could be obtained in order to measure the strength of feeling on certain questions.

The use of the questionnaire was justified by the possibility of transferability which this approach enabled and which would allow any areas of strong consensus or divergence of opinion to be identified and analysed.

1.8.1. Focus group method

The researcher is not a member of the SLT community. The aim was therefore to encourage discussion and debate amongst SLTs in relation to the diagnostic process and understanding of DLD characteristics/criteria. Focus groups were deemed the most appropriate method to achieve this as they allow dynamic interaction. Rather than one-to one interviews, the focus group forum allowed participants to present their views openly amongst

their peers and to confirm, comment on and challenge the perspectives of others. This method is useful for obtaining detailed, nuanced accounts of the SLTs' first-hand experience and the dynamics of the groups were sufficiently open to enable the interactions of the participants to focus the discussion on topics which were important to them. The effect of this was to move the direction of the discussion to areas which had not been previously considered (for example, the issue of assessing bilingual children) when developing the original set of key questions. To facilitate lively discussion without creating an overwhelming group size, each focus group was kept within the 8-12 number of participants, following the guidance laid down by Barbour and Kitzinger (1999), Krueger and Casey (2000) and Smithson (2010).

1.8.2. Questionnaire method

It is well known that in the case of qualitative data, unlike quantitative data, generalisability is often an issue (Leung, 2015; Polit & Beck, 2010; Smith, 2018). To supplement the data from the three focus groups from different service areas and geographical regions and in order to have some idea of the representativeness of the views of those in the focus groups, a questionnaire method was additionally employed to gain understanding of this.

The questionnaire was conducted online in order to extend the range of qualitative methods used and to provide an alternative sampling method to the purposive sampling used in the focus group research. A volunteer sample of 35 language practitioners responded to the online questionnaire which was distributed to all current members of the database of a national association of professional language clinicians. Online questionnaires provided an effective means of gathering views on a wider geographic scale than had been possible in the focus group investigations.

1.8.3. Method Triangulation

As different methods and two researchers were used in the data collection, it was considered useful to compare the findings from each and to address issues of validation and potential source of bias. One well known drawback of qualitative data collection is the low number of participants and the consequent problem of establishing whether they are representative of the target population. In this study, both focus group and questionnaire methods were used to establish whether the views expressed in various regions in the focus group were typical of more nationally held views which were gathered through an online questionnaire.

The findings from the focus group and questionnaire were compared to the literature on SLTs' experiences with other disorders, (Collis & Bloch, 2012; Roulstone et al., 2015; Watson & Pennington, 2015) the literature on key indicators of DLD (e.g. Conti-Ramsden et al., 2001; Ward& Gilmore, 2010 Yazdani, Sima0Shirazi, Sleimani, Reza Razavi & Dolatsahi, 2013) and to the few articles which exist on the problems of assessing bilingual children at risk of developing DLD (Bedore & Peña, 2008; Gillam, Peña, Bedore, Bohman & Mendez-Perez, 2013; O'Toole & Hickey, 2013; Paradis, Crago, Genesee & Rice, 2003; Verhoeven, Steenge, van Weerdenburg & van Balkom, 2011)

1.9. Rationale for use of quantitative methods

A quasi-experimental approach was used involving the observation of a pre-existing independent variable (i.e. whether a child was considered to be typically developing or "at risk" of developing a language disorder) and the generation of quantitative data which could be used to quantify the difference in the responses of the participants.

Given recent research, the changes to DSM V and concern for the early support for children with DLD and/or SCD, it was decided that the executive function, inhibition may provide an indicator of an early vulnerability to developing a language disorder. The meta-analysis by Pauls and Archibald (2016) found compelling evidence from a review of 46 studies comparing children with and without DLD on behavioural measures of inhibition and cognitive flexibility which indicated that children with DLD performed consistently below typically developing children on inhibition tasks ($g = -0.56$) and that these effects were seen, irrespective of the task demands or the severity of the linguistic impairment. On the basis of this evidence, three inhibition tasks were selected for the current study (a nonverbal inhibition test, a verbal inhibition test and a self-control test) as these were all appropriate for use in the preschool age group and, if shown to be a good indicator of vulnerability to a language disorder, were simple enough to be incorporated into any potential screening tool. The evidence as to which of these tests is the most effective indicator of vulnerability is not currently known and this provided a further rationale for their inclusion in the study.

Prospective memory is also dependent on executive function and inhibition (Mahy, Moses & Kliegel, 2014a) and for this reason, a number of prospective memory tasks were embedded in the inhibition tasks which involved the participant remembering to pass a wooden block to the researcher on completion of each inhibition task and then remembering to pick up a gift when leaving the room.

There is also a known language-specific indicator, nonword repetition which is suggested to be reliable, but issues have arisen with its specificity to particular languages, making it unsuitable for use with bilingual children. Chiat, Polisenska and Szewczyk (2012) have produced a quasi-universal nonword repetition test which is designed to be used with bilingual children as it draws the nonword sounds from combinations which do not occur in specific languages. This test has been incorporated into the COST Action ISO804 framework and is being extensively trialled by researchers across the world. Given that the theoretical approach is that deficits in inhibition would lead to deficits in language development, it is therefore of interest to compare the results of the inhibition tests with the quasi-universal nonword repetition test.

Early identification is key and there are known risk factors for DLD. Given that the aim of the current research is to enable early identification of a vulnerability to a language disorder to be made, these risk factors were also taken into account. In addition, it is intended to follow up the children in future years to track their language development in comparison to their scores on the tests taken during the preschool period as part of the current study.

1.9.1. Experimental method

The study used an independent measures design involving comparison of three groups of participants in the age range of 3 to 4 years:

The three groups were comprised of - 1) Typically developing children (N=30); 2) Monolingual children “at risk” of a language disorder (N=30); 3) Bilingual children “at risk” of a language disorder (N=30). The comparisons were made between the groups on each of the 3 inhibition tasks, the prospective memory task and the nonword repetition task. The first comparison was to analyse the results of the typically developing group against the “at risk” group which was made up of both the monolingual and bilingual “at risk” groups combined. The second comparison was to analyse the monolingual “at risk” group against the bilingual “at risk” group. The third comparison was to analyse the correlations between the performances of the “at risk” groups.

1.10. Overview of Research Aims

The aims of the research were: firstly, to understand the issues in diagnosis and assessment of children with language impairment and to synthesize the knowledge of clinicians, teachers and SLTs working directly with the assessment and diagnosis of children with DLD; secondly to investigate whether executive function abilities (i.e. inhibition, prospective memory) may

be impaired in children at risk of developing DLD in the preschool period and thirdly, to investigate whether executive function tests correlate with a revised test of nonword repetition suitable for use with bilingual children.

1.11. Ethical consideration and approval

Ethical approval was obtained for the qualitative study on 4th November 2013 and 19th August 2014 from the ECDA for Health & Human Sciences at the University of Hertfordshire. Protocol number LMS/PG/UH/00145.

Ethical approval was obtained for the quantitative study on 29th January 2016 from the ECDA for Health & Human Sciences at the University of Hertfordshire. Protocol number CLMS/PGR/UH/02248.

CHAPTER 2

A Qualitative Study of the Experiences of Speech and Language Therapists in assessing and diagnosing DLD

This chapter provides a detailed account of the qualitative study which formed the first part of the research. The Introduction gives an overview of the current issues in the assessment and diagnosis of DLD, in particular the debates which have surrounded classification and the use of terminology in addition to the challenges faced by speech and language therapists when assessing and diagnosing children with DLD. The following section gives information about the focus group study which was carried out and details the settings, the sample, the recruitment procedures, the participant characteristics, the development of questions, the process of data collection and how data was recorded and handled. These procedural details are followed by a section on reflexivity and the important role this played in the research process. The results of the thematic analysis are described followed by an overview of the findings and a discussion and the conclusions that were able to be drawn from these. The next section gives information about the questionnaire that was carried out, including details of the recruitment and the profile of the participants, the development of questions, the procedure and the data analysis that was undertaken. The results of the data analysis from the questionnaire are given in two parts – the quantitative and the qualitative analysis. This is followed by an overview of the findings, both quantitative and qualitative, and a discussion and conclusion based on these findings. The chapter concludes with a general discussion of the results of both the focus groups and the questionnaire and the overall conclusions which can be drawn.

2.1 Introduction

The aim of this research was to gain an in-depth understanding of the experiences of SLTs involved in the assessment and diagnosis of children with DLD, including both the linguistic and nonlinguistic aspects of the disorder.

It has long been apparent that, despite affecting around 7% of the population, DLD is hardly known in comparison to other childhood disorders. It is widely accepted that the later the diagnosis, the more considerable are the longer-term effects i.e. poor educational outcomes,

long periods of unemployment, difficulties in relationships and a high risk for depressive and anxiety disorders (Beitchman et al., 2001; Clegg, Hollis, Mawhood & Rutter, 2005; Conti-Ramsden & Botting, 2004; Haynes & Naidoo, 1991). Evidence for the importance of early intervention comes from longitudinal studies such as the Manchester Longitudinal Study (Conti-Ramsden et al., 2012) which indicated that interventions after the age of 7 resulted in continued language delay, rather than resolution.

There is therefore an urgent need for early accurate assessment. However, there are conflicting pressures on support services as the government drives to move the emphasis away from the diagnostic process to a screening assessment. Debate has also erupted concerning terminology (Reilly et al., 2014a, 2014b).

The longstanding classification of Specific Language Impairment (SLI) and Pragmatic Language Impairment (PLI) were replaced in the DSM V (2013) by the new diagnostic categories of Language Disorder (LD) and Social Communication Disorder (SCD). PLI was defined as a difficulty in understanding and using language in context and/ or following the social rules of language, despite relative strengths in word knowledge and grammar. SCD is defined by a primary deficit in the social use of nonverbal and verbal communication. Individuals with SCD may be characterised by difficulty in using language for social purposes, appropriately matching communication to the social context, following rules of the communication context, understanding nonliteral language and integrating language with nonverbal communication behaviours. This reclassification was based on evidence of issues with diagnostic criteria, co-morbidity and increasing evidence that deficits are not specific to the language domain (Henry et al., 2012; Reilly et al., 2014a, 2014b). The term DLD was proposed following the CATALISE consultation with language professionals from several countries (Bishop et al. 2016) as this was thought to provide a more appropriate diagnostic description of the difficulties faced by children with language problems which may not be specific to language and may be co-morbid with other conditions. The process of diagnosis is made especially complex by the heterogeneous nature of DLD. Research consistently reports concerns in diagnosis e.g. relying on exclusion rather than inclusion criteria. The assessment tools available vary in specificity and theoretical basis and it is the expertise of the SLT that is central to screening and diagnosis (Dockrell, 2001; Whitehouse, 2014).The main concern of SLTs is the identification of children with DLD in order to put in place appropriate interventions and therapeutic support.

Prior to the introduction of DSM V (2013) the diagnosis of SLI was based on age appropriate nonverbal ability and exclusionary criteria such as no evidence of hearing difficulties, neurological dysfunction, oral, structural or motor problems and no symptoms of impaired reciprocal social interaction or restriction of activities, the latter being an attempt to rule out any evidence of Autism Spectrum Disorder (ASD). Since then, there has been a major shift in the theoretical views of SLI/DLD, with the emphasis moving away from a purely linguistic approach towards a more broad based approach. Some nonlinguistic aspects of DLD (e.g. hypothesis-testing and analogical reasoning) have been recognised since the 1980's (Nelson, Kamhi & Apel,1987; Nippold, Erskine & Freed, 1988). Recent research has questioned the evidence for age appropriate nonverbal ability in children with DLD and has found impairments in their executive function abilities (Henry et al., 2012; Pauls & Archibald, 2016; Roello, Ferretti, Colonello & Levi, 2015). This suggests that DLD affects multiple domains, not only language. Within the range of executive functions, inhibition has come to be a major focus for research into DLD (Bishop & Norbury, 2005; Ellis Weismer, Evans & Hesketh, 1999; Lorsbach et al., 1996; Marton et al., 2007; Seiger-Gardner & Schwartz, 2008).

This shift in focus presents major challenges to the SLT. Many commonly used standard assessment tools are based on linguistic theory and are therefore designed to identify grammatical, phonological and semantic deficits but the assessment of SCD (previously known as Pragmatic Language Impairment) has continued to be problematic in terms of validity. Against this background, the SLTs across NHS trusts in the UK employ evidence-based practice to ascertain as accurately as possible, the language difficulties of the child and provide appropriate support and therapy for the child and the parents/carers. The SLT is therefore faced with considerable challenges, given the rapid changes to theoretical knowledge. However, little is known with regard to the experiences and perceptions of the SLTs in their service areas and it was therefore considered essential to gain a deeper understanding of the diagnostic process with SLTs in order to address any gaps in current knowledge and to understand the challenges.

To the researcher's knowledge there is only one published study which has explored the challenges facing SLTs generally (Roulstone et al. 2015) and only one study which has focused on diagnosing SLI/DLD in bilingual children, O'Toole and Hickey (2013). The latter study focused on the issues for SLTs involved in diagnosing bilingual Irish/ English children and gave an insightful analysis of the controversy over assessments used in the diagnosis of

monolingual children and raised issues for the SLTs in diagnosing and treating bilingual children.

It was therefore considered important to find out what SLTs consider to be reliable indicators of DLD and to establish which, if any, of these are nonlinguistic. Also, in view of government guidelines for the use of screening as opposed to assessment and diagnosis, it was considered essential to gain an understanding of the current assessment process and to identify what would be needed by SLTs in an early screening/assessment tool.

Aims of the study

1. To gain an understanding of the experience of SLTs working with language impaired children in assessment and diagnosis.
2. To identify the needs of SLTs in the process of assessment and diagnosis.
3. To gain an understanding of the SLTs experience in order to inform further research study.

With these aims in mind, a series of focus groups were conducted with a number of language professionals and these were followed up by a questionnaire to the membership of a national association of language clinicians. Focus groups were the most appropriate method as they provided a forum for the exchange of ideas between the participants and allowed for comments to spark off additional comments amongst members of the group. The researcher was aware of the possibility of domination of the groups by a few speakers or the non-contribution of some members of the groups, but in practice this did not arise. The researcher was also conscious of the risk of “group think” affecting the focus groups whereby members of the group seek to minimise conflict by suppressing alternative viewpoints. This could have been an issue as in each focus group all the participants were drawn from the same institution, but again, in practice this did not arise.

2.2. Focus groups

The number of focus groups was set at 3 in order to give reasonable geographic coverage across England (1 in the north, the midlands and the south). Following the recommendations of Guest, Namey and McKenna (2017), it was decided that this number of focus groups would be sufficient to identify all of the most prevalent themes. From the literature (Caesar & Kohler, 2007; Grimm & Schulz, 2014; Lyons, et al., 2007) it is suggested that there is a lack of standardisation of practice on a national (and international) level and it was therefore

decided that accessing SLTs' views in different regions and from different types of institution would yield more interesting data. This approach was used since it would enable any local variations in practice to be recorded. Furthermore, the semi-structured nature of the focus group questions meant that if any regional issue of interest emerged naturistically from the discussion, this could be further explored by the researcher.

In line with the recommendations of Barbour and Kitzinger (1999), Krueger and Casey (2015) and Smithson (2010), the maximum number of participants in each focus group was set at 10. This number was decided upon to ensure a wide variety of experience amongst the participants whilst maintaining a suitable group size for discussion. It was also considered (following the guidance of Guest et al., 2017) that this group size would be a reasonable estimate of when data saturation would be reached i.e. when new information produces little or no change to the codes identified.

2.2.1. Settings

In order to gain access to a variety of institutions in which assessment and diagnosis of DLD take place, three different types of establishment were approached. One was a specialist language school which accepted only children who had already exhibited language problems. One was a specialist language unit in a mainstream primary school where children spent half the day working intensively on language and then returned to a mainstream classroom for the afternoon. The third was a specialist language school which catered for the needs of children with language difficulties from primary school age through to adolescence. The schools were identified on the basis of having experience of assessing children with DLD alongside those with ASD and all had children from the age of 5 years upwards. Also, all the schools had NHS SLTs working with the children in their care even though these were educational rather than clinical environments. It was acknowledged that the settings for the focus groups were specialist workplaces and this could influence the views expressed by the SLTs, for example on prior screening of the children, if the SLTs were working with children with well-established DLD who may have exhausted other intervention possibilities. The children in all three schools had been identified as having language difficulties and some had undergone an initial assessment before admission. The SLTs in each school had been part of the assessment and diagnostic process.

In order to maximise uninhibited contributions from the participants, the focus groups were held in quiet rooms in the participants' professional locations. The timings of the groups were

planned for 1.5 hours, in accordance with the recommendations of Krueger and Casey (2015) but were given a maximum length of 2 hours.

2.2.2. Sample

The inclusion criteria related to the study's objective to gather evidence from experienced SLTs with first–hand knowledge and direct practical experience of assessing and diagnosing children with DLD. All the participants in the study met the following criteria:

1. Qualified speech and language therapists.
2. Currently involved in the assessment and diagnosis of children with DLD.
3. A minimum of two years' experience of assessment and diagnosis of children with DLD.

Two years' experience was considered an appropriate minimum level as participants with this level would have accumulated a considerable amount of casework in this area and would have been exposed to a variety of situations.

The sampling strategy aimed to reflect a degree of variation in the regional experiences of SLTs and was therefore based on geographic location rather than demographics. The strategy also aimed to reflect the experiences of SLTs in different types of institution. A purposive sample was therefore taken from three different types of institution in different areas within the UK. The Headteacher of each of the schools was approached and they were asked to liaise with staff in order to provide a suitable selection of participants for each focus group, given the aims of the research. None of the target participants opted out of the research.

2.2.3. Recruitment

The researcher acknowledged the role of the Headteacher in acting as a potential gatekeeper in the (possibly biased) selection of participants from their staff who met the inclusion criteria, but this was unavoidable in order to gain access to suitable participants working in front-line settings.

2.2.4. Participant characteristics

Seventeen SLTs were involved in the three focus groups with five in two of the focus groups and seven in the other focus group. Participant numbers were less than the lowest recommended maximum of 10 (Smithson, 2010).

A profile is given below:

Age range 20 to 25 – 2 female, 1 male. Experience 1 to 3 years
Age range 25 to 30 – 1 female, 1 male. Experience 5 to 9 years.
Age range 35 to 40 – 2 female. Experience 17 to18 years.
Age range 40 to 50 – 9 female, Experience 18 to 28 years.
Age range 50 to 60 years 1 female. Experience 38 years.

The mean age was 39 with a range of 27 years. All were directly involved in the assessment and diagnosis of children with DLD. All met the minimum experience requirement of having two years working in the field.

2.2.5. Development of questions

A set of semi-structured interview questions was developed based on the topics identified in the current literature (see below).Consideration was given to the one study of experiences of SLTs in dealing with bilingual diagnosis (O'Toole & Hickey, 2013) and similar studies diagnosing other childhood developmental disorders e.g. ASD and related disorders (Charman & Baird, 2008; Rogers, Goddard, Hill, Henry & Crane, 2016). Each question was intended to stimulate discussion on issues relevant to the research question. Some closed questions were included, e.g. "Are there any reliable indicators you would look for in a child who has SLI?" but the content of these was deliberately phrased so as to stimulate discussion on a topical issue, rather than generate a simple yes /no answer. A number of questions were formulated in a deliberately open way in order to maximise the discussion arising from them. Follow-up questions were also considered in case the original question failed to elicit a sufficient response, e.g. for Question 1 "What would be the typical age for referral to you?" And for Question 3,"How far do you think 'gut instinct' plays a part in assessment?". Question 5 was aimed at accessing evidence of non-language abilities of children with DLD (as the literature suggests executive function impairments) but was deliberately phrased in an easily understandable way in order to elicit evidence based on accounts of children's lack of organisation or forgetting to do something.

The term SLI was used throughout as the SLTs had not yet adopted the new DSM V or the CATALISE recommended term (DLD). Furthermore, the focus of the study was on SLTs' experiences of diagnosis not on changes in terminology and classification.

Focus group questions:

1) How do children come to be referred to you?
2) What do you think of the current assessment procedures?
3) Are there any reliable indicators you would look for in a child who has SLI?
4) What differences do you notice in the use of language in children with SLI and ASD?
5) Are there any non-language difficulties which you notice such as every day memory?
6) If you could design a screening tool for SLI, what would be the most important feature you would want to see in it?

2.2.6. Data collection

The focus groups were led by the same researcher acting as facilitator. The researcher has no professional background in speech and language therapy and therefore the potential for leading or biasing the data collection and analysis was limited. To overcome any possible bias, the researcher engaged in a process of reflexivity in line with the procedure in Ritchie and Lewis (2005). The researcher conducted each focus group in a quiet room in each location at the end of the school day and began by explaining the purpose of the research. In order to build rapport, the participants were asked about their roles before the questions began. Participants were informed that their responses would be viewed neither as right nor wrong. The researcher acting as facilitator intervened as and when necessary to probe further into issues which arose spontaneously but were of high relevance to the research question. For example, the issue of assessing and diagnosing bilingual children was not included as part of the original interview schedule, but was mentioned by several participants and the researcher used follow up questions to delve deeper into the participants' experience of this. Every member of each focus group made at least one contribution. Speaker 1 in Focus Group A had 38 years' experience and as a reflection of this, contributed more than other speakers. There were concerns that there could be dominance by some speakers and reticence on the part of others, but in practice this was found not to be the case. All participants agreed to be audio-recorded. At the end of each focus group, the researcher drew the discussion to a close and gave a summary of the views expressed which was acknowledged to be an accurate interpretation of the focus group's opinions. The

participants were thanked and assured of total anonymity and confidentiality. Focus group A lasted 1.5 hours and Focus groups B and C lasted one hour each.

2.2.7. Data recording and handling

All focus group data were audio-recorded and transcribed verbatim by the researcher for subsequent thematic analysis following techniques set out by Braun and Clarke (2006). The initial analysis was conducted within each group and this was followed by an across-group analysis which was organised around similarities and differences emerging from each group.

The stages of analysis involved firstly familiarisation with the data through transcribing, listening, reading and re-reading the transcripts. The second stage involved generating initial codes for each transcript, with interesting features being systematically coded across the data set. These codes were compared with others within the transcript and across transcripts within each data set, resulting in codes being collected into potential themes for each group. An audit trail of the themes and reflections was used to ensure the themes represented the views of the participants. The next stage involved checking that the themes worked in relation to the coded extracts and the data set, resulting in a written summary of the themes with corresponding extracts. The summaries were reviewed by a second researcher to test the robustness of the proposed thematic scheme. Rigour was achieved by revising, collapsing and dividing themes through an iterative process. The final thematic map was checked independently by another researcher. NVivo software was used to manage the thematic analysis process.

2.2.8. Quality

A process of reflexivity was applied by the researcher which involved assessing to what extent their knowledge of the research in this area could influence the way questions were asked and the data were interpreted. Particular attention was paid to the objective presentation of the questions and the researcher was satisfied that no attempt had been made to lead the participants in a certain direction. For example, question 6 asking whether or not any nonlanguage difficulties were seen by SLTs was only included if this issue had not arisen naturally and, in two of the three focus groups, this information had already been offered.

2.2.9. Results of thematic analysis

The results of the thematic analysis are reported in accordance with Braun and Clarke (2006) and are stated in the form of each major theme and subtheme along with relevant quotations from the transcripts.

The seventeen subthemes which were originally identified were collapsed into ten subthemes. For example, two separate subthemes were originally identified as "Understanding delay can be a deficit" and "Coming to terms with a child with DLD" and these were collapsed into one subtheme which encompassed "Parents' misunderstanding and misconceptions of DLD". The subthemes yielded three main themes which are discussed below: "Barriers to early referral", "Factors in assessment" and "Concerns over continued future support". See Figure 2.1. below.

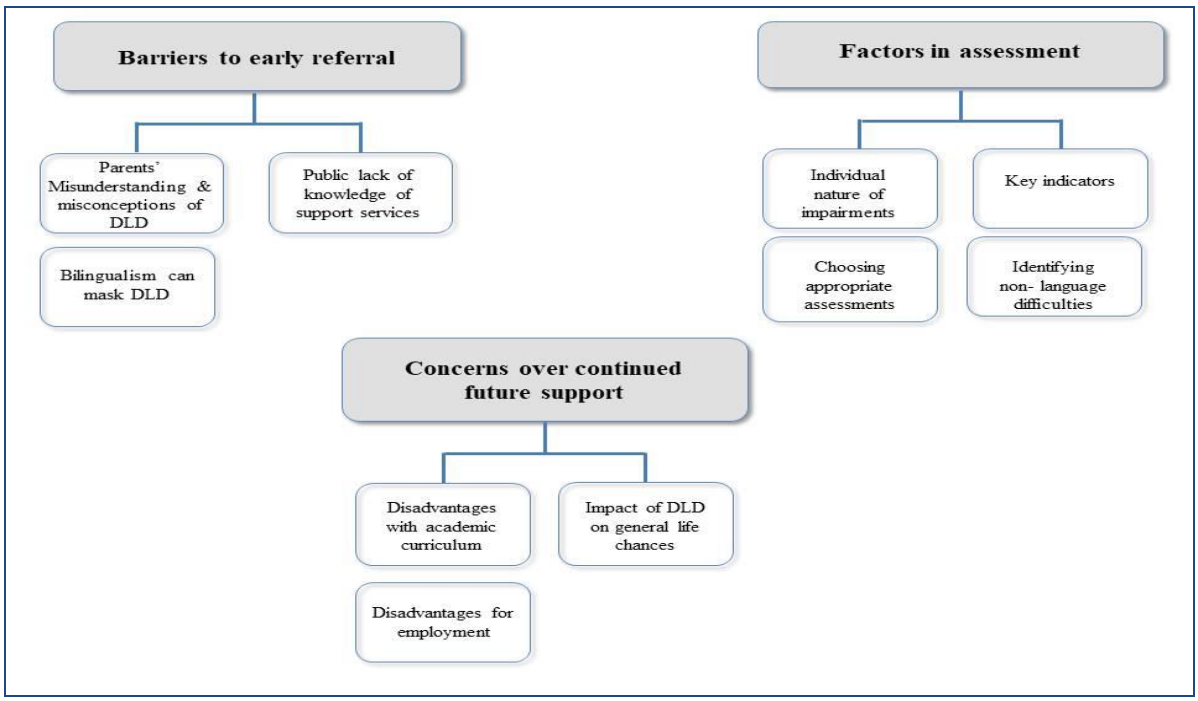

Figure 2.1. *Thematic map of major themes (in grey) and subthemes*.

1. Main theme 1 Barriers to early referral

The SLTs expressed concern about the barriers to referral from the perspective of the child, the parents and wider public understanding. In their view, parents were not aware of DLD, of the support available or how to access services providing intervention for their child. Several SLTs contrasted the diagnosis of DLD with ASD and they expressed concern about the

inequity which they felt was largely due to a lack of public awareness of DLD. Interestingly, they did not compare the diagnosis of DLD against disorders other than ASD. They noted that in terms of referral this was of concern and reported without exception that early referral was very important for achieving the best outcomes from interventions. However, early referral was hindered by the parents' misperceptions of DLD and SLTs felt there was a need to publicise the help available.

The SLTs reported that parents lacked knowledge of DLD and if they noticed the language delay, did not consider it as something which needed intervention and support, but rather, something that would resolve itself. This main theme encompassed concerns about the issues with parents' misunderstanding of children's language problems and the SLTs' widely held view that early referral is essential.

Many (at least 4 SLTs in every focus group) described case examples in which parents had been reluctant to acknowledge that their child may have a language problem:

> SLT 8: "Very often families hope that things will turn out OK and their child is just delayed, whereas it may be that the level of deficits they are showing would point to a language deficit rather than delay."

The SLTs also expressed the difficulties posed by the existence in some areas of local guidelines which prevented them directly offering support to the child's parents:

> SLT 9: "If parents are unaware that help exists, then it is difficult to ask and the issues are never addressed."

Parents were also found to misunderstand what was meant by intervention or help and they tended to interpret the need for intervention as specialist provision in a special school:

> SLT 11: "Parents don't know about us. They have to ask "is there any specialist provision for my child?" and the minute you talk about that they think you mean special school."

The concern of SLTs was that such barriers resulted in a delay in being referred.

> SLT 4: “If you look back in the history of the children who come to us at the age of 7 and later you would see that there were early warning signs of things not being right and these were just never picked up on at the time by parents or teachers.”

There was a strong consensus (15/17 SLTs) that early intervention was important for positive outcomes. They agreed that some form of additional screening of children around the age of 3 to 4 years coupled with tertiary referral to a specialist provision would be beneficial to check that their language is developing as it should. This would result in earlier referral than is currently the case and enable effective intervention to be put in place. The SLTs stated strongly that screening and appropriate referral should be done before the child enters school:

> SLT 12: “You don’t want to leave it until they get in the classroom and find they have got real problems.”

The SLTs noted that delay in referral could also be due to bilingualism which can mask the underlying DLD:

> SLT 9: “Some children, especially bilingual children tend to be referred later because the fact that they are bilingual tends to mask the SLI and the assumption is that the child is not talking so well because it’s bilingual and it’s learning bilingually, which is the problem, whereas it is a language issue.”

2. Main theme 2 - Factors in assessment

The SLTs were entirely consistent when reporting key indicators of DLD i.e. word order errors, verb errors, word finding problems, nonword repetition difficulties and to a lesser extent difficulties in understanding and producing narratives (muddling ideas and expression of ideas) and slow processing of verbal information. However, all SLTs commented on the fact that the key indicators as incorporated into the standardised tests could only contribute so much to assessment and that observing the child’s behaviour informally was also a valuable indicator, particularly when distinguishing children with DLD from those with ASD. Indeed, the SLTs reported that distinguishing these two disorders in children did not pose any difficulty:

> SLT 6: “The SLI child is really keen to communicate but isn’t able to do so effectively. The child with ASD is only keen to communicate on topics that interest them, so they can be quite narrow in what they talk about. That is a very key marker.”

The whole assessment process was also seen as being sometimes markedly different in children with ASD compared to those with DLD, particularly with the answering of questions in an unusual manner:

> SLT 2: “The tendency of some children on the spectrum to come up with unusual answers can also mean that they don’t always seem to pass the test as it has been designed, yet some of their answers are acceptable if a bit unconventional.”

Another feature of the assessment process was mentioned as being the contrasting approaches of the children with ASD and those with DLD to the testing process, with the child with autism tending to treat the assessment as a problem solving task which detracts from the procedure’s purpose as in the following comment:

> SLT 3: “You get some children on the autistic spectrum who positively enjoy doing tests and see it more as a fun puzzle task than as a proper language task, so I’m never entirely convinced that the test is actually measuring their language ability because they seem to treat it more as a problem solving task.”

The differences between children with ASD and those with DLD were also observed in general classroom activities, such as reading and producing narratives. Informal observation was seen by all participants as part of the assessment process. It was noted that, although there were some individual differences, the children with DLD tended to struggle with the macrostructure of the narrative and became very muddled, whereas the children with ASD could generally produce a good narrative but with very limited content. As one SLT commented in relation to the narratives produced by children with ASD:

> SLT 4: “You know they cannot stop themselves from bringing in their favourite figures, so it can be very predictable.”

One area in which there was observed to be similarity in the classroom behaviour of both children with ASD and those with DLD was in the problem of switching from one task to another as in the following observation:

> SLT 3: "We might work on Number, Shape, Measuring for a couple of days. SLI and ASD children find it really difficult to jump from one thing to another, so for example if we do addition that might go well, but then if we do subtraction, they will just do addition again, because they can't move onto subtraction. That is a shared thing with both ASD and SLI."

The SLTs were generally confident that they could distinguish between children with ASD and those with DLD and they explained how they relied on their experience of working with children with DLD to inform the choice of assessment and the interventions they would put in place. They acknowledged there was likely to be variation in assessment practice across service areas depending on the availability of assessments in each area and differences in the expertise of the SLT. The experience of the SLTs informed their approach to assessment and their judgements in choosing the appropriate subtests from a variety of tools:

> SLT 9: "It [assessment] relies heavily on the skill of the SLT which is OK if you have a lot of experience and you feel you are aware of the kinds of problems that children present with…"

Some SLTs used older tests - there was mention of the Canterbury and Thanet test- as they felt they tapped into Social Communication Disorder (previously known as Pragmatic Language Impairment) and they felt the existing tests such as the CELF did not really tap into this aspect of language. They also used non-formal assessments:

> SLT 4: "I use a mixture or standardised and non-standardised tests, so if there are various gaps that standardised tests don't pick up on, I can use informal assessment."

Another factor was the heterogeneity of the DLD population (12/17 SLTs) which required different assessments and extended to common non-language characteristics such as memory and organisation abilities. For example, some children were unable to remember to meet at a certain place at a certain time, or to return to a different classroom and may need strategies put in place:

> SLT 10: "The other thing you must do is give them cues to remember things so if the classroom is on the way to another classroom they might have the cue to think "I should go in there". So they would ask themselves "where should you be?"

These organisational/memory difficulties were seen to persist and one SLT noted that for some children, no improvement was seen in over two years of working with them. The SLTs unanimously expressed the importance of treating children individually because of the heterogeneity of the disorder. They felt that early screening would be useful and some suggested it would be more useful if it allowed progress tracking over time.

Main theme 3 - Concern over continued future support

All the SLTs expressed concern about the effects which DLD could have on the children's later lives. These concerns were in relation to later academic and employment success and for future relationships.

Over a third of the SLTs drew attention to the problems children with DLD have with accessing the whole academic curriculum due to their language problems. Children with DLD can face difficulties in numeracy as a consequence of phonological and working memory difficulties:

> SLT 13: "20 and 12 are very often confused by children with SLI as they start with the same sound."

The knock-on effects of poor academic achievement on employment prospects were a source of heartfelt concern for the children's future wellbeing:

> SLT 10: "If you think about it, who is going to have the most problems with that [networking]. It's going to be those who have speech and language problems. Those are the ones who are going to fail most in that sort of situation."

> SLT 11: "I think that is the biggest problem for children with SLI. If they fall behind because of the way the world is, they are much more at risk."

A number of SLTs in each focus group pointed out that the world is becoming increasingly focused on communication and networking, both of which disadvantage the child with DLD.

2.2.10. Overview

The SLTs expressed very heartfelt concern about the factors which hinder referral and these were largely related to a lack of knowledge about DLD as a childhood disorder and the help

that is available to families in this field. This lack of knowledge was felt to extend beyond simply a lack of awareness amongst parents and carers to a lack of general public awareness which was seen as an unfortunate state of affairs which contributed to late referral of children affected by the disorder. It was apparent that the SLTs were in agreement about the key indicators of DLD but there was widespread acknowledgement that they are not well served by the current assessment tools which fail to pick up on several aspects of the children's behaviour such as organisational and memory difficulties which would be consistent with current research on executive function deficits. It was clear that many SLTs rely on their expertise and knowledge gained as a result of many years working in the field when making assessment and diagnostic decisions. It was interesting to hear how each group expressed concern for the longer term futures of the children they assess and the difficulties which they are likely to face.

2.2.11. Discussion

This study aimed to gain an in-depth understanding of the experiences of SLTs involved in the assessment and diagnosis of children with DLD including the linguistic and nonlinguistic aspects of the disorder. This is the first study in the UK to examine the experiences of speech and language therapists working with school age children diagnosed with DLD, although other studies (Eadie, Yorkstone & Amtmann, 2006; Collis & Bloch, 2012; Roulstone et al., 2015; Watson & Pennington, 2015) have examined the assessment process in clinical and community settings for other disorders. Their findings are similar to those of the current study in that the SLTs working with other disorders such as progressive dysarthria and cerebral palsy commented on the need for diagnostic tools which look beyond the known clinical features of the disorders to consider aspects of communication which are not purely linguistic. The findings of the current study are therefore in line with these previous studies, which can be seen to reflect the recent progressively shifting evidence base towards a multiple mechanisms view which considers the contribution of nonlinguistic deficits in language development (Henry et al., 2012; Pauls & Archibald, 2016) and the known issues in diagnosis. Nonlinguistic aspects include shifting and sustained attention (executive function abilities). A major focus of recent research (Marton et al., 2007; Spaulding, 2010; Pauls & Archibald, 2016) has been an impairment or delay in inhibition and its potential effect of overloading working memory (Archibald & Gathercole, 2006) which would increase the processing demands on the child and affect language.

Also in line with the studies on other disorders there are a number of challenges for the SLT in the referral and assessment processes. For example, previous studies (Eadie et al., 2006;

Collis & Bloch, 2012; Watson & Pennington, 2015) found that the existing tools for assessment of language difficulties were inadequate at some level and this sentiment is echoed in the current study. Additionally, Roulstone et al., 2015 found that parents were not well informed about the availability of speech and language therapy and this view was also common in the current study. However, the current study also found that certain issues thought to be challenging were actually seen by the SLTs as straightforward. For example, there is a considerable body of research on the overlaps between autism and DLD and the difficulties these may present in assessment and diagnosis (Williams et al., 2008; Whitehouse et al., 2007; Conti- Ramsden et al., 2006) but in the current study this was not seen by any SLT as being problematical. This may reflect the high level of professional experience amongst many of the focus group participants and may also indicate the marked contrasts in nonverbal communication which a skilled SLT is able to observe in a child with autism and a child with DLD. It is also the case that in some children, autistic-like behaviours develop over time and the lack of difficulty in distinguishing children with DLD from those with autism found in the current study, may simply be reflective of the fact that the assessments being discussed are carried out mainly in the early years. The comparison which the SLTs made between diagnosing DLD and ASD rather than other developmental disorders may also reflect the most common reasons why children are referred to a specialist unit.

Children can be referred for language support by parents, health visitors, teachers but the SLTs expressed the view that there were barriers to the referral process which were at odds with the need for early referral to ensure the best outcomes for the child. This view was supported by explanations that parents were unaware of childhood language disorder and assumed that any delay in their child's language would resolve itself over time. These findings relate closely to those of Roulstone et al. (2015) who reported that, after engaging with SLT services, parents often came to realise and accept that their child had communication difficulties. In referral, the SLT seeks to support the parent and child in understanding DLD but in some areas the SLTs reported that local guidelines are such that the parent is required to ask about the support that is available for their child. The view of the SLTs in this area was that, given that parents are unaware of DLD and any supporting services, this process is not straightforward. This view can be related to the findings in the literature on parents' perspectives of speech and language therapy (Glogowska & Campbell, 2004; Marshall, Goldbart & Phillips, 2007, Roulstone et al, 2015) where the same sentiments are expressed. The SLTs noted that the referral issues largely remained even though there had been initiatives to publicise developmental language impairment (Bishop, Clark, Conti-Ramsden, Norbury & Snowling, 2012) and to gain consensus on criteria for the re-

classification of DLD (Bishop et al., 2016, 2017) and expressed disappointment that this was the case.

The views of the SLTs in relation to assessment were consistent in noting the limitations of assessments themselves i.e. lack of a reliable measure of social communication difficulties and the broader impairments and a main emphasis on the language domain i.e. phonology and grammar. They consistently expressed the importance of considering the whole child and this resonates with the approach described by SLTs in the research on other language disorders (Collis & Bloch, 2012; Watson &Pennington, 2015). Nine of the seventeen SLTs mentioned the inclusion of non-language elements (e.g. phonological short term memory and working memory) in standardised assessment tools such as the CELF 4, (now superseded by the CELF 5, Wiig et al., 2013) but this was felt to fall short of identifying the full extent of these deficits. This also relates to research findings on assessment tools used with other language disorders (e.g Collis & Bloch, 2012) in which SLTs expressed the need to assess beyond the technical impairment which was not being met by the assessment tools available. Nevertheless, the SLTs were very consistent in their views of early markers of DLD i.e. short simple sentences with grammatical omissions (verb-endings, grammatical function words), poor nonword repetition, and these markers are widely reported in the literature as key characteristics (Bishop & Leonard, 2014). Interestingly, there is an abundance of research investigating the identifying features of language impairment versus autism (Bishop & Norbury, 2002; Manolitsi & Botting 2011; Whitehouse et al., 2007, 2008), but in practice the assessment process was seen by many experienced SLTs as being guided more by observation of the approach taken by the child with autism not just the result of the test.

Descriptions of organisational and memory difficulties common in children with DLD were often mentioned spontaneously by the SLTs without prompting. These descriptions are consistent with the literature on executive function difficulties which have been found to be impaired in children with DLD (Henry et al., 2012, Pauls & Archibald, 2016; Roello et al., 2015). Difficulties in remembering to execute an intended action in the future (prospective memory difficulties)were described by eight SLTs and this also relates to recent research (Mackinlay et al., 2009; Rendell et al., 2009; Ford et al., 2012). Thirteen of the seventeen SLTs reported the usefulness of non-formal assessments and observing children (as part of the standard practice) in order to provide support for these difficulties which are not captured by current assessment tools (which may include some but not all nonlinguistic features).
The availability of such assessments may differ across NHS trusts and an important finding was the potential for variation in assessment across service areas. In current practice, the

guidelines (RCSLT, Taylor-Goh, 2017) state that diagnosis of DLD requires the use of standardised tests, observation, a measurement of language deficits and their functional impact, in addition to an assessment of phonological short term memory and working memory. It was clear that the SLTs' experience was an important factor in their choice of assessment and intervention but, although they were trying to follow best practice guidelines, the choice of appropriate assessments was partially dependent on availability which may vary across service areas. This relates to previous research findings (Collis & Bloch, 2012; Watson & Pennington, 2015) in which SLTs described using assessments they had made themselves or taking a pragmatic approach to assessing beyond the limits of the available tools. In the current research, one group of SLTs reported using a relatively old assessment as they felt it captured pragmatic language difficulties (Social Communication Disorder) whereas other more recent tests were deemed unreliable. This calls into question the reliability and validity of older assessments which, although thought more appropriate by SLTs, may be lacking in other aspects if they are not standardised. This highlights the potential variation across areas.

The experience of the SLT was mentioned by every focus group as being an important factor and this may also vary across service areas, but further research is necessary to better understand such variation, and particularly issues in relation to bilingualism, in order to ensure consistency in assessment and diagnosis.

It was interesting to find that discussion of the provision of support beyond the primary school arose naturally in each focus group. DLD was seen to affect academic success (for example in misunderstanding numbers that sounded similar) and social relationships. SLTs were also concerned, given the ever increasing use of electronic communications and networking needed for careers and employment that these children are at a disadvantage. This view is reflected in the literature (Conti-Ramsden, Mok, Pickles & Durkin, 2013) which describes how DLD can contribute to social difficulties in children's peer relationships and self-reported emotion and behavioural problems in adolescents with persistent language impairment. A diagnosis is needed to ensure future support but the dynamic nature of development and the mechanisms employed are known to lead to changing profiles of DLD children such that the changing needs of the children need to be supported throughout the educational process (Parisse & Maillart, 2009). It was beyond the scope of this study, but a greater understanding of the issues would be beneficial to inform effective continued support. The themes suggest that improvements in practice could alleviate the referral process, the variation in the use of assessments and provide continuing support beyond language delay.

These views chime with the recommendations of the Bercow: Ten Years On report which include a strengthening of the Department of Education's strategy to support opportunity areas to develop plans to improve communication and language skills across the age range, not just in the early years. Other recommendations in the report echo the findings from the current study, such as the provision of an accessible and equitable service for all families. The issue of awareness of the disorder is challenging to resolve, but efforts to provide information across the educational sector (i.e. teacher training, SLT training) and to parents (advertising website information and so on) are warranted (and form part of the recommendations of Bercow: Ten Years On) in addition to the already well known work of campaigns to increase awareness (Bishop et al., 2012, 2016; RALLI; 2014; RADLD, 2018). A review of current guidelines in relation to referral and the process for parents to access services would be useful to further understand and ultimately improve on this process. There appears to be some trepidation on the part of parents around diagnosis and there could be an issue of stigma, but further research is needed. Finally, the availability and preferred use of different assessments by SLTs in practice would be an interesting avenue for further research.

2.2.12. Conclusion

In summary, the aim of this research was to gain an in-depth understanding of the experiences of SLTs involved in the assessment and diagnosis of children with DLD including both the linguistic and nonlinguistic aspects of the disorder. It was suggested by the SLTs that a wider public understanding would alleviate some of the issues in referral as parents are currently unaware of the disorder, of the support services and misunderstanding of the implications of assessment and diagnosis are common. SLTs suggest parents need support in understanding the referral and assessment process and in understanding the diagnosis. Clearer communication of information to parents could go some way to achieving earlier referral and further research may shed light on the differences in practice across regions. Many current assessment tools are based primarily on language even though some (e.g. CELF 5) have incorporated elements of nonlinguistic features such as phonological short term memory and working memory, but all SLTs noted common behaviours related to executive function deficits. The conclusion can be drawn that there is still scope for the current research on nonlinguistic features of DLD to be more widely used to inform practice. There appears to be a need for assessments for the bilingual child which would incorporate nonlinguistic features. Early referral could be supported by early screening, not used as a universal screening but based on the concerns of parents and carers (Bishop et al, 2017). There also appears to be a need for future research to understand the nature of assessment,

given the new DSM V classification of Social Communication Disorder which spans both DLD and ASD. The implications of later referral and persistent DLD are of concern and SLTs agreed that support beyond the early school years was needed.

2.3. Questionnaire

An online questionnaire was carried out over a six month period to gauge the generalisability of the findings from the focus group data. The term DLD had not gained widespread usage in the SLT community at the time the questionnaire was distributed and so the term SLI was used throughout. The SLTs had not yet adopted the new DSM V or the CATALISE recommended term, DLD. Furthermore, the focus of the study was on SLTs' experiences of diagnosis not on changes in terminology and classification.

2.3.1. Recruitment and profile of participants

The questionnaire was distributed to all current members of a national organisation of professional language impairment specialists. All respondents (36 in total) were female and either currently working or had worked as SLTs with language-impaired children. It was acknowledged by the researcher that the volunteer sampling method used was likely to generate a biased sample of participants who were highly motivated to express their views, but this was accepted as a means of accessing a wide population.

2.3.2. Development of questions

The same questions were asked in the questionnaire as in the focus groups in order to ascertain if the focus group findings were representative of more general experiences and opinions. These were:

1) How do children come to be referred to you? (multiple choice answer)
2) What do you think of the current assessment procedures? (rating on a scale of 1-10)
3) Are there any reliable indicators you would look for in a child who has SLI?
4) What differences do you notice in the use of language in children with SLI and ASD?
5) Are there any non-language difficulties which you notice such as every day memory?
6) If you could design a screening tool for SLI, what would be the most important feature you would want to see in it?

It was acknowledged that, although the online questionnaire was unlikely to provide rich data, it would serve to highlight any areas of agreement or disagreement with the focus group data. Based on the focus group findings, the following questions were also included:

1) How important is it that you get the right diagnosis of SLI (DLD) at an early age?
2) On a scale of 1 to 10, what would be your ratings of current assessment procedures?
3) The following are suggested to be reliable indicators for assessing the possibility of SLI (DLD):
   - nonword repetition
   - word order errors
   - word finding problems
   - verb errors
   - other indicators – please describe.

   Please indicate which of these you would consider to be reliable.

These additional questions were included as they addressed issues which emerged as being particularly salient in the focus groups and, in the case of questions 2 & 3, would give some objective measurement to the strength of feeling already seen in the focus groups. All the questions gave the respondents the opportunity to provide a descriptive response, apart from the multiple choice response required for “How do children come to be referred to you?” and “On a scale of 1 to 10 what would be your rating of current assessment procedures.”

2.3.3. Procedure

The questionnaire responses were collated using Qualtrics software and were subjected to equivalent thematic analysis as the focus group data. Quantitative data from the questionnaire were also collated and analysed.

2.3.4. Data analysis

The questionnaire data was transcribed verbatim and the same thematic analysis approach (based on Braun & Clarke, 2006)) was applied as used on the focus group data, albeit on a smaller scale. In contrast to the focus group responses, the questionnaire responses were analysed individually and as a single group with relevant similarities and differences being identified as they emerged.

After thorough reading and re-reading, initial codes were generated and then collated into potential themes which were reviewed by a second researcher. The ensuing discussions between the researchers led to a consensus and a thematic map which was compared with the focus group analysis. Both thematic maps were merged to provide an overall analysis of the qualitative data from both sources. See Figure 3.1 above.

A small amount of quantitative data collected was able to be extracted and analysed in contrast to the findings of the qualitative analysis which were analysed using thematic content analysis.

2.3.5. Results of data analysis

a. Quantitative data

Interestingly, current assessment procedures were rated as only 5.65/10 on average (SD 1.26) by the respondents. This finding supported the data from the focus group participants.

In terms of the language features which were thought to be reliable indicators for assessing the possibility of DLD, there was a high degree of consensus that a number of markers could be used, with mean scores (out of 10) for nonword repetition of 6.05 (SD 1.34); word order errors, 6.71 (SD 1.46); word finding problems 7.0 (SD 1.73) and verb errors 6.82 (SD 1.58).

The means of referral of children showed a strong emphasis on school as being the main source of referrals (84%) which ties in with a number of statements made in the focus group that significant number of children are 'falling through the net' and not being identified in preschool settings.

b. Qualitative data

The questionnaire data was fairly homogeneous and, two main themes and their corresponding subthemes were identified. The nature of the questionnaire precluded any dynamic interaction as had been possible in the focus groups and no subthemes could be identified in the questionnaire data to support the third main theme which arose in the focus group research "Concerns over continued future support."

The main themes were:

1. Barriers to early diagnosis
2. Factors in assessment

Main theme 1 – Barriers to early referral

The professionals reported that children may come to them through a variety of routes and some routes such as parental referral may result in delay. Avoiding such delays by providing early diagnosis was regarded by many respondents as being the first step to meeting the child's needs with appropriate support: Three respondents commented on the need to see

the child's progress in the context of the language difficulties they were facing, as in the following comment:

> Respondent 2: "[Early diagnosis] is also important so that professionals, schools and parents have the right expectations of the potential of these students."

Although the respondents spoke in terms of diagnosis rather than referral, the subtheme identified could be merged with the subtheme identified in the focus group analysis "Parents' misunderstanding and misconceptions of DLD".

Main theme 2 – Factors in assessment

Almost all respondents (30/36, 83%) pointed out the difficulties which children with DLD have in remembering to do something, particularly when the instruction has been given verbally. This was reported as having a range of impacts. The following comments were typical:

> Respondent 11: "I would highlight poor short-term memory, difficulty remembering instructions and consequently difficulties with relationships."

> Respondent 15: "Huge variation but organisation is often an issue."

Difficulty with time sequences was a common observation mentioned by six respondents as contributing to other areas such as awareness of connections between events as in the following comment:

> Respondent 5: "Confusion with time and abstract concepts and organisation of their belongings, sequencing events and tasks, cause and effect issues and sense of timing and danger."

This subtheme was merged with the subtheme "Identifying non-language difficulties" identified in the focus group data.

All respondents reported being quite confident in distinguishing between children with ASD and those with SLI/DLD on the level of behaviour and language. The following comment was characteristic of this sentiment:

> Respondent 2: “The ASD child may have better language but they don’t engage as readily. Both can have behaviour difficulties, but ASD are often not just language-specific difficulties. SLI want to communicate and use more gestures.”

All respondents identified marked differences in language between children with ASD and those with DLD, the most common being the more parrot-fashion formulaic, rote learned quality of the language of children with ASD, compared to the disordered and muddled content of the language of children with DLD. One respondent referred to the differences in assessment pattern between the two groups as follows:

> Respondent 7: “The pattern of vocabulary acquisition is often different – those with ASD tend to be able to ‘rule out’ the wrong answer on assessment of the understanding of vocabulary which can give a false picture of their apparent knowledge which is not backed up practically. Those with SLI are more likely to present with word finding difficulties.”

Also, the links between poor language and auditory memory were highlighted:

> Respondent 9: “Differences in auditory memory, ASD children can repeat back larger pieces of information more accurately than those with SLI who often struggle to recall exactly what they have heard.”

This subtheme was merged with the subtheme “Key indicators” in the focus group data analysis.

Although several (8/36, 22%) commentators observed that detailed diagnosis could not simply be replaced, an additional subtheme identified was the need for an assessment tool which would be fit for purpose. Every commentator on this mentioned that such a tool should be quick and easy to administer to children at the youngest possible age, both verbal and nonverbal elements should be included and the tool should have the ability to trace progress. The following comments were typical of those received:

> Respondent 10: “I would like to see any assessment tool as one to gauge progress, as current diagnostic assessments are not sensitive enough to show the progress that may be seen functionally.”

Respondent 3: “It would have to be quick and easy to use and ideally take in some of the nonverbal aspects of the child’s behaviour as these can be very informative.”

This subtheme was merged with the subtheme “Choosing appropriate assessments” identified in the focus group data.

2.3.6. Overview

The findings from the questionnaire confirmed those from the focus groups in that the SLTs were concerned about the lack of parental knowledge about DLD which can lead to children not being referred early for specialist support. They also referred to a lack of suitable assessment tools which capture all aspects of a child’s language difficulties and the current assessments achieved only a moderate average rating (5.65/10, SD 1.26). As in the focus group findings, the questionnaire respondents were confident in being able to differentiate children with ASD from those with DLD and were using informal observation to note the differences in their approach to testing. Nonlinguistic aspects of behaviour such as memory and organisation were also referred to as being important in assessment and diagnosis in addition to formal language tests.

2.3.7. Discussion

a. Quantitative data

The slightly surprising finding in this data was the equal mean scores given to the reliable indicators of DLD (maximum score 10 – nonword repetition, 6.05; SD 1.34 word order errors, 6.71, SD 1.46; word finding problems 7.0, SD 1.73 and verb errors 6.82, SD 1.58) as nonword repetition is considered in the literature to be the most robust measure. However, the equal scoring of these measures would imply that the picture is still unclear and factors such as possible bilingualism in the children being assessed may have contributed to the rating of this measure as being no more powerful than other measures, especially as the existing nonword repetition tests do not take account of the child’s previous experience with other languages. It would also imply that, in line with the Bishop, Adams and Norbury (2004) study on nonword repetition, it should be seen in conjunction with other indicators (Bishop suggests heritability) rather than being considered in isolation. The methodology used may also have had some effect since in the questionnaire this was presented as a multiple choice question rather than as an open question as it had been in the focus groups, so respondents may not have reflected on their answers in the same way.

Other than this finding, the quantitative data showed the expected result that satisfaction with the current assessment procedures is fairly low (5.65/10, SD 1.26), leaving considerable scope for enhancement.

b. Qualitative data

The qualitative data indicated a need for early referral and assessment as a means of implementing appropriate and timely interventions. There was also consensus on the issues of providing clear communication to parents on the support which is available and in treating every child whether monolingual or bilingual as an individual. The references to deficits in memory and organisation skills support the literature on the contribution of executive function deficits to the disorder and point to a need to test these areas which tend to feature in minor form in the assessment tools available.

2.3.8. Conclusion

In summary, the aim of this research was to gauge the generalisability of the findings of the focus group data. The findings confirmed those from the focus groups, in particular a lack of parental awareness often leading to delayed referral for specialist support. A lack of suitable assessment tools was also mentioned, together with a confident approach to differentiating children with ASD from those with DLD. Nonlinguistic aspects of behaviour were also mentioned as being important in assessment. These findings therefore confirmed that the focus group data was generalisable to a wider population.

2.4. Discussion of focus groups and questionnaire findings

The results of the qualitative studies were homogeneous. In this way, the first two aims of the mixed method approach were met by the collection of qualitative data. These aims were:

1) To understand the issues in diagnosis and assessment of children with language impairment and to synthesize the knowledge of clinicians, teachers and SLTs working directly with the assessment and diagnosis of children with DLD.
2) To investigate whether executive function abilities (i.e. inhibition, prospective memory) may be impaired in children at risk of developing DLD in the preschool period.
3) To investigate whether executive function tests correlate with a widely accepted test of nonword repetition suitable for use with bilingual children.

Both the focus groups and questionnaire were similar in their findings – namely that early referral and early diagnosis are essential to providing appropriate support for the language-impaired child and this process is impeded by the lack of communication between clinicians and parents and a lack of knowledge by parents as to what support is available. In addition, there is widespread consensus on the language impacts of DLD, namely its heterogeneity, the presence of key language based indicators and differentiating characteristics between children with DLD and ASD. The wider impacts of DLD on children are largely agreed upon as being a lack of organisation, rooted in memory and time sequencing difficulties which have a knock-on effect into a lack of academic progress and long-term consequences for social relationships and employment. When asked what they would like to see in a screening/assessment tool the participants' responses were unified: a screening/assessment tool should be quick and easy to carry out and should aim to pick up both monolingual and bilingual children at risk of DLD at the earliest possible opportunity, with a view to monitoring progress over time.

2.5. Conclusion

The experiences of the SLTs demonstrate the complex nature of assessment. They expressed agreement that many of the key indicators are primarily linguistic, but they also expressed a need for the identification of nonverbal deficits which may provide further indication of a vulnerability to language difficulties. They also indicated the current lack of assessments which address the needs of bilingual children. This feedback, together with the literature on the nonverbal deficits associated with DLD informed the design of the quantitative study in the current research.

CHAPTER 3

Experimental studies of inhibition

Chapter 3 outlines the second study in the research which was informed by the findings of the first study. The chapter explains the reasons for the choice of tests, the selection of participants and the procedures adopted. The results analysis is discussed in terms of its theoretical and practical applications.

3.1. Introduction

The aim of this study was to investigate whether executive function tests correlate with a revised test of nonword repetition suitable for use with bilingual children.

The findings of the qualitative study suggested that Developmental Language Disorder is actually much broader than simply “problems with language” and this supports the recent literature on the nature of the disorder. Increasing evidence implicates executive function impairment (Blair & Razza, 2007; Brace et al., 2006; Carlson et al., 2005) particularly inhibition (Archibald & Gathercole, 2006) and the speech and language therapists in the focus groups and questionnaire described prospective memory problems which are known to be related to executive function. The findings of the qualitative study also indicated a need to identify children at much earlier ages than is currently the case. As inhibition and prospective memory are known to develop rapidly during the preschool years in typically developing children, delay or deficits in these abilities may exist in preschool children with DLD, given the development of inhibition has been very closely related to the development of language and deficits have been increasingly found in school age children with DLD (Wolfe & Bell, 2007). The qualitative study also highlighted the widespread difficulties which speech and language therapists face in assessing and diagnosing bilingual children on the basis of standard language tests, but recently a nonword test has shown good reliability using recordings of nonwords with typically developing and language impaired children within the COST Action ISO804 framework (Chiat et al., 2012; Chiat & Polisenska, 2016). Given the above, it is therefore of interest to understand inhibition and prospective memory ability in both monolingual and bilingual preschool children at risk of language disorder in comparison to their peers.

In the light of the findings from the qualitative study that one of the difficulties in assessing bilingual children is due to the unsuitability of the existing tools, which are based predominantly on language, it is suggested that measuring executive function rather than language deficits or delay could provide a means of identifying bilingual children at risk of DLD. Moreover, this approach could be used as the basis for an assessment tool and this would need to be fit and fair in a myriad of languages, since the individual features of different languages make this a virtually impossible task. The findings of the qualitative study therefore led to the decision to investigate inhibition and prospective memory in monolingual and bilingual preschool children, comparing typically developing children with children referred to language therapists, with risk factors for language disorder. The rationale was to establish whether measurement of inhibition would provide a useful method of identifying the "at risk" groups and to investigate whether prospective memory was delayed.

3.2. Inhibition

Inhibition is known to develop rapidly during the ages of 3 to 4 and it is the ability to inhibit a prepotent response which develops most rapidly (Dowsett & Livesey, 2000; Gerardi-Coulton, 2000; Reed et al., 1984). Jones et al. (2003) found that the ability to inhibit an action in a Simple Simon task increased from 22% to 90% over this age range. A different aspect of inhibition which has been labelled as distractor interference also shows substantial growth during the preschool years (Ruff & Capozzoli, 2003). However, compared to older children preschool children are still more likely to pay attention to task-irrelevant information (Lane & Pearson, 1982). As this development in suppression abilities occurs at the same time as language acquisition, it is possible that these processes interact. Numerous studies have already shown the importance of inhibitory control for speech discrimination (Lalonde & Werker, 1995), the learning of lexical labels (Baldwin & Moses, 2001) and the development of nonliteral language (Champagne et al., 2004). Bishop and Norbury (2005) and Wolfe and Bell (2003) have further documented the positive relationship between inhibition and language functioning.

Various reasons have been put forward to explain why children with DLD have been found to be impaired on inhibition (Clark et al., 2013; Russell et al., 1999). One explanation (Montgomery, 2003) suggests that if a child has poor inhibition, this results in overloading of memory. If memory is overloaded, then it would be expected that impaired inhibitory processes in children with DLD would be observed.

There is a body of research evidence which indicates that prepotent response inhibition is closely associated with language impairment, although there is considerable variation in the ages of the participants and the types of tasks used thus leading to slightly different conclusions. For example, Im-bolter et al. (2006) suggest that inhibition is related to language performance, via its dialectical relationship with mental attentional capacity and that deficits in inhibition (and updating to some extent) affect the efficient use of resources for activating relevant information in language tasks. This was based on an anti-saccade task embedded within a range of other executive function tasks on children aged 7 to 12. Bishop and Norbury (2005) found that children with DLD performed worse than typically developing children on both verbal and nonverbal inhibition tasks and they were able to find a positive relationship between language functioning and inhibition performance. Furthermore, using younger children in the 4 to 5 age range, Spaulding (2008, 2010) found children with DLD performed significantly worse than typically developing children on a Stop / Go test which required children to either say or not say the word “dinosaur” or “butterfly” in response to a stimulus. This used a minimally verbal task but it may be that even this level of required language response may have been responsible for the lower performance in the language impaired children. When the inhibition task has required a motor response on presentation of a short visual stimulus as in the studies by Dodwell and Bavin (2008) and Noterdaeme et al. (2000), there was no significant difference in the performance of children with DLD compared to typically developing controls and it may be that selective visual inhibition is a comparative strength for children with DLD, even though their sustained visual attention (requiring working memory) is weak. Other than the Spaulding studies referred to above, the research on inhibition in children with DLD to date has used children of school age and above (see Pauls & Archibald, 2016 for a review) which may act as a confounding variable as children of 7 and above may already be using compensatory mechanisms and strategies. It is therefore of utmost importance to the current study to use a task for measuring inhibition which is age appropriate and from the perspective of a speech and language therapist relatively straightforward and unambiguous to use.

A number of inhibition and prospective memory tests were reviewed for their suitability for this age group, together with a nonword repetition test which would be suitable for use with bilingual children. Given in school age children there is some contradiction in findings with regard to verbal and nonverbal inhibition tasks, both were included in the study.

3.3. Nonverbal inhibition test

Luria's tapping test is a well-established and validated nonverbal inhibition test (Diamond & Taylor, 1996). Its suitability includes that it is simple to administer and does not require verbal responses. Diamond and Taylor (1996) carried out a longitudinal study of 160 children using Luria's tapping test to examine inhibition in children. They were tested every six months between the ages of 3 and 7. They found inhibition increased rapidly between 3.5 years and 6 years old and the largest improvement in the percentage of correct responses occurred between 3.5 and 4 years of age (17% difference). No sex differences in performances on any of the tasks were found. This task is motoric (the children have to tap a dowel either once or twice)as well as nonverbal and has been found to be more robust than verbal inhibition tasks in studies examining social-emotional behaviour in disadvantaged 4-5 year olds (Rhoades, Greenberg & Domitrovitch, 2009). The task is simple to administer, however, 3 to 6 year old children's performance on this task over 16 trials decreases in accuracy, despite the instructions being remembered by most children. In Diamond and Taylor's (1996) study the most common error was to always tap twice irrespective of what the experimenter did, which may indicate that the children who performed in this way were only able to remember one of the rules. Imitation of what the experimenter did was not seen in any participant older than 4.

In children with DLD aged 5 and above, other nonverbal tasks have been employed (e.g. copying hand gestures) to engage younger children (Botting et al., 2010; Hill, 2001; Iverson & Braddock, 2011). There is, however little data on younger typically developing children or children with DLD using these tasks and the studies which have been carried out (e.g. DiDonato Brumbach & Goffman, 2014; Wang et al., 2014; Watson & Bell, 2013) have tended to rely on maternal ratings of motor abilities or focus on general co-ordination. Given Diamond and Taylor's findings that the largest improvement in performance was observed between the ages of 3.5. to 4, this suggests that during these preschool years, inhibition is developing rapidly. The literature on the link between language and inhibition would suggest that 3 to 4 year old children who are "at risk" of developing a language disorder would perform less well on this nonverbal task compared to typically developing children in the same age range (fewer correct responses) and also that these children would show longer response latencies on this task.

3.4. Verbal inhibition task

There are few tests of verbal inhibition suitable for young children due to the “yes” bias which young children tend to show in tasks requiring a yes/ no response. A further issue is the demands of a verbal response on young children and particularly children who may be at risk of language disorder and therefore already delayed in their language development. Espy (1997) developed a verbal inhibition task named Shape School and this is one of the few tests of inhibition suitable for use with preschool children. The test has been validated using relatively large numbers of children. In the original research by Espy (1997) seventy children aged 32 to 68 months took part in the study and were tested in three groups: 32-41 months (3 years), 42-53 months (4 years) and 54-68 months (5 years). This involves showing the child a set of 15 colourful abstract characters and then asking the child to make various responses. The control condition ensures that the children are able to perform the task and requires the child to name the colour of each character and the inhibition condition requires the child to name only the colours of the happy characters. All the children completed these tasks. There are a further three conditions which were not completed which involved saying the shape and the colour of each character, both separately and concurrently. The inclusion of shapes as well as colours in the last three conditions to the task would have made these too demanding for the 3 year old participants. It was predicted that the youngest children would not be able to process shape names automatically and this would lead to greater variability in performance.

The results demonstrated that the task (control and inhibition) was suitable for use with children as young as 32 months and not only could all the children complete the task, it also showed itself to be sensitive to the age-related differences in executive function which could be observed. It is well known that executive function abilities improve rapidly during the ages of 3 to 4.

The findings from Espy (1997) were subsequently reinforced by a later study (Espy, Kaufman, Glisky & McDiarmid, 2001) which found significant differences between 3 year olds and all the older groups both in terms of their efficiency scores (calculated as the net correct answers divided by time) and the time taken to complete the control and inhibit conditions. A significant difference was also shown between the time taken and efficiency scores for the group of 3-5 year olds and the older groups (4.0 and 4.5 years old). The number correct score was significantly different only between the group aged 3.0 and the group aged 4.5.

These findings support the literature on the development of inhibition which indicates that there is a surge during the ages of 3 and 4 (e.g. Carlson, 2005). This was also borne out by Clark et al. (2013) who further supported the validity of the Shape School task as a measure of verbal inhibition in their longitudinal study. They used the Shape School task and described the pattern of development of executive control. In a sample of 388 children they found substantial gains in accuracy and speed on all the Shape school conditions, with particular acceleration in gains being shown between the ages of 3 and 3.75.

A further point here is that, bearing in mind the aim of this research is to promote a means of testing inhibition which could be incorporated into a screening tool for all 3-4 year olds, the use of colours is appealing to many children, including children with autism, as the identification and categorisation of colour is often one of the earliest skills acquired. The layout of the test should also be of interest to the child with autism who engages in repetitive play behaviours such as lining up objects in rows as in the Shape School task; the child is encouraged to follow the shapes across the rows with their finger. It is well known that children with autism have difficulty in distinguishing emotions (Baron Cohen et al., 2009; Loveland et al., 1997; Rump et al., 2009) and the Shape School task is suitable on this level too, as the expressions on the characters' faces are also kept simple with no possible confusion arising between the expressions of the happy or sad faces. The test is therefore appropriate not only for typically developing children, but also those who may have disorders such as autism, both functionally and in terms of content. On basis of the findings from Espy (1997) and Espy et al. (2001), it was expected that 3 to 4 year old children "at risk" of developing language disorder would achieve significantly lower efficiency scores on a verbal inhibition task based on the Shape School inhibition task, compared to typically developing children in the same age range.

3.5. Self-control task

Another measure of inhibitory control linked to language is known as a delay inhibitory control task (Watson & Bell, 2013). This involves a self-control task in which the child is required to delay the initiation of the response for a short time. Such tasks would involve, for example asking a child not to look underneath a cup covering a sweet. Measuring young children's self-control was originally used in the domain of assessing impulsivity and behaviour difficulties (Reed et al., 1984) and it was seen as incorporating a language component in subsequent studies (e.g. Greenberg & Kusche (1993), with internal inhibition providing a basis for verbally regulated inhibition). It was suggested that children who experience language delay would therefore have impulsivity and behaviour problems. Self-

control was specifically examined by McCabe and Meller (2004) in the context of the effects of language disorder on social competence and parental reports indicated significantly lower levels of self-control in the children affected by language disorder compared to controls.

Espy et al. (1999) used a self-control task suitable for young children and aimed to provide a similar test to the A not B task which has been widely used on pre-school children to measure executive function performance. The task requires the participant to inhibit the natural response to retrieve a sweet concealed under a cover which they have been specifically told not to touch. The experimenter gives the instruction and then looks away while surreptitiously monitoring the participant. The result is measured as the latency to touch the sweet. Espy et al. (1999) found that amongst the 2 -5 age range, the participants (N = 117) had a mean response latency of 125.57 seconds, with a range of 0 to 150 seconds. Self-control was found to be related strongly to age and to performance on the A not B task. No significant sex differences were found in the pre-school children's performance on either the self-control of A not B tasks. Based on this, it would therefore be predicted that 3 to 4 year old children who are "at risk" of developing a language disorder would show significantly shorter response latencies in a test of self-control compared to their typically developing peers.

3.6. Prospective memory task

Many of the explanations provided by speech and language therapists regarding problems with organisation and memory as a characteristic feature of children with DLD centred on forgetting to do things in the future. Prospective memory is a type of memory which involves remembering to do things in the future or on the appearance of a particular cue. In contrast to retrospective memory, prospective memory focuses on when to act without focusing on information content. This prospective memory ability is known to develop around the age of 3 (Kliegel et al., 2008). Any task which would measure this ability in preschool children would therefore need to be extremely child-friendly and offer the child the chance to show action-related prospective memory and reward-related prospective memory as it is known that children's performance can differ depending whether a reward is involved.

The basic kinds of prospective memory are event-based which involves remembering to do a certain action when the specific circumstances are present and time-based which involves remembering to perform an action at a particular point in time. Several theories have been put forward to explain the possible mechanisms involved in prospective memory and these fall into three broad categories according to the Preparatory, Attentional and Memory model.

This model identifies two further components: a monitoring component when the intention is formed and then maintained and a second component involving retrospective memory processes which differentiate between the wanted prospective memory intentions and unwanted thoughts, in an attempt to keep focus on the intended goal and not the other options surrounding it. Retrospective memory is used to remember what action is supposed to be performed in the future and the monitoring process is needed to be able to perform this action at the appropriate time. An alternative model, based on the Reflexive Associative theory sees monitoring as being unnecessary to the prospective memory process and states that when an intention is created for a task to be performed in the future, an association is formed between the target cue and the intended action. When the target cue appears, the automatic associative memory system triggers the retrieval of the intended action and returns it to conscious awareness. An example would be seeing the shop where one needs to remember to buy something which acts as a cue to make the purchase.

McDaniel and Einstein (2005) proposed a multi-process model which suggests that where a cue is not very salient or the cue and target are not highly associated (in which case spontaneous retrieval occurs) prospective memory requires monitoring. For example, if the intention is to buy milk on the way home, this could be spontaneously triggered on seeing a bottle of milk (i.e. in a shop window or on an advertisement etc) but most often one has to monitor the intention to remind oneself to carry out the intention on the way home.

There has been a body of research investigating links between prospective memory and language performance, but in the main this suggests this is in relation to the social use of language. For example, Brandimonte and Ferrante (2008) have drawn attention to the role of prospective memory in shaping our social interactions with others, while Ford et al. (2012) identified the strong contribution which theory of mind makes to prospective memory in children aged 4-6 years and, on the basis of this, proposed a self-projection hypothesis. This includes envisioning the future and understanding the minds of others and has received support from Buckner and Carroll (2007). Malle (2002) had previously drawn attention to the fact that for the symbols of language to be understood, there must necessarily be an understanding of another's mind, although it is debatable as to whether theory of mind precedes language or vice versa, or whether they co-evolve (Astington & Baird, 2005). An alternative view of prospective memory regards it as being closely connected to executive functions and that failures of prospective memory may be attributed to the exhaustion of cognitive resources during a difficult task. However, prospective memory is linked to executive function and, in particular, inhibition. Inhibition has been found to be closely

associated with prospective memory performance (Kvavilashvili et al., 2001; Wang et al., 2008). Mahy et al. (2014a, 2014b) found inhibition as tested by the 'Simon Says' task to be the only significant predictor of prospective memory performance compared to working memory and shifting in pre-school children. The picture is not clear cut regarding the links between inhibition and prospective memory as Mahy and Moses (2011) found working memory and not inhibition to be the strongest predictor of prospective memory performance in 4 year olds.

One possibility is that prospective memory in young children is influenced by the comparative immaturity of the pre-frontal cortex which may not be sufficient to allow for the strong association of target items or contexts with novel actions. Prospective memory performance will therefore depend on more external factors such as motivation (e.g. sweets) and the amount of previous experience with this particular item-action association, since increased previous experience makes spontaneous retrieval more probable, even in the absence of active maintenance on account of strong latent representation.

Motivation and inhibition were found to be a key factor in Slusarczyk and Niedzwienska's (2013) study of event-based prospective memory in 2-6 year olds, with children in the 2-4 age range performing equally poorly on interruption tasks and a systematic improvement observed in children of 4 and above. The interruption required the children to inhibit the ongoing activity in order to perform the prospective memory task which, in younger children, may be explained alternatively by the depletion of their executive resources in the ongoing activity which made it difficult for them to think about anything else, including the prospective memory task.

An alternative view of prospective memory in young children is that young children's prospective memory may depend to a large extent on the development of retrospective memory, as strong correlations have been found between the two (McDaniel et al., 1998; McDaniel & Einstein, 2007). This is in line with Moscovitch (1994) who suggested that event-based prospective memory is mediated by a reflexive episodic associative memory system sub-served by hippocampal neuropsychological components which rapidly delivers to consciousness the information associated with the presented cue. McDaniel et al. (1998) found that the encodings which facilitated interaction of a cue with a memory trace were those which produce semantic information. This again points up the links between prospective memory and language development and therefore it would be expected that children with DLD, with delayed inhibition would also have prospective memory problems.

For the purpose of the current experiment, the objective in designing the prospective memory tasks was to make them as natural as possible, while still tapping in to the children's abilities in this area. Three event-based prospective memory tests were chosen which could be embedded within the administration of the set of tests and would not appear as though they were another test to be completed. The child had to remember to give the researcher a wooden block after each activity had been completed and when three blocks had been collected by the researcher, the child was asked to remember to collect a prize (a box of sweets) on their way out of the testing area. These tasks were deemed to be appropriate to the participants' age (3 to 4) as they included an element of motivation (a desired reward) which is known to play a part in the prospective memory performance of very young children. As mentioned above, a deliberate choice was made to use an event-based task as the literature indicates that children with ASD tend to show prospective memory deficits in time – based tasks but are unimpaired in event-based tasks (Williams et al., 2013). This test would therefore provide a means of identifying children with DLD from those with ASD since the children with DLD should theoretically show a deficit in their performance on this event-based task.

The links between prospective memory, working memory and inhibition have not been fully identified. However, on the basis of the research findings outlined above (Kvavilashvili et al., 2001; Mahy & Moses, 2011; Mahy et al., 2014 a, 2014b) it is expected that any deficits in inhibition and/or working memory would also be seen in prospective memory performance. On this basis it was therefore predicted that 3 to 4 year old children who are "at risk" of developing a language disorder would perform worse on a test of prospective memory compared to typically developing children in the same age range.

3.7. Nonword repetition as an identifier of DLD

It has long been known that nonword repetition is a robust identifier of children with DLD and is a useful tool for examining performance in children whose language is limited. The use of nonword repetition tests to detect language impairment has a long history and it has gained a remarkable status in the past ten years through its incorporation into the most widely used standardised diagnostic tool, the Clinical Evaluation of Language Fundamentals (CELF) (Wiig et al., 2013). It originated as a tool devised by Gathercole and Baddeley (1989) to support their hypothesis that phonological short-term memory plays a significant role in language acquisition. There has been considerable debate about what is actually being measured in the test (Archibald & Gathercole, 2007a; Snowling et al., 1991; Van der Lely &

Howard, 1993) as there is evidence to suggest that it is not simply the length of the nonword, i.e., the amount of phonological material but also the structure of the material which influences repetition performance (e.g. Marshall & Van der Lely, 2009). Gathercole & Baddeley (1990) found that children with language disorder have selective difficulty in repeating long trisyllabic nonwords but have no difficulty in repeating mono- or disyllabic nonwords. However, it has also been found that, irrespective of nonword length, the position of a cluster within an item affects how accurately it can be repeated by children with language disorder. Children with language disorder are less likely to repeat a cluster accurately when it is word-medial, e.g. feblitorgist as compared to when it is word-incited, e.g. flebitorgist. In comparison, typically developing children are unaffected by cluster position. This would point to an accurate perception of clusters by children with language disorder but indicate a lack of ability to memorise their position in the nonword or to articulate it correctly.

An additional factor which underpins nonword repetition accuracy is word-likeness. The extent to which a nonword is similar to existing lexical representations does influence repetition accuracy. Gathercole et al. (1991) for example, found that children with an awareness of rhymes with known words aided phonological memory and other research studies (Jones et al., 2010; Leclerq et al., 2013; Messer et al., 2010; Metsala & Chisholm, 2010) have found that the more word like the nonword sounds or if the nonword contains a single real morpheme from the known language, the greater the chances of successful repetition Correspondingly, nonword repetition correlates strongly with breadth of vocabulary (Gathercole, 2006). There is evidence to support the view that children with language disorder benefit less from the similarity to words of nonword stimuli (Archibald & Gathercole, 2006).

Nonword repetition has been widely accepted as a viable clinical marker of language disorder which is not only superior to other proposed markers such as past tense and third person singular making (e.g. Conti-Ramsden et al., 2001) but is largely independent of IQ. (Conti-Ramsden et al., 2001; Ellis Weismer et al., 2000). Studies have also found that working memory cannot fully explain performance on nonword repetition (Archibald & Gathercole, 2006) and it is thought that its discriminating power may lie in its ability to tap into multiple indices of language impairment involving both input and output processes such as phonological perception, storage, recall and articulation. Nonword repetition is designed to tap into phonological memory and demands on production and has consistently been found to be highly heritable in studies of twins (Bishop, 2002; Bishop et al., 1999, 2006).

However, early versions of the nonword repetition tasks were not culturally sensitive and therefore unsuitable for children with bilingual backgrounds. Recently, Chiat et al. (2012) and Chiat and Polisenska (2016) have developed a cross-linguistic nonword repetition test which aimed to minimise the effects of language experience and knowledge. Thus far, no effects of gender have been found in the use of this measure (Hamann & Ibrahim, 2017; Tuller et al., 2018). On the basis of the wide acceptance of nonword repetition as a clinical marker, it was predicted that 3 to 4 year old children "at risk" of developing a language disorder would achieve a significantly lower total number of correctly repeated nonwords in a universal nonword repetition test compared to typically developing children in the same age range.

3.8. Risk factors for DLD

Early identification of children with DLD relies on SLTs' expertise in knowing the risk factors and use of assessments such as nonword repetition and checklists (together with self-reports from parents). There are some risk factors for DLD which have been identified e.g., heritability and low birthweight, but in particular delay in the development of language.

The heritability of DLD has been extensively studied in samples of twins (Bishop, 2002; Bishop & Hayiou-Thomas, 2008; Newbury et al., 2005; Tomblin & Buckwalter, 1998) and focusing on children identified as being at risk (by parents or clinicians). Results suggested that expressive language difficulties are heritable but non expressive difficulties were not. Though these studies focused on heritability, an interesting finding was that a battery of language tests was less useful and that the early referral by clinicians and parents was more reliable in identifying children with DLD. They note their findings of a mismatch between the SLTs' recognition of DLD and diagnosis based on psychometric tests was in line with other studies (Bishop & Hayiou-Thomas, 2008).

Being pre-term and /or low birth weight can be a risk factor (Jansson-Versakolo et al., 2010). Briscoe et al.(1998) used low birth weight to identify an "at risk" group of 3 year olds who performed poorly on receptive vocabulary knowledge (as measured by the BPVS) and on expressive skills as measured by the Bus Story Information Score (Renfrew, 1997). Although no deficits were seen at 12 months, they were observable at 24 months. Jansson-Versakolo et al. (2010) suggest that being pre-term or having a low birth weight can but may not always influence language development. It therefore remains an important risk factor.

Late-talking is a known risk factor which alerts clinicians (and often parents) to the possibility of language delay. Although many children who are delayed in their talking do catch up with

their peers, provided their language difficulties are not associated with other issues, it remains a fact that approximately 25% of late–talking children will not move into the range for typically developing children by the age of 3 (Paul & Roth, 2011) or the age of 7 (Rice et al., 2008). Children who are late-talkers and by the age of 3 are delayed in language may be referred to SLTs for assessment. SLTs are skilled at identifying such factors and referring the children for assessment, so that, if therapy is needed, it can be put in place early. Although the reasons for some children continuing to have language problems, whilst in some children these problems resolve remain unclear, but delayed onset of language remains an important risk factor for language development.

Summary

Children with DLD perform worse than typically developing children on measures of inhibition and prospective memory tests. Inhibition is known to be linked to language development and prospective memory difficulties are frequently reported in children with DLD. In this present study, the focus was on 3 to 4 year old monolingual and bilingual children, as developmental changes at this age are rapid and therefore suited to the study of inhibition. Inhibition was measured using a motor inhibition test, a test of self-control and a verbal inhibition test. The self-control task was included as a simple suppression of response task. The nonverbal inhibition test was included as a nonverbal motoric task and a verbal inhibition task based on the Shape School task was also included as a test of prepotent inhibition. The predictions were that children "at risk" of language disorder would perform worse than typically developing children in the same age range on all these tasks and would also be significantly worse compared to their typically developing peers on a prospective memory and nonword repetition task.

3.9. Method

3.9.1. Participants

A total of 90 children aged 36 to 48 months participated in this study (See Table 4.1 below). Thirty children were typically developing (all monolingual) and sixty children (30 monolingual, 30 bilingual) were classified as "at risk" of language disorder. Children were classified as being "at risk" as they had all either been referred to a specialist language unit or were undergoing assessment due to concerns about their language. Participants were recruited from two main settings – a playgroup for typically developing 3-4 year olds, and a nursery attached to a primary school with large numbers of monolingual and bilingual 3-4 year olds receiving language support. The sample size was calculated following an a priori power

analysis using G* Power (Faul, Erdfelder, Lang & Buchner, 2007). The analysis was completed using a moderate effect size (f = .5 see Cohen, 1992). Assuming α = .05 and 1 – β = .80, the a priori power analysis indicated that a similar effects size would be detected using a minimum sample of 114 participants using a one-tailed test.

The typically developing group was comprised of thirty full term, healthy children from working class to middle class backgrounds. Their ages ranged from 38 to 46 months. The sample was drawn from a population of pre-school children at a playgroup in Hertfordshire, UK.

Monolingual participants both typically developing and “at risk” of developing language disorder were defined as those children who had English as their sole language and had been cared for in homes where only English had been spoken.

Bilingual participants were defined as those children who had been exposed to two (or more) languages in the course of their upbringing, either both languages simultaneously or sequentially, i.e. one language spoken initially in the home environment followed by exposure to English outside the home. The bilingual languages of the children included: Polish, Hebrew, Urdu, German, Romanian, Bengali, Hindu, Irish Gaelic, Spanish and Punjabi.

Table 3.1

Age and Gender Profile of Participant Groups

Sample Classification	No. of Males	No. of Females	Age Range [months]	Mean Age [months]	S.D.
TD	15	15	38-46	42.27	2.83
ML-AR	19	11	36-48	41.27	3.15
BL-AR	18	12	36-48	41.40	3.28

3.9.2. Criteria for defining “at risk” of Language Disorder

The criteria selected for defining ‘at risk” of developing Language Disorder were selected according to known risks (Barry et al., 2007; Bishop, 2002; Moyle et al., 2007; Rescorla., 2002; Sansavini et al., 2010; Schirmer, Portuguez & Nunes, 2006) which have been identified as being associated with a vulnerability to the disorder. These were:

a) Having a sibling diagnosed or suspected of having a language disorder.
b) Having a parent diagnosed or suspected of having a language disorder.
c) The child being a late-talker.
d) The child being pre-term and/or low birth weight.

In addition to the above risk factors, the children in the experimental “at risk group” in the current study has already been identified as being “at risk” of language disorder by schools and had been referred to the school to attend a special language unit. Almost all were undergoing language assessment.

3.9.3. Materials and Procedure

To measure inhibition, three tasks were employed: a nonverbal inhibition task, a verbal inhibition task and a test of self-control. In addition, a prospective memory task was used and a nonword repetition test designed for use with both monolingual and bilingual children. The tests were carried out in a single session and the sequence was randomised to prevent order effects. All the tests were video recorded.

3.9.4. Nonverbal inhibition test

Luria’s tapping test requires both the ability to hold two rules in mind and the ability to inhibit a strong imitation response tendency. These abilities improve between 3 and 6 years of age. This test was designed to be used with 3 to 7 year olds and measures motor based inhibition (suppression) in young children. The child first copies the action of the researcher (tapping a dowel either once or twice) and is then required to inhibit the copy action and perform the alternative action (tap once when the researcher taps twice and tap twice when the researcher taps once). The required response is nonverbal.

Procedure

Each child was tested individually in a quiet corner of a classroom. The experimenter sat across a table from the participant.

The experimenter began by saying:

"When I tap one time like this (experimenter taps once), *I want you to tap one time like this* (experimenter taps once). *Let's try that when I tap one time* (experimenter taps once), *you tap …"*

The experimenter handed the dowel over to the child. If the child responded correctly they were praised and the experimenter proceeded to the second rule which has the following script:

"*OK. Now when I tap two times like this (experimenter taps twice), I want you to tap one time like this* (experimenter taps once). *Let's try that*. *When I tap two times* (experimenter taps twice). *You tap …*". The experimenter hands the dowel to the child.

If the child's response was incorrect, the experimenter explained and demonstrated the second rule again. The child received praise if correct.

The experimenter then started the pre-test by tapping once and handing the dowel over to the child for them to give the response of tapping twice. The child was again praised if correct and the experimenter then tapped twice and handed the dowel over to the child for them to give the response of tapping once. If the child was incorrect on either of the pre-test trials, the experimenter explained and demonstrated rules 1 & 2 again. If the child was correct on the pre-test, these two trials counted as the first two trials of testing. This was done to avoid children who readily understood the task becoming bored by being given too much practice. The test itself consisted of sixteen trials and each trial comprised the experimenter's tap and the participant's response. Only one dowel was used which was passed between the experimenter and the child in order that neither the child nor the experimenter would begin tapping before the other one had finished. The experimenter also avoided influencing the child's response by reaching to take the dowel too early or by letting the child hold it too long. This was particularly the case in the situation where a child had tapped once – the experimenter deliberately did not reach for the dowel in case the child tapped for a second time.

To be included in the data, the child had to be correct on each of the rules at least once over the practice session and trials 1 and 2. It was important to establish that the child understood what they were being asked to do, so that the test measured only their ability to do it. The following sequence of taps was used in order to pseudorandomised the presentation of stimuli to the child and to prevent the child recognising any patterns:

1,2,2,1,2,2,1,1,1,2,1,2,2,1,1,2.

3.9.5. Verbal inhibition Task

The verbal inhibition task was based on the Shape School test published by Espy (1997) and measures executive control in in pre-school children aged between three and five. The task is verbal. A practical aspect of the Shape School is its ability to engage the pre-school child. It does this by setting the scene in a familiar environment, that of the playground. Additionally, the task is short and does not demand a long attention span. The ability to name colours is usually well learned by typically developing children by the age of 4. (Schopler et al., 1990) which makes the use of colours an appropriate choice. Only the primary colours of red, blue and yellow are used which prevents any confusion with colours which may not be familiar to some children and so will not be processed automatically, where the automatic processing of information is required. Furthermore, the presentation of the Shape School is in an appealing format which helps to maintain the child's engagement. In addition, none of the studies which have used Shape School task has shown a discernible difference in the performance of boys compared to girls, and it was therefore considered appropriate to use in the current research. It is based on colourful characters which are appealing to the pre-school age group and has five conditions:

A Colour Naming (Control Condition)
B Inhibition
C Shape Naming (All wear hats)
D Attentional Control (A Colour + C Shape)
E Concurrent Attentional Control and Inhibition (with and without hats, happy and sad)

Task A Colour Naming (Control Condition) and B (Inhibition) were selected for the current study. In previous research (Parker, 2005) it was felt that the physical presentation of the Shape School was a drawback as the booklet is 30cm x 42cm and proved cumbersome to administer where space was limited. It was therefore decided in the current research to produce single sheets of stimuli for the two conditions which were to be used.

It was also felt from Parker (2005) that the original instructions used by Espy, 1997 were over wordy and would benefit from being condensed. For example, the original wording for the Inhibit condition is:

"Good job! Now all of the children from all of the classes are here. I want you to tell me the names of the children with happy faces as fast as you can without making any mistakes. Start here and tell me the names of the children one at a time, across the rows, without skipping any. Remember, tell me the names of the children with happy faces and do not tell me the names of the children with sad faces. Do you understand? Get ready, go!"

Procedure

The test was administered in two parts: (1) the Control Condition and (2) the Inhibition Condition. To start with, the child was introduced to the Shape School and its pupils. The only materials required were the Shape School character sheets.

1) Control Condition

The control condition began with the introduction of Mr. Circle's class. It was explained to the child that the names of the pupils are their colours. The child was then asked to name each of three characters according to their colour (e.g., Mr. Blue, Miss Red) before proceeding to the test where three rows of five characters were displayed. The child was asked to name all the children according to their colour as quickly as possible without omitting any or making any mistakes. The trial was timed and the scores of correct and incorrect answers calculated. This was modified in the current research to a more concise version which reads:

"Well done! Now all the classes are here. I want you to tell me the names of the children who have happy faces but not the children with sad faces. Start on the top row and tell me the names of all the children with happy faces as fast as you can. Do you understand? Get ready, go!"

It was felt that although the more complex instructions could be understood by typically developing children, those with executive function difficulties would benefit from this simplified form of instruction.

2) Inhibition Condition

In this condition the experimenter explained to the child the Shape School pupils who were ready for lunch were happy and had smiling faces and those who were not had sad faces. The child was then asked to name the pupils by colour that were happy beginning at the top row and working as quickly as possible without making a mistake. This trial was also timed and the number of correct and incorrect answers calculated.

The efficiency score was calculated as the number of correct minus the number of error divided by time to completion.

3.9.6. Self-Control Task

The self-control task is a measure of inhibitory control and is unrelated to IQ. (Espy et al.,1999). This task (also known as delay of gratification task) is a widely recognised test of inhibition (Espy et al., 1999; Lee et al., 1983). No previous studies have found any sex differences in performance on this task and it was consequently deemed to be appropriate for use in the present study. The fact that Espy et al. (1999) found that performance on this self-control task was unrelated to IQ was an additional factor in the decision to include this test in the present study. It requires the child to inhibit the behavioural response of retrieving the desired reward. The materials used were a sweet and a cup which was used to conceal the sweet.

Procedure

Each child was tested in a quiet corner of the classroom. The child was first shown the reward (a sweet). The experimenter used an animated tone of voice to comment on the desirability of the reward (e.g. I love Smarties, don't you? I like the red ones best, don't you?). The child then watched the experimenter hide the reward under a cup on the table. The experimenter then said *"Please don't touch the sweet while I am not looking"*. The experimenter then turned away from the table so her back was facing the child and pretended to look through some papers while surreptitiously monitoring the child. The interaction was video-recorded and the latency to touch the reward on each trial was scored up to a maximum of 150 seconds.

3.9.7. Prospective Memory Task

The prospective memory test in the current study involved asking the child to remember to give the researcher a small wooden block after each of the individual tests was finished and then remembering to pick up a reward on the way out of the room.

Procedure

Completion of each test was clearly signalled to each child by the researcher saying:

"This test is finished now. What do you have to do?"

The child was also told at the beginning that if they gave the researcher three blocks at the end they could take a packet of sweets from the basket which was positioned on a table near the door as they went out. The maximum score was therefore based on completion of all four prospective memory tasks. To prevent the child rehearsing the instructions, they were given before a task which fully engaged them. In order to ensure that a child did not fail the test due to simply forgetting the instructions which would involve using retrospective memory, a standard prompt question was used if a child failed to carry out any of the prospective memory tasks.

This was as follows:

“Was there anything you had to do when you had finished each little test?”

No other prompts (e.g. facial expression or eye movement) were intentionally used.

The order of the prospective memory tasks was as follows (the order of presentation of the motor inhibition test, the self-control test, the verbal inhibition test and the nonword repetition test was randomisd):

1. Instructions given to the child
2. Motor inhibition test
3. End of motor inhibition test
4. If no prospective memory was shown, prompt given
5. Test of self-control
6. End of test of self-control
7. If no prospective memory was shown, prompt given
8. Test of verbal inhibition
9. End of test of verbal inhibition
10. If no prospective memory shown, prompt given
11. Test of nonword repetition
12. End of test of nonword repetition
13. Child is told they can leave the room
14. If no prospective memory shown in collecting a reward, prompt given

3.9.8. Nonword Repetition Test

The nonword repetition test chosen for the present study has been specifically developed by Chiat et al. (2012) for use with two to four year old monolingual and bilingual children. It has not as yet been validated but is currently in the validation process. This test has taken word length, word likeness, prosody and articulatory complexity into account. It comprises 4 practice items and 36 test items with each set containing an equal number of words and nonwords controlled for length and prosody.

Procedure

The method recommended by Chiat et al. (2012) was followed. All children were assessed individually in a quiet corner of the classroom. Before commencing the task each child was introduced to a glove puppet with a moveable mouth and was asked to copy some words that the puppet was going to say. It was explained to the child that the puppet would also say some 'silly puppet words' which they were asked to copy too. The only materials required for this test were the glove puppet.

Two practice trials were carried out before the test began. If a child gave no response, two further chances were given to respond to an item. The children's responses were video-recorded and subsequently transcribed for analysis.

The scoring system recommended by Chiat et al. (2012) was used. Responses were scored as being correct if they contained all the phonemic components of the target in the correct order with no additional phonemes. Errors were recorded as the loss of a syllable, e.g. omission of a vowel with or without adjacent consonants and as the combining of two syllables into one by saying the consonant from one with the vowel from the other, e.g. 'min' for machine.

3.10. Results

The statistical analysis was carried out in three sections:

1. Typically developing children compared to the "At risk" group.
2. Monolingual "At risk" children compared to Bilingual "At risk" children.
3. Correlational analysis of the performance of the "At risk" groups

3.10.1. Section 1 Typically Developing /"At risk" group

Nonverbal inhibition test (correct responses)

It was predicted that 3 to 4 year old children "at risk" of developing a language disorder would achieve a significantly lower percentage of correct responses on the motor inhibition test compared to typically developing children in the same age range. It can be seen from Table 3.2 below that both the means (74.17 compared to 41.63) indicate a substantially weaker performance by the "at risk" group. Using an independent samples t-test, the difference in the mean percentage of correct scores between the typically developing and "at risk" children was significant, t (88) = 11.61, p<0.001, one-tailed test, with a large effect size found, d = 2.60.

Table 3.2

Descriptive statistics for the TD vs At Risk Group on the Nonverbal inhibition test (percentage of correct responses)

	Studied Group	N	Mean	SD	Skewness
Nonverbal inhibition test (percentage of correct responses	TD	30	74.17	13.90	-0.04
	At Risk	60	41.63	9.22	-0.78

Nonverbal inhibition Test (response latencies)

It was predicted that 3 to 4 year old children "at risk" of developing a language disorder would show significantly longer response latencies on Luria's tapping test compared to typically developing children in the same age range. It was seen from the kurtosis measure in the TD group (2.55) that the distribution deviated from normality and this meant that a t-test would not be appropriate. The skewness and kurtosis in this group were larger than would be expected due to the presence of an outlier (participant 16) who had a longer response latency of 1.2 seconds compared to the group mean of 0.76 seconds. The boxplot below (Figure 3.1.) shows the effect of this outlier. Using the median measure of central tendency, both groups produced an equivalent figure of 0.79. The mean difference was only 0.05. A non-parametric test was therefore deemed more appropriate in this case and

hypothesis 2 was not confirmed as the Mann Whitney U test was not found to be significant U = 756.5, p = 0.11, one-tailed test. A Welch's t-test was also carried out as this was considered to be a suitable parametric test for skewed data and this was found to show a low level of significance t = 1.89, p = 0.03, one-tailed test.

Table 3.3

Descriptive statistics for the TD vs At Risk Group on the Nonverbal inhibition test (Response latencies)

	Studied Group	N	Mean	SD	Skewness
Nonverbal inhibition test (response latencies)	TD	30	0.811	0.119	1.147
	At Risk	60	0.76	0.126	-0.211

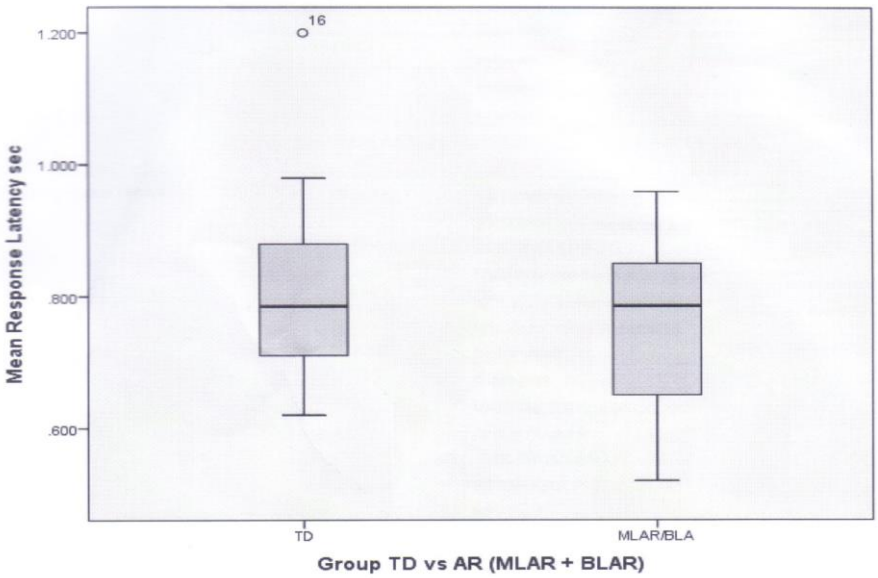

Figure 3.1.The mean response latencies on the Nonverbal inhibition test between the typically developing and "at risk" children

Verbal inhibition task

It was predicted that 3 to 4 year old children who are “at risk” of developing a language disorder would achieve significantly lower efficiency scores on the verbal inhibition task compared to typically developing children in the same age range. The mean efficiency score of the typically developing group 0.67 is approximately 3 times larger than that of the “at risk” group and further analysis of the means was carried out to establish whether this was due to the “at risk” group taking longer to complete the task or making more errors in the naming of characters. The means showed that the times in the inhibition condition were similar for both the typically developing group and the “at risk” group (22.53 secs and 28.66 secs respectively) when the outlier was removed from the “at risk” group. However, there was a large difference in the mean number of correct responses between the typically developing group and the “at risk” group (14.93 and 10.5 respectively), indicating that the “at risk” group showed greater difficulty in inhibiting incorrect responses. The means for both groups were also compared for the control condition to see whether there were any differences in the ability to name the characters from their colours, but this was not shown to be the case, with the typically developing group having a mean time of 23.84 secs and a mean correct response score of 15, while the “at risk” group performed similarly with a mean time of 24.5 secs and a correct response score of 14.93.

It was considered inappropriate to use a parametric approach to test the hypothesis in view of the kurtosis of 2.03 which was higher than expected due to the presence of an outlier with an extremely low efficiency score in the “at risk” group. The effect of this outlier is shown in the boxplot below. Hypothesis 4 was confirmed by the results of a Mann Whitney U test, U = 0.00, N1 = 30, N2 = 60, $p < 0.001$, one-tailed test, with a large effect size found, d = 2.78. A Welch’s t-test also confirmed the significant difference found using the nonparametric Mann Whitney U-test and gave a t value of 20.29, $p < 0.0001$, one-tailed test.

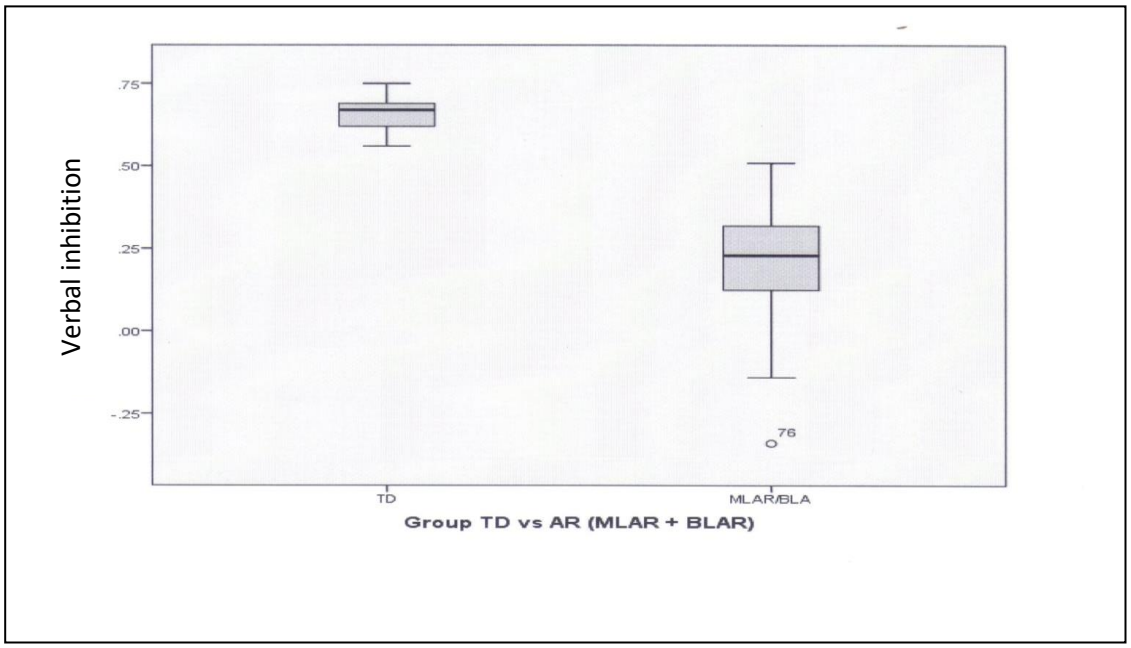

Figure 3.2. The mean efficiency scores on the Verbal inhibition test between the typically developing and "at risk" groups

Table 3.4

Descriptive statistics for the TD vs At risk Group on the Verbal inhibition task (efficiency scores)

	Studied Group	N	Mean	SD	Skewness
Verbal inhibition task (efficiency scores	TD	30	0.666	0.05	0.048
	At Risk	60	0.217	0.156	-0.825

These findings were also compared to those obtained in previous studies which have used this method and the results are reported below in Table 3.5. From these comparisons, it can be seen that the typically developing group in the present study performed broadly in line with children in previous studies, but the “at risk” group were markedly slower and less accurate in the inhibition task, although their performance in the control condition was quite close to that of the typically developing groups in all the studies both on time and accuracy.

This suggests that it was the cognitive demand in the inhibition task which produced the lower performance in the “at risk” group which is in line with expectations.

Table 3.5

Comparison of Espy (1997) & Espy et al (2001) & Parker (2005) to Present Study

Variable		Espy (1997)	Espy (2001)	Parker (2005)	Present study TD group	Present study At Risk group
Time (secs)	Control	23.7	23.75	21.67	23.84	24.5
	Inhibition	23.65	22.56	21.55	22.53	28.9
Correct (max 15)	Control	14.8	14.94	14.72	15.0	14.35
	Inhibition	14.8	14.81	14.87	14.93	10.5
Efficiency	Control	0.73	0.72	0.73	0.63	0.54
	Inhibition	0.7	0.71	0.75	0.67	0.22

Self-control task

It was predicted that 3 to 4 year old children who are “at risk” of developing a language disorder would show significantly lower response latencies in a test of self-control compared to children in the same age range.

It was considered inappropriate to run any statistical analysis on these results, as this test produced no useable data, since all the participants performed at ceiling, that is 100% of the participants performed this test correctly. All the participants exceeded the maximum time allowed (150 seconds). It was thought that, due to the setting of the test in a classroom, the participants responded to this test more as a request for obedience to a rule rather than as a test of inhibition. There was no measurable difference between the groups.

Prospective memory task

It was predicted that 3 to 4 year old children “at risk” of developing a language disorder would achieve a significantly lower number of correctly recalled prospective memory tasks compared to typically developing children in the same age range. The typically developing group achieved a higher mean score of 2.53 compared to 1.3 by the “at risk group”. The mean difference was 1.23 and the low skewness and kurtosis scores meant that a t test could be applied as normality was almost achieved. Using an independent samples t-test, the difference in the mean number of correctly recalled tasks between the typically developing and the “at risk” children was significantly different, t (88) = 6.11, p < 0.001,one-tailed test, with a large effect size found, d = 1.49.

Table 3.6

Descriptive statistics for the TD vs At Risk Group on the Prospective memory Task.(Number of tasks correctly recalled).

TD vs At Risk Group

	Studied Group	N	Mean	SD	Skewness
Prospective memory task (No. of tasks correctly recalled)	TD	30	2.53	0.97	-0.58
	At Risk	60	1.30	0.74	-0.55

Nonword repetition test

It was predicted that 3 to 4 year old children “at risk” of developing a language disorder would achieve a significantly lower total number of correctly repeated nonwords in a universal nonword repetition test compared to typically developing children in the same age range. The comparison of means (TD=10.13, AR=7.12) indicates the weaker performance by the “at risk” group which is in line with expectations. The mean difference was 3.01. There was a slightly greater dispersion in the “at risk” group with the lowest score being 2 compared to a lowest score of 7 in the typically developing group. The low kurtosis and skewness scored enabled a t-test to be used which showed a significant difference in the mean number of nonwords correctly repeated, between the typically developing children and

the “at risk” children, t (88) =6.84, p< 0.001, one-tailed test, with a very high effect size, d=1.53.

Table 3.7

Descriptive statistics for the TD Vs At Risk Group on the Total number of Nonwords repeated correctly.

	Studied Group	N	Median	SD	Skewness
Total number of Nonwords repeated correctly	TD	30	10	1.613	-0.18
	At Risk	60	7	2.545	0.22

3.10.2. Section 2 Monolingual / Bilingual “At risk” groups

To the researcher’s knowledge there is no prior research available on comparisons of monolingual and bilingual children in the 3 to 4 age group on inhibition tasks of this type and the hypotheses were therefore formulated as two-tailed. The only exception is in the nonverbal inhibition test for which there is some limited evidence (Bialystok, Barac, Blaye & Poulin-Dubois, 2010) that bilingual children have an advantage in this task and it was therefore predicted that the bilingual group would perform better (i.e. a higher percentage of correct answers) on this task than the monolingual group. For all other tests, it was hypothesized that there would be a significant difference between the performance of the monolingual and bilingual groups.

As detailed In Section 1, the self-control task produced no useable data and so has been omitted from the statistical analysis.

Nonverbal inhibition test (correct responses)

It was predicted that 3 to 4 year old bilingual children “at risk” of developing a language disorder would achieve a significantly higher percentage of correct responses on the motor inhibition test compared to monolingual children “at risk” of developing a language disorder in the same age range. A one-tailed hypothesis was used in this case as the evidence from Bialystok et al. (2010) showed that bilingual children have an advantage in this task over monolingual children and this justified the use of a one-tailed hypothesis. It can be seen

from Table 4.8 below that the means (42.57 compared to 40.70) indicate a slightly better performance by the monolingual “at risk” children compared to the bilingual “at risk” children. Using an independent samples t-test, the difference in the mean percentage of correct scores between the monolingual and bilingual “at risk” children was not significantly different, *t* (58) =0.78, *p* =0.22, one-tailed test.

Table 3.8

Descriptive statistics for the Monolingual vs Bilingual “At Risk” Groups on the Nonverbal inhibition test (percentage of correct responses)

ML-AR vs BL-AR Groups – Table of Descriptive Statistics

	Studied Group	N	Mean	Median	SD	Skewness	Kurtosis
Nonverbal inhibition test (% correct responses)	ML-AR	30	42.57	41.5	8.29	-0.51	-0.60
	BL-AR	30	40.70	41	10.13	0.87	1.63

Nonverbal inhibition test (response latencies)

It was predicted that there would be a significant difference in the response latencies on the nonverbal inhibition test between 3 to 4 year old monolingual children “at risk” of developing a language disorder compared to bilingual children “at risk” of developing a language disorder in the same age range. It can be seen from Table 3.9 below that the monolingual “at risk” group had a longer mean response latency compared to the bilingual “at risk” children (0.79 compared to 0.73 seconds). Using an independent samples t-test, the difference in the response latencies of the monolingual and bilingual “at risk” groups was found not to be significant, *t* (58) = 1.57, *p* = 0.06, two-tailed test.

Table 3.9

Descriptive statistics for the Monolingual "At risk" group vs the Bilingual "At risk" group on the Nonverbal inhibition test (response latencies)

	Studied Group	N	Mean	Median	SD	Skewness	Kurtosis
Nonverbal inhibition test (response latency)	ML-AR	30	0.79	0.81	0.12	-0.7	0.09
	BL-AR	30	0.73	0.73	0.13	0.23	-1.46

Verbal Inhibition Task

It was predicted that there would be a significant difference in the efficiency scores achieved by 3 to 4 year old monolingual children "at risk" of developing a language disorder and bilingual children "at risk" of developing a language disorder in the same age range. The mean efficiency score of the monolingual "at risk" children was higher than that of the bilingual "at risk" children (0.26 compared to 0.18). Using an independent t-test, the difference in the mean efficiency scores between the monolingual "at risk" children and the bilingual "at risk" children was found to be significant, t (58) =2.02, p = 0.048, two-tailed test, with a moderate effect size of d = 0.52.

Table 3.10

Descriptive statistics for the Monolingual "At risk" vs Bilingual "At risk" group on the Verbal inhibition task (efficiency scores)

	Studied Group	N	Mean	Median	SD	Skewness	Kurtosis
Verbal inhibition test	ML-AR	30	0.26	0.25	0.13	0.55	-0.62
	BL-AR	30	0.18	0.23	0.17	-1.16	1.53

Prospective Memory

It was predicted that there would be a significant difference in the number of correctly recalled prospective memory tasks between 3 to 4 year old monolingual children "at risk" of developing a language disorder and bilingual children "at risk" of developing a language disorder in the same age range. The monolingual "at risk" group achieved a mean score slightly higher than the bilingual "at risk" group 1.47 compared to 1.13). Using an independent t-test, the difference was found to be not significant, t (58) =1.77, p = 0.08, two-tailed test.

Table 3.11

Descriptive *Statistics for the Monolingual "At risk" group vs the Bilingual "At risk" group on the Prospective Memory Tasks*

	Studied Group	N	Mean	Median	SD	Skewness	Kurtosis
Prospective Memory Tasks	ML-AR	30	1.47	2	0.68	-0.92	-0.24
	BL-AR	30	1.13	1	0.78	-0.24	-1.26

Nonword repetition test

It was predicted that there would be a significant difference in the total number of nonwords repeated by 3 to 4 year old monolingual children “at risk” of developing a language disorder compared to bilingual children “at risk” of developing a language disorder in the same age range. The comparison of the means indicated a substantially better performance by the bilingual children “at risk” of developing a language disorder compared to the monolingual “at risk” children (8.10 compared to 6.13). Using an independent t-test, the difference in the means was found to be significant, t (58) = 3.22, p = 0.002, two-tailed test, with a large effect size of d = 0.83.

Table 3.12

Descriptive statistics for the Monolingual “At Risk” Group vs the Bilingual “At Risk” Group on the Total number of Nonwords Repeated Correctly

	Studied Group	N	Mean	Median	SD	Skewness	Kurtosis
Total Non-words Repeated	ML-AR	30	6.13	6	2.42	0.82	0.92
	BL-AR	30	8.1	8	2.31	-0.184	-0.597

Summary of results of Monolingual/Bilingual “At Risk” group comparisons

A summary table is given below of the type of inhibition measured and the relevant p values. The typically developing group had a significantly higher percentage of correct inhibition responses compared to the “at risk” group.

Table 3.13

T-test results on the monolingual and bilingual "at risk" children

Test	Inhibition Measurement	*P*-Value
Nonverbal inhibition test % correct [1 tailed]	Pre-potent Inhibition	0.22
Response Latency [2 tailed]		0.06
Verbal inhibition test [2 tailed]	Suppressive Inhibition	0.048*
Prospective Memory [2 tailed]	Prompted PM	0.08
Total nonwords [2 tailed]	Phonological Memory	0.002**

* Moderately significant difference (without Bonferroni correction)

** Strongly significant difference (with Bonferroni correction)

In order to take a conservative approach to the statistical significance of each test, a Bonferroni correction was applied. To reduce the potential familywise error rate an alpha level of p = 0.01 was used, which meant that the results of the nonword repetition test remained strongly significant.

ANOVA Analysis

All five measures were analysed using a one-way ANOVA with two planned contrasts; 1. Typically developing children versus “At risk” children and 2. Monolingual and Bilingual “At risk” children. The variances on the percentage of correct responses for the nonverbal inhibition test and the efficiency scores on the verbal inhibition task were found to violate the assumption of homogeneity and the ANOVAS reported are therefore based on the Welch’s statistic.

Nonverbal inhibition test (correct responses)

The performance between the children on the percentage of correct responses on the nonverbal inhibition test was found to be statistically significant using the Welch’s statistic, $F(2,55.88) = 66.48$, $p < 0.001$, Cohen’s $f = 1.49$. The follow up contrasts showed that the typically developing children achieved more correct responses compared to the “At risk” children, $t(42.20) = 11.60$, $p<0.001$, Cohen’s $d = 3.57$, however, no differences were found between the monolingual and bilingual “At risk” children, $t(55.82 = 0.78$, $p = 0.22)$.

Verbal inhibition task

The performance on the efficiency scores on the verbal inhibition task was found to be statistically significant using the Welch’s statistic, $F(2,46.32) = 218.21$, $p<0.001$, Cohen’s $f = 2.97$. The follow up contrasts showed that the typically developing children were more efficient compared to the “At risk” children, $t(72.90) = 20.72$, $p < 0.001$, Cohen’s $d = 4.85$. Furthermore, the monolingual “At risk” children while still scoring very low, scored significantly better than the bilingual “At risk” children, $t(53.33) = .2.02$, $p = 0.024$, Cohen’s $d = 0.55$.

Prospective memory task

The prospective memory of the children was tested by the maximum number of blocks the children remembered to give the experimenter after each task, with a possible maximum of four. The differences in the numer of blocks given to the experimenter was statistically significant, $F(2,87) = 23.90$, $p < 0.001$, Cohen’s $f = 0.71$. The follow up contrasts showed that typically developing children remembered to hand over more blocks compared to the “At risk” children, $t(87) = 6.73$, $p < 0.001$, Cohen’s $d = 1.44$, however no differences were found between the monolingual and the bilingual “At risk” children, $t(87) = .1.58$, $p = 0.06$.

Nonword repetition test

The performance on the nonword repetition test between the typically developing children and the "At risk" children was found to be statistically significant, $F(2,87) = 26.13$, $p < 0.001$, Cohen's $f = 0.74$. The follow up contrasts showed that not only did the typically developing children repeat more words correctly compared to the "At risk" children, $t(87) = 6.30$, $p < 0.001$, Cohen's $d = 1.35$, but the bilingual "At risk" children repeated more words correctly than the monolingual " At risk" children, $t(87) = -3.55$, $p < 0.001$, Cohen's $d = 0.76$.

3.10.3 Section 3 Correlational analysis Monolingual/Bilingual "at risk" groups

Nonparametric correlation tests were used due to the presence of outliers in certain datasets (nonverbal inhibition response latency and verbal inhibition) and the significant results are reported below for the ML-AR group and the BL-AR group:

ML-AR group

The only significant correlation found was between the verbal inhibition test and the nonword repetition test (total nonwords correctly repeated). A Spearman's rank-order correlation test was run to determine the relationship between 30 participants' scores on the verbal inhibition test and the nonword repetition test. There was a weak significant positive correlation between the verbal inhibition test scores and the nonword repetition test scores $r(30) = 0.36$, $p = 0.05$.

BL-AR group

The only significant correlation was found between the nonverbal inhibition test (percentage correct) and the nonword repetition test (total nonwords correctly repeated). A Spearman rank-order correlation test was run to determine the relationship between the scores on the motor inhibition test and the nonword repetition test. There was a weak positive correlation between the motor inhibition test scores and the nonword repetition test scores $r(30) = 0.40$, $p = 0.03$

A summary table is given below together with comparison correlations for the typically developing participants.

Table 3.14

Comparison Table of Correlation Coefficients - Monolingual/Bilingual "at risk" groups

	Nonverbal inhibition test % Correct			Verbal Inhibition Test Efficiency			PM			Total Nonwords Repeated		
	TD	ML-AR	BL-AR	TD	ML-AR	BL-AR	TD	ML-AR	BL-AR	TD	ML-AR	BL-AR
Nonverbal inhibition test % Correct	-	-	-	0.68****	0.09	0.04	0.67****	-0.02	-0.001	0.36	-0.21	0.40**
Verbal Inhibition Test	0.68****	0.09	0.04	-	-	-	0.67****	-0.09	0.24	0.38**	0.36*	0.15
PM	0.67****	-0.02	-0.001	0.67****	-0.09	0.24	-	-	-	0.58***	0.14	-0.21
Total Nonwords	0.36	-0.21	0.40**	0.38**	0.36*	0.15	-	0.14	-0.21	-	-	-

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∗ Moderately strong positive correlation p =0.05 (2 tailed)

** Moderately strong positive correlation p =0.03 (2 tailed)

*** Very strong positive correlation p=0.001

**** Very strong positive correlation p<0.0001

Further analysis was also carried out using the correlations between the verbal inhibition test correct score, with the time element removed in order to gain a closer understanding of any potential relationship between the task demands amongst the two groups. A summary table is given below, however, none of the correlation coefficients were significant at an alpha of 0.05.

Table 3.15

Comparison Table of Correlation Coefficients using the Verbal Inhibition test correct answer score (no time element included)

	Verbal inhibition test correct answer score		
	TD	ML-AR	BL-AR
Nonverbal inhibition test % correct	0.34	0.04	0.03
Prospective Memory	0.31	0.06	0.08
Total nonwords correctly repeated	-0.15	0.33	0.14

3.11. Discussion

As predicted, the typically developing children performed better than the “at risk” group on all the tests with the exception of self-control test in which all the participants performed at ceiling. Although this test is considered to be a valid measurement of inhibition, perhaps due to the setting of the experiment in a school classroom or possibly due to the presence of the researcher throughout the test, it did not yield any useful data in the current research. All the participants performed at ceiling and therefore showed the ability to inhibit. The nature of the task i.e., following the instruction not to touch something was, in retrospect, too similar to the kinds of instruction which children would be used to receiving as part of their normal school day and this data was therefore withdrawn from the analysis.

The most significant difference between the groups was seen on the verbal inhibition test (effect size d=4.54), while the lowest was seen on the nonverbal inhibition test response latency (effect size d=0.41). This may be due to the different nature of the tasks. The nonverbal inhibition test requires a motor response and the ability to take turns with another person, whereas the verbal inhibition test requires a verbal response and no interaction with another person during the task. If the results from the % correct on the nonverbal inhibition test are compared, it can be seen that the largest effect size (d=2.6) is much bigger than that for the response latency (0.41), indicating that the “at risk” group were slower than the typically developing children in their responses but were significantly much worse at inhibiting the incorrect response. The high effect size (d =1.49) in the prospective memory test indicates that, in line with the findings of the qualitative study, the “ at risk” group show clear difficulties in remembering to do something in the future, even when prompted. The effect size seen in the test of nonword repetition (d=1.53) provides further support for the use of this test in current assessment tools as a strong indicator of vulnerability to language disorder.

The t-test results between the ML-AR group and the BL-AR group show that they performed similarly on the nonverbal inhibition test and the prospective memory task (but significantly less well than the typically developing group). This finding suggests that both groups were delayed in nonverbal inhibition i.e., the prepotent inhibition of an immediate motor response and prospective memory i.e., the encoding and storage of an instruction and storage of an instruction the retrieval in response to a cue. The most significant difference between the groups was found in the nonword repetition test (d=0.83). The significantly better performance of the bilingual children on this test compared to the monolingual children may be interpreted as the consequence of the bilingual children being exposed to a greater range of phonological input. Even using a specially designed test (Chiat et al., 2012) which did not contain any phonemes which the bilingual children would have heard before, there nevertheless seemed to be a greater sensitivity in their ability to repeat sounds. This may be due to a larger phonological store. However, the verbal inhibition test showed better performance by the monolingual children compared to the bilingual (d=0.52) and in this test the phonological advantage of the bilingual children evident in the nonword repetition test did not support performance on the verbal inhibition test. This test requires a simple verbal response to a visual stimulus and the difference between the groups, although significant, was not as marked as in the nonword repetition test which places demands on phonological memory. In typically developing children, bilingualism is associated with enhanced executive

function, yet these results would seem to indicate that any benefits of bilingualism in the “at risk” children are limited to the phonological store.

The correlations were not significant with the exception of the monolingual group’s results on the verbal inhibition test and the nonword repetition test (r = 0.38, p = 0.05) and the bilingual group’s performance on the nonverbal inhibition test % correct and the nonword repetition test (r = 0.04, p = 0.03). These results may be due to the heterogeneity within the groups, as the children were “at risk” of language disorder and had not received a formal diagnosis. Further research is needed to understand fully the nature of the correlations.

3.12. Conclusion

The results of study 2 showed significant inhibition deficits in the “at risk” group compared to the typically developing group. The nonword repetition test, as a strong indicator of language disorder, showed deficits in the “at risk” group and the prospective memory test, being related to executive function, also showed deficits in the “at risk” group as expected. Comparisons of the performance of the monolingual and bilingual “at risk” groups indicated significant differences in verbal inhibition and nonword repetition. The significant correlations between verbal inhibition and nonword repetition in the case of the monolingual “at risk” group and between nonverbal inhibition and nonword repetition in the case of the bilingual “at risk” group point to interesting differences in the way each group performed on these tasks.

Chapter 4

Conclusion

Chapter 4 outlines the findings from this research in the light of the aims and provides an interpretation of their implications in terms of theory and practice. It also includes a consideration of possible future research, based on the questions which the current study has brought to light. In brief, the findings of study one were that DLD is a heterogeneous disorder which has both linguistic and nonlinguistic aspects and can be masked by bilingualism, but also has some key indicators which are widely accepted by clinicians. This informed the design of Study 2 which found that there were inhibition deficits in 3 to 4 year old children identified as being “at risk” of DLD and there were differences in the deficits shown by monolingual and bilingual “at risk” children.

The aims of the research were: firstly, to understand the issues in diagnosis and assessment of children with language impairment and to synthesize the knowledge of clinicians, teachers and SLTs working directly with the assessment and diagnosis of children with DLD; secondly to investigate whether executive function abilities (i.e. inhibition, prospective memory) may be impaired in children at risk of developing DLD in the preschool period and thirdly, to investigate whether executive function tests correlate with a revised test of nonword repetition suitable for use with bilingual children.

At the onset of this programme of research, the theory in this area indicated that the difficulties experienced by children with DLD were no longer to be seen as restricted to the language domain. It was therefore important to understand the experiences of SLTs working with language impaired children. The first study was therefore designed using a qualitative method (focus groups and questionnaire) to understand the issues in diagnosis and assessment of children with language impairment and to synthesize the knowledge of clinicians, teachers and SLTs working directly with the assessment and diagnosis of children with DLD. The results of the first study indicated that three main themes could be identified in speech and language therapists’ experience in assessment and diagnosis of DLD: The participants’ experiences of the barriers to early referral, Factors in assessment and Concerns over continued future support. The subthemes associated with each main theme were, respectively: parents’ misunderstanding and misconceptions of DLD, bilingualism can

mask DLD and public lack of knowledge of support services; individual nature of impairments, choosing appropriate assessments, key indicators and identifying nonlanguage difficulties; disadvantages with academic curriculum, disadvantages for employment, impact of DLD on general life chances. These results confirmed that, in addition to language deficits, there were other nonlinguistic deficits in children with DLD which were not fully covered by the existing assessment tools. The results also indicated a need to gain a better understanding of the deficits in language impaired bilingual children and to focus on the preschool age group in order to identify children with DLD at an early stage. This informed the design of study two which aimed to investigate the nature of the nonlinguistic deficits in both monolingual and bilingual preschool children who had already been identified as being "at risk" of language disorder. The study focused on executive function deficits in these children, specifically inhibition and prospective memory. These executive function deficits were compared with the children's performance on a nonword repetition test suitable for use with bilingual children, as deficits in this task are known to be a reliable marker of language impairment.

The results of study two indicated that children "at risk" of developing a language disorder performed significantly worse than typically developing children on all tasks other than the test of self-control. Correlational analysis revealed significant relationships between the abilities of the monolingual at risk group on the nonword repetition test and the verbal inhibition task and in the case of the bilingual group on the nonword repetition test and the nonverbal inhibition test. These findings suggest that inhibition deficits can be observed in children who are at risk of developing a language disorder but the nature of the deficit may differ in monolingual children compared to bilingual children. The results and their implications for theory and practice are discussed.

4.1 Support for Study 1 from Study 2

A number of findings in study 2 support study 1. These were:

i) The potential masking of DLD by bilingualism
ii) Key indicators of language impairment
iii) The individual nature of language impairment
iv) Nonlanguage difficulties as a feature of language impairment

4.1.1. The potential masking of DLD by bilingualism

The issue of assessing bilingual children with language impairment was raised in study one as being particularly difficult to deal with. In study one, the SLTs spoke of the difficulties which they face in assessing bilingual children due to the lack of suitable assessment tools which fail to accommodate criteria for these children. The precise nature of the deficit in bilingual children remains poorly understood and the findings of study two indicated that this deficit is subtly different to the deficits which can be observed in monolingual children. For example, it was shown in study two that the bilingual "at risk" children performed better on the nonword repetition test than the monolingual "at risk" children, although their performance was still below that of the typically developing children. Given that poor nonword repetition is seen by many language clinicians as a reliable indicator of DLD, it could be argued that this may be a potential source of the masking issue. One possible explanation is that bilingual children, by virtue of being exposed to a greater range of sounds than their monolingual counterparts are able to show a higher performance on phonological short-term memory tasks. In support of this, Campbell and Sais (1995) found that 4 year old bilingual Italian-English children were superior to their monolingual counterparts in speech-sound awareness and this benefited their subsequent acquisition of reading skills, a finding which was replicated by Dickinson, McCabe, Clark-Charelli and Wolf (2004) with Spanish/English bilingual 4 year olds. Depending on the cut off points for measuring impairment on standard tests of nonword repetition which are not normed on bilingual populations, it may be the case that some bilingual children who are "at risk" of developing language disorder are able to pass these tests and their bilingualism may act as a masking factor. An alternative argument would be to reject the view of nonword repetition as a purely phonological task and to regard it instead as involving both phonological and working memory and it may be that the greater phonological store which bilingual children appear to benefit from impacts on the functioning of their working memory. It may also be argued that, as the greater phonological store which bilingual children benefit from can mask their language impairment if nonword repetition is used an indicator, other, nonverbal inhibition tests may be more informative and overcome the masking factor.

4.1.2. Key indicators of language impairment

This aspect is uncontroversial in that there is wide acceptance of the reliable linguistic markers of DLD amongst both clinicians and researchers. For example, there was widespread agreement in the first study regarding the reliability of nonword repetition as a key indicator of language impairment. This was supported in the second study by the significant difference between the performance of the typically developing children and the

“at risk” group on this measure. It was also noticeable that the findings from both the focus groups and the questionnaire indicated that language deficits remain the primary focus of the clinician, although non-language deficits are acknowledged to be important. This may be a reflection of the training given to SLTs which centres on the identification of language deficits and may also be influenced by the use of standardised tools such as the CELF 5 which, although incorporating a non-language element, focus mainly on language deficits. The SLTs showed an appreciation of nonlinguistic aspects of language disorder for assessment and therapy in study one. In the second study, it could be clearly seen that the nonverbal inhibition test produced a significant difference in performance by the typically developing group compared to the “at risk” group, thereby supporting the findings from the SLTs in the first study.

4.1.3. The individual nature of language impairments

Heterogeneity cut across both studies and is pertinent to the growing acceptance of DLD as being not just limited to the linguistic domain but including a range of nonlinguistic deficits. In study one, the SLTs described how heterogeneous children with language impairment are and how they often rely on their own experience to select combinations of appropriate assessment tools which they felt would identify particular combinations of deficits which a single standardised assessment would not necessarily detect. This heterogeneity could also be seen in the results of study two. The variance in the monolingual and bilingual “at risk” groups was considerable across the range of tests and the potential bilingual advantage was not present in all children. It can be argued that any preschool assessment or screening tool should be designed with this heterogeneity in mind, in order to identify both linguistic and nonlinguistic deficits in children, all of whom may present with a mixed profile of strengths and weaknesses.

4.1.4. Nonlanguage difficulties as a feature of language impairment

Nonlanguage difficulties as a feature of language impairment were identified in the first study as an issue which should be part of the assessment process, but these were not generally incorporated into a number of standardised assessment tools. It was also seen in the second study in the difference between the performance of typically developing children and those “at risk” on the prospective memory task and the nonverbal inhibition test. The comments of the SLTs on the disorganisation of the children they assess chimed closely with the reported findings in the literature, particularly their observations on the children’s issues relating to planning and prospective memory difficulties. These difficulties were also seen in the results

of the prospective memory task in study two in which the “at risk” group scored significantly worse than the typically developing group.

4.2. Discussion

The results are broadly in line with the view that children with DLD are impaired in inhibition. The “at risk” children showed significantly weaker inhibition performance compared to typically developing peers at age 3 to 4 when inhibition abilities are developing rapidly alongside language. Previous research (Oram Cardy, 2003; Imbolter et al., 2006; Kohnert, 2013; Marton et al., 2007; Spaulding, 2008, 2010; Tropper, 2009) has reported deficits in the performance of children with DLD on response inhibition tasks compared to typically developing peers, while other studies (Dodwell & Bavin, 2008; Noterdaeme et al., 2000) have not. However, all these studies with the exception of Spaulding (2008, 2010) used a range of different tasks which varied in the level of linguistic and nonlinguistic inhibition required of the child. The conclusions drawn from previous research are that the children may be relying on other executive functions to compensate for inhibition deficits. With the exception of Spaulding (2010), previous studies have tended to use children of school age (typically 5 to 8 years) and, given these ages, it is possible that these children have developed cognitive strategies (Bishop & Norbury, 2005; Im-Bolter et al. 2006; Marton et al., 2007). The performance of the 3 to 4 year old children in the current study may reflect the fact that, at this age, they are still rapidly developing inhibition abilities and any direct comparison with the previous studies would have to be tenuous, given the developmental trajectory of inhibition which is thought to continue up to the age of 10-12.

The current study also used children who were considered to be “at risk” of developing a language disorder and were in the process of assessment, whereas previous research has used children who had already received a diagnosis of DLD. However, the majority of studies on school-age participants have supported inhibition deficits in language impaired children and it was therefore expected that the 3 to 4 year olds in the current study would show similar difficulties in this area. The 4 to 5 year old children in the Spaulding (2010) study offer the best comparison to the current study and their results confirm the findings. Using a stop-go paradigm to test pre-potent response inhibition which involved not pressing a button in response to a verbal instruction, the results of the comparison between language impaired and typically developing children in Spaulding’s study were highly statistically significant with large effect sizes. The second study in the current research found similar results using the nonverbal inhibition test, with a much larger sample size (60 compared to 22). This supports Spaulding’s previous findings. The task which Spaulding’s (2010) study used to measure

distractor interference used different types of speech, environmental sounds and visual animations as distractors and required the child to press a button as their response. It was therefore more complex than the verbal inhibition task in the current study and did not require a verbal response. Each type of distractor in Spaulding's study produced a worse performance by the language impaired children compared to the typically developing children. This is similar to the results of the verbal inhibition task in the current study which was based on a visual distractor (ignoring the images of faces with sad expressions) and the withholding of a verbal response. The results support evidence that in children "at risk" of language disorder aged 3 to 4, inhibitory control which involves a visual distractor and a verbal response is impaired. As in Spaulding's (2010) study, both the typically developing and the language impaired groups performed similarly in the control conditions of the test, indicating that it was the cognitive demands of the resistance to distractor interference which posed difficulty for the language impaired children. The results of the current study are in line with other studies on resistance to distractor information in typically developing pre-schoolers (Gianvecchio & French, 2002; Jones et al, 2003; Posner & Rothbart, 1998; Reed et al, 1984, Ruff & Cappozzoli, 2003). It may be that the "at risk" children in the current study showed distinctive or possibly just slower development of this ability.

The results of the verbal inhibition task in the current study are not completely in line with those of other studies which have used visual stimuli to measure inhibition, notably Dodwell and Bavin (2008) and Noterdaeme et al. (2000). These studies used school age children (6 – 7 years and 7-20 years respectively) and found that visual inhibition appeared to be more preserved in language impaired children than inhibition of nonverbal auditory and linguistic stimuli. In these previous investigations, the irrelevant information was embedded within the task as in the current study, with the exception that a verbal response was not required. For example, Dodwell and Bavin (2008) presented sequences of animal pictures at various locations on a computer screen for 2 seconds each. The child was required to press a button as soon as an animal appeared but not if a dinosaur appeared. The task involved 60 presentations of stimuli, 10 of which were the dinosaur. In the Dodwell and Bavin (2008) study it may be that the language impaired children had strategies which they were able to use by the age of 6 to 7 and they were also able to make use of the comparatively long exposure time of 2 seconds. This may have been too slow for an automatic response to the stimuli to develop and inhibition may have required less effort or even have been facilitated.

In the Noterdaeme et al. (2000) study, a Go/No go task was used in which the participant had to respond by pressing a button if an x was shown on the screen but not if a + was

shown. Forty stimulus presentations were made, comprising 20 of each symbol. The language impaired participants had comparable error rates and response latencies to the typically developing group and this may be attributed to the use of strategies in participants who were much older than those in the current study. It is noticeable that in both these previous studies of inhibition in language impaired children, no verbal response was required, only a motor response to a visual stimulus (the pressing of a button). It may be that the verbal demands of the verbal inhibition task in the current study were cognitively demanding to the “at risk” children in a way which did not arise during the previous studies. It was noticeable that the verbal task of naming all the characters in the control condition did not pose any difficulty for the “at risk” children and it was this same task, combined with the task of withholding the naming of certain characters which produced a decreased performance in this group. The bilingual “at risk” group showed no advantage in the verbal inhibition test, despite their better performance in the nonword repetition test compared to the monolingual “at risk” group and it may be that these results reflect the variation in this group of heterogeneous bilingual children. The results also bear comparison with the findings of Henry et al. (2012). This earlier study found the most robust differences between typically developing and language impaired groups to be on nonverbal inhibition, using a motor task involving making a fist if the experimenter pointed their finger, but found verbal inhibition using a task involving saying “doll” if the experimenter said “car” or “bus” instead of “drum” to be nonsignificant. This study used older participants (aged 9 to 10) than those in the current study and so cannot be directly compared, as older participants may have had greater language ability and experience. The verbal inhibition task in the Henry et al. (2012) study is also different in nature to the one in the current study and this may account for the difference in results. For example, in the Henry et al. (2012) study, the task was purely verbal in that the researcher simply said the word and the participant was expected to say the opposite word. This required phonological memory, as does the nonword repetition test, but also memory for known words. No visual stimulus was involved. In contrast the verbal inhibition task in the current study involved responding to a visual stimulus as well as using verbal inhibition. It may be that the “at risk” children in the 3 to 4 year age group in the current study found the combination of visual and verbal processing difficult to deal with and one for which they had not developed any strategies. In contrast, the older children in the Henry et al.(2012) study only had verbal input and response to deal with and may, in any case have developed strategies for dealing with everyday situations where the opposite of an imitation response is required. Nevertheless, there is broad support from Henry et al. (2012) for the deficit of nonverbal inhibition which can be observed in the current findings and, interestingly in the

Henry et al. (2012) study it was noted that this was the only executive function which did not show any improvement with age in language impaired children.

The results from the prospective memory test are in line with predictions. In order to test prospective memory in as valid a way as possible, efforts were made to rule out the effects of retrospective memory as an explanation. The children were given prompts if they failed to hand the block to the researcher after each test as instructed which would demonstrate execution of the prospective memory intention. There were only six children across all the groups who failed to perform the required prospective memory task on all occasions, even after a prompt had been given. When the results were re-analysed, removing the data from these six children, they were still found to be significant.

It therefore seems more probable that the deficits were due to working memory issues rather than retrospective memory. However, it may be the case that in some children, the original instruction was not encoded successfully and therefore the prompt would have had no effect. In retrospect, a test question at the end of the task could have been asked in order to measure whether the child had in fact remembered the original instruction. Alternatively, the children may have encoded the instruction successfully but failed to retrieve it successfully. Also, in the case of the “at risk “ group the prospective memory of some children seemed unaffected by reward, as the prospect of a prize on the way out of the room had no improvement on memory performance and they left without remembering to pick up their sweets. This contrasts with the findings of Slusarczyk and Niedzwienska’s (2013) study on prospective memory in typically developing 2 to 4 year olds for whom motivation was a key factor. Research shows that motivation has a generally positive effect on prospective memory performance in typically developing 2 to 4 year olds (Somerville et al.,1983) although Guajardo and Best (2000) did not find this when they asked children to press a key at a specific time during a computer-based task. Kliegel, Brandenburger and Aberle (2010) suggest that the effect of motivation depends on whether the task to be remembered is internally motivating, such as opening a “magic box” or picking up a sweet. It may be that simply handing a small block of wood to the researcher on completion of each part of the task was not sufficiently motivating even for the typically developing children. This view is supported by the current study, as only one of the typically developing children failed to collect the reward on their way out, whereas over half the “at risk” group failed to do so. It may be that, in the case of the “at risk” children in the current study, the embedding of the tasks in a series of other tasks was simply too cognitively demanding and the reward of a prize was not sufficient to overcome this. An alternative explanation would be to use

McDaniel and Einstein's (2005) approach which describes prospective memory as occurring either spontaneously or as the result of strategic monitoring of the environment while rehearsing the required behaviour in one's head. In the current study, the children are more likely to have been displaying spontaneous prospective memory in which the appearance of a cue reactivates the encoded instruction, rather than strategic monitoring which typically develops later. However, it could be argued that the current study did not contain very obvious cues, simply the ending of a task which may or may not have been noticed by the participants and this may have affected the results. (Cejudo, Gomez-Ariza & Bajo, 2018; Einstein et al., 2005; Kliegel et al., 2013). It is therefore difficult to conclude that spontaneous recall was being used by the children, since strong cues would typically produce a prospective memory response in children of this age. In retrospect, a stronger cue could have been used. Also, the handing of a block to the researcher is not a naturalistic task. However, it could also be argued that this type of non-salient cue is closer to a real-life scenario than a very obvious cue and was therefore ecologically valid. Nevertheless, the presence of the basket of sweets was a very obvious visual cue for the child to perform the final part of the prospective memory task and as noted above, this had little effect on the performance of the children "at risk" of language disorder. It can also be seen in the results that the lack of obvious cue did not affect the prospective memory performance of the typically developing group, so it would not be justified to claim that this made the task too difficult for children in the 3 to 4 age group. It seems more reasonable to attribute the performance of the "at risk" group to inhibition and executive function deficits which in terms of everyday prospective memory result in the kinds of organisational difficulties described by the clinicians involved in the assessment and diagnosis of children with DLD.

The results from the nonword repetition test are in line with the one other quasi-universal nonword repetition test which exists (Dos Santos & Ferré, 2016). In both study 2 and in the tests carried out by Dos Santos and Ferré (2016), performance decreased as the number of syllables increased and children "at risk" of language impairment, both monolingual and bilingual, performed significantly worse than typically developing children. This may be explained as a deficit in phonological or working memory or a combination of the two. Given the greater phonological store which the bilingual "at risk" children appear to have compared to the monolingual "at risk" children, it may be that in bilingual language impaired children, their performance is more affected by difficulties with working memory. The results of the current study confirm previous research on nonword repetition deficits in children with DLD across English and a range of other languages (Bishop et al., 1996; Casalini et al., 2007;

Conti-Ramsden et al., 2001) Girbau &Schwartz, 2007; Elin Thordordottir, 2008). They also lend support to the inclusion of this measure in standardised assessment tools.

The differences and correlations in the performance of the monolingual and bilingual "at risk" children are more problematic to interpret in the light of previous studies as there is a lack of research in this area. The few studies which exist have compared monolingual children with DLD and bilingual children with DLD on language measures rather than executive functions. For example Paradis et al. (2003) found no difference in the grammatical aspects of spontaneous language production in 7 year old monolingual children with DLD and simultaneous bilingual children with DLD. Furthermore, Windsor, Kohnert, Lobitz and Pham (2010) found no difference in the grammatical competence levels of 6 to 10 year old monolingual and bilingual children with DLD. The results from the current study can be compared to the study by Iluz-Cohen and Armon-Lotem (2013) who found an advantage for bilingual children with DLD on suppressive inhibition i.e. resistance to a distractor, but not on response inhibition. The results from the verbal inhibition test in which the monolingual "at risk" participants performed better than the bilingual "at risk" participants would appear to contradict the results from this previous research, although it must be borne in mind that small samples are used in both studies. The bilingual children in the current study are also from a more diverse range of language backgrounds and spoke a more typologically diverse range of languages, whereas the Iluz-Cohen and Armon-Lotem (2013) study used a homogeneous group of English-Hebrew preschool children. There is also a marked contrast in the results of the nonverbal inhibition test in the current study when compared to previous research. A one-tailed hypothesis was used as Bialystok et al. (2010) had previously found a bilingual advantage for typically developing children using this task. In the comparison between the monolingual and bilingual "at risk" groups in the current study, there was no significant difference in performance and the monolingual "at risk" children in fact performed slightly better than the bilingual "at risk" group. This may be a consequence of the fact that the current study was carried out on children who were "at risk" of language impairment, so any advantages which bilingualism may have conferred are not available to them, either due to their young age or to their low level of language development. This finding would also be in line with the findings of the Iluz-Cohen and Armon-Lotem (2013) study which found no advantage for response inhibition in bilingual children with DLD. Theoretically, this can be explained by the fact that the lexicon of both languages is cognitively available to the bilingual child and the type of inhibition which the bilingual child must carry out is suppressive (i.e. suppressing the unwanted language) rather than inhibiting a habituated response. There would therefore be no advantage to the bilingual child in terms of response inhibition but

there would be in terms of distractor interference or suppressive inhibition. The findings of the current study on nonword repetition in the current study in which the bilingual "at risk" children performed significantly better than the monolingual "at risk" children can be compared against previous research in this area but these comparisons are limited by the fact that some of the previous studies using bilingual children (Messer et al., 2010; Summers et al., 2010) have used separate nonword repetition tests for each of the child's languages. A direct comparison with these previous studies is not useful as the tests in the two languages are not necessarily matched in phonological difficulty and the hetereogenous results obtained from these appear to reflect differences in the children's language experiences. The closest comparison which can be made with previous research on nonword repetition in bilingual language impaired children is with the Dos Santos and Ferré (2016) French/English test which compared bilingual children with DLD and typically developing bilingual children on a series of "language dependent" (i.e. the sound occurs in the languages with which the child is familiar) and "language independent" (i.e. the sound does not occur in the languages with which the child is familiar) items and found that the bilingual children performed significantly worse than their typically developing counterparts. To the researcher's knowledge there have been no published research studies on a quasi-universal nonword repetition test using preschool monolingual and bilingual participants "at risk" of language impairment. The findings of the current study show that this measure identified bilingual children "at risk" of language disorder and the results from the other studies in the current research support this.

4.3. Links between inhibition and language acquisition

The results give strong support to the links between inhibition and language acquisition. The children in the "at risk" group performed worse on all the inhibition tests compared to the typically developing children. Their language difficulties may be the consequence of poor inhibition resulting in overloaded working memory, making it hard for them to acquire vocabulary and grammar and select appropriate items when required. It is noticeable that in the current study the "at risk" children performed worse than their typically developing counterparts on both verbal and nonverbal inhibition tasks. Fatzer and Roebers (2012) argued that, as language sustains working memory, retaining verbal material may be the root of the poor performance of language impaired children on inhibition tasks and there should be some observable difference between their performance on verbal and nonverbal tests. The research has produced inconsistent findings on this (Henry et al., 2012; Kuntz, 2012; Lukacs et al., 2015). Arguments put forward have included the use of strategies developed by older children to mitigate their processing difficulties, while others (e.g. Lukacs et al.,

2016) have attributed problems with verbal as opposed to nonverbal tasks to fundamental deficits in verbal short term memory span. These arguments do not necessarily relate to the current study as the ages of the children would suggest they have not had time to develop strategies and there was no discernible deficit in verbal as opposed to nonverbal short term memory span. In the current study there were no observable differences in the “at risk” group’s performances on nonverbal compared to verbal inhibition. However, there were some interesting findings which may shed light on the role of inhibition and working memory. The overloading of working memory would arise in these tasks from processing the instruction and carrying out the task simultaneously. It would seem reasonable that “inefficient” inhibition would lead to longer response latencies, but in the nonverbal inhibition test, there was no significant difference in the typically developing and the “at risk” group. The significant difference was found in the percentage of correct responses. The results of this test would therefore indicate that the deficit in the “at risk” group is not one of slow processing but a specific deficit of inhibition. As the nonverbal inhibition test requires a motor rather than a verbal response, the weaker performance of the “at risk” group appears to arise on a nonverbal level. Archibald and Gathercole (2006) argue that working memory and verbal STM are essentially separate systems and the results may be interpreted according to this view. In the analysis of the verbal inhibition control and inhibition conditions, it can be seen that the “at risk” group produced longer response latencies and increased errors in the inhibition condition. This may be the effect of overloading both working memory and verbal STM as the demands of this task are high, requiring verbal STM to hold the instruction in mind, working memory to resist the distracting stimuli and to inhibit the prepotent naming response. It may be that these results reflect the overloading of both working memory and verbal STM systems in a complex task. This is in marked contrast to the verbal inhibition task in Henry et al. (2012) which did not involve a visual inhibition element but was purely verbal (the researcher says “doll” or “car” and the child says the opposite word) and produced nonsignificant findings between typically developing and language impaired participants. The results may be different in the current study as the requirements of the verbal inhibition task may be more demanding per se and they are being placed on much younger children.

The results from the prospective memory task can also be seen as arising from weak inhibition. The task requires that verbal STM maintains the instruction and is activated at the completion at the end of each task. It was noticeable how the element of reward had a differential effect on the groups. Motivation to remember the prospective task generally increases performance in typically developing children when a reward is offered (Slusarczyk &Niedzwienska, 2013; Somerville et al., 1983). This element was present in the current study

in the form of a prize to be collected on the way out of the testing area. A fifth of the typically developing children failed to collect their prize whereas over half of the “at risk” group failed to collect their prize even when prompted. These results may be an indication of how the executive function systems of the “at risk” group were overloaded by the complexity and number of the tests they had been asked to do, or it may be that they were unable to suppress the tests they had just completed, to the point that even a reward had little effect for many of the children. However, in most studies on prospective memory (e.g. Carlson, 2005; Kerns, 2000; Mackinlay et al., 2009; Mahy & Moses, 2011) the tasks are embedded within other activities in order to prevent rehearsal and the current study does not therefore differ in this respect. An alternative explanation would be that, given that a fifth of the typically developing children did not respond to the reward in the prospective memory tasks, the timing of the reward at the end of a series of tasks which were not in themselves intrinsically rewarding, may have affected their performance. This still means that 80% of the typically developing children did respond to the reward and so gives support to Slusarczyk and Niedzwienska (2013) and Somerville et al. (1983) and highlights the lack of this effect in the “at risk” group.

A different explanation would be that the “at risk” group were not able to use language as inner speech to mediate through the tasks. The use of inner speech is associated with cognitive flexibility (Alderson-Day & Fernyhough, 2015; Cragg & Nation, 2010; Perrone-Bertolotti, Rapin, Lachaux, Baciu & Loevenbruck, 2014) and it may be the case that the “at risk” group had difficulty in keeping track of instructions. As the typically developing group were able to complete the tasks successfully, it does not therefore seem that the instructions given were too complicated for the age of the children. It is interesting that the most frequent error in the nonverbal inhibition test was to simply perseverate, not even to imitate the researcher, possibly indicating that the instruction of doing the opposite of what the researcher had just done was not being maintained and acted upon. This meant that the prospective memory intention was not kept active, ready to be acted upon in the presence of a cue. In the prospective memory test, the most common error was for the child to not respond appropriately even when prompted. It may be that a lack of inner speech hindered the retrospective memory which relied on encoding of the original instruction for the prompt to be effective. In the verbal inhibition task, the most common error was simply to name all the characters instead of just the ones with happy faces and it may be that in this case too, a lack of inner speech made it difficult for the “at risk” children to retain and apply the instruction or to inhibit a more natural response of remembering all of these.

Another link between poor inhibition and language focuses on inhibition as resistance to distractor information and posits that children with language difficulties have inadequate suppression of irrelevant information which may include background noise. This may be a causal factor in the perseveration seen in the nonverbal inhibition task. In the case of sound, the lack of suppression means that their perception and formation of phonological representations can be affected, making it difficult to attach labels to concepts. In the current study, the verbal inhibition task involved a visual stimulus and verbal inhibition. The “at risk” group had difficulty in suppressing the irrelevant characters i.e. the visual stimulus and this was slightly surprising as in some studies this has been shown to be a strength in children with DLD. However, the verbal inhibition required may have contributed to the poor performance of the “at risk” group. In the nonword repetition test, the “at risk” group performed significantly worse than their typically developing counterparts. This may be interpreted as the results of inadequate suppression of background noise as the test was conducted in a naturalistic, albeit quiet setting or it may simply be due to poor phonological or working memory. Given the greater phonological store of the bilingual children compared with the monolingual children, a tentative explanation may be that their deficits could possibly be due more to working memory problems than phonological memory. This may not be the case however, as most children with DLD have scores on working memory tests in the normal range and working memory is not a reliable indicator of the disorder. Indeed, the longer 4 and 5 syllable nonwords which would place greater demands on working memory posed similar levels of difficulty for both the typically developing and the “at risk” children which is to be expected.

If one takes the approach that the degree of severity of language impairment is not linked to the degree of severity of inhibition or other executive function deficits, this leads to the view that the root of the difficulties which children with language impairment face is not primarily verbal. A useful moderation would have been to control for verbal ability to measure how much of the children’s performance was linked to their verbal abilities. Henry et al. (2012) found low executive function ability in children with DLD and low language even after controlling for verbal ability and it would have been interesting to compare the findings of the present study on this basis.

The patterns across the monolingual and bilingual “at risk” groups show a fairly similar performance on all of the different tasks. The analysis revealed differences in performance in the area of the verbal inhibition task (which involves mainly suppressive inhibition but also prepotent response inhibition) and the nonword repetition test (which measures

phonological/working memory). The monolingual “at risk” group performed significantly better than the bilingual “at risk” group on the verbal inhibition task, while the bilingual “at risk” group performed better than the monolingual “at risk” group on the nonword repetition test. The performance difference in the verbal inhibition task may be explained in part by the high level of demand on working memory and, in particular the high demand for suppressive inhibition. The bilingual “at risk” children were required to select the name of the character in the visual stimulus which is descriptive of the character’s colour (choosing the appropriate colour from their bilingual lexicon) and show visual inhibition as well. According to Ricciardelli (1992) any advantage for executive function arising from bilingualism requires a minimal threshold of language competence to be met. Therefore, it may be that the 3 to 4 year old children in the current study who have already been identified as having a risk of developing a language impairment may simply not have been able to reach a level of language competence which would enhance their executive functions. On the basis that the particular executive functions involved in the verbal inhibition task (suppressive inhibition and prepotent response inhibition combined) may be impaired in these children, we would not necessarily expect any advantage to arise from their bilingualism.

On close analysis of the monolingual and bilingual “at risk” groups’ performance on nonword repetition, it can be seen that the bilingual children outperformed the monolingual children at every syllable length. The nonword repetition test used was specifically selected to avoid any effects of “wordlikeness” across a range of languages and it is therefore unlikely that the bilingual group’s performance was due to any similarities between words they were already familiar with from other languages. It would seem that the bilingual advantage is due to enhanced phonological awareness resulting in stronger phonological representations in verbal STM. However, given that the bilingual group’s performance is still below that of the typically developing group, this potential advantage is not sufficient to overcome the underlying deficit. This test can still therefore be regarded as a robust indicator of language impairment.

The analysis further indicated that, in contrast to the typically developing group who show strong relationships between their performances across the different tests, the number of relationships between the performances of the monolingual and bilingual “at risk” groups on the various tests is much more limited. The monolingual group showed a moderately strong relationship between their performance on the verbal inhibition task and the nonword repetition test, while the bilingual “at risk” group showed a slightly stronger relationship between their scores on the nonverbal inhibition test percentage correct and their scores on

the nonword repetition test. One explanation for this may be differences in task complexity which would indicate which of the tasks are experienced by each group as requiring equivalent effort. The monolingual “at risk” group appear to have found the verbal inhibition task and the nonword repetition test to be equally cognitively demanding. Although the tests did not target cognitive demand as such, this would suggest that resistance to distractor stimuli (suppressive inhibition) combined with prepotent response inhibition and the demands of nonword repetition on verbal STM are of a similar magnitude for the monolingual “at risk” group. Conversely, the bilingual “at risk” group appear to experience the demands of the nonverbal inhibition test which involves a motor response and prepotent response inhibition as being of a similar cognitive demand to the nonword repetition test involving verbal STM. This explanation is based on a purely quantitative approach to understanding working memory processes.

Alternatively, it may be that the inhibition of a nonverbal motor task which also involves some element of switching is a particular executive function deficit in the bilingual “at risk” group, while the more verbally based task used in the verbal inhibition task, involving a high level of resistance to distractor interference is a particular executive function deficit in the monolingual “at risk” group. In typically developing children, bilingualism has been shown to be advantageous in the development of working memory, particularly at higher levels of executive function demands (Morales, Calvo & Bialystok, 2013). A tentative suggestion would be that, in the area of language impairment, bilingualism affects the development of working memory and its interaction with working memory mechanisms in qualitatively different way to that experienced by monolingual children. Clearly, further research would be needed to explore this fully. The results of the current study can be compared to those found by Bialystok and Viswanathan (2009) that typically developing bilingual 8 year olds outperformed monolingual children on suppressive interference tasks but not on response inhibition. This finding was confirmed by Barac, Moreno and Bialystok (2016) who found that 5 year old typically developing bilingual children performed significantly better than their monolingual peers on tasks requiring interference suppression and were also better on complex response inhibition (a go/no go task). The advantage both in terms of speed and accuracy is observable only on tasks requiring a high degree of interference or complex response inhibition and has been explained by the constant need which typically developing bilingual children have to inhibit the competing language. There is very little research on nonverbal inhibition in bilingual children with DLD, but the findings of research on typically developing children has been confirmed in school age bilingual children with DLD (Iluz-Cohen & Armon-Loten, 2013) who also showed an advantage over their monolingual

counterparts only in suppressive inhibition. This advantage of bilingualism for suppressive inhibition has been observed in typically developing children as young as 4 (Bialystok & Martin, 2004). It would seem from the results of the current study that the suppressive inhibition advantage in typically developing children that would generally flow from being bilingual is simply not present in 3 to 4 year old children "at risk" of developing language impairment. Barac et al. (2016) link the bilingual advantage in suppressive inhibition to electrophysiological brain differences and it may be that the very young child with language impairment does not have these neuronal networks in place.

The relationship between the nonword repetition test and the nonverbal inhibition test in the bilingual "at risk" group is also surprising in that bilingualism has not generally been shown to confer an advantage on the inhibition of motor tasks, since the inhibition of a motor response does not form part of the bilingual child's linguistic development. The result is not surprising when seen from the perspective of bilingualism conferring general executive function benefits and one possible explanation may be that the bilingual "at risk" children experienced a slightly lighter cognitive load from the motor inhibition test due to executive function gains which was similar to the slightly lighter cognitive load which the nonword repetition test appears to have placed on them due to their greater phonological awareness compared to the monolingual "at risk" children.

4.4. Limitations

4.4.1. Qualitative Study

The focus groups and questionnaire gave an interesting insight into the experience of front-line speech and language clinicians using the current assessment procedures for DLD. It also enabled a comparison to be made with other qualitative studies involving consultations with speech and language clinicians working with other disorders (Eadie et al., 2006; Roulstone et al., 2015). It was interesting to find that the results of the present study were broadly in line with the previous research and therefore demonstrated concurrent validity. This study also informed the design of the quantitative study, in particular the inclusion of a group of bilingual children at risk of language disorder. This aspect of assessment had not been originally included in the focus group questions but arose spontaneously in the course of discussions. Similarly, the descriptions given of non-language difficulties observed by the clinicians were essentially prospective memory issues and this led to the embedding of prospective memory tasks within the inhibition tasks. Likewise, the fact that there was

widespread agreement amongst SLTs on the use of nonword repetition tests as a key indicator of DLD led to the inclusion of this test alongside the other tests.

The focus group method proved to be effective in eliciting large volumes of useful data and issues relating to "group think" or dominance of the group by one or more individuals did not arise in practice. A limitation was that only three focus groups were conducted, albeit in different types of institution and in different parts of the UK, but in retrospect it would have been informative to garner a wider range of opinion from a more diverse range of institutions and locations. These could have included both clinical and educational settings in a larger number of geographically diverse areas. This limitation was offset to some degree by the combining of the focus groups with the questionnaire which was distributed nationwide to all members of a professional body for speech and language clinicians, so a broader range of institutions and geographical locations was accessed. This also enabled some level of method triangulation to be applied and the data from each source to be validated. A process of reflexivity was also engaged in by the researchers to maximise the objectivity of the data collection and subsequent analysis. The data from both the focus groups and questionnaire were subject to the general considerations which should be applied when using qualitative data regarding validity and interpretation but these potential drawbacks were minimised by skilful management of the focus group dynamic during data collection and by the application of inter-coder reliability procedures to the thematic analysis.

4.4.2. Quantitative Study

A major strength of the study was that a large sample of children "at risk" of language impairment were included and that all were undergoing assessment by SLTs for DLD. Even with this large sample size, the study was underpowered by 24 participants and recruiting these additional participants would have increased the validity of the findings. It would also have been desirable to obtain more details on the background of each child, but in the institutions which took part in the research, information on the factors which were used by the SLTs to classify the children as being "at risk" could not be shared in the usual way due to data protection considerations and the researcher therefore obtained this information by contacting the children's parents/guardians directly. This meant that the measurement of risk factors was based on self-report by the parents/guardians. Nevertheless, the risk factor profiles of the children are supported by the literature in this area and in the preschool age group speech and language therapists' assessment of "at risk" children has been found to be more reliable than language tests (Bishop & McDonald, 2009).

One limitation of this method was that the parent or guardian was only able to give non-detailed information regarding the level of exposure to English and any additional language experienced by the bilingual child. This data collection method reduced the level of accuracy and objectivity which would have been desirable. The eclectic range of languages which the bilingual children were exposed to was also reflective of the difficulty in accessing these children, resulting in an uneven spread of different language types with a wide range of linguistic features. It was also impractical to recruit only sequential or simultaneous bilingual "at risk" children, so this experimental group had a heterogeneity which was not ideal. An additional difficulty which applied to both the monolingual and bilingual "at risk" groups was that, as all the children were in the process of undergoing assessment, it was not possible to obtain any measurement of the severity of their suspected language impairment. Almost all were language delayed, but no other details on their receptive or expressive language issues had been gathered.

A strength of the study was the methodology, as the tests themselves were easily understood by the participants and the length of testing (approximately 15 minutes per participant) was appropriate for the concentration spans of children in this age range. The self-control task did not prove to be a useful indicator of inhibition as all the participants performed at ceiling and this may be attributed to the institutional environment (a pre-school language unit) in which the test was carried out. This may have influenced the children's behaviour to the extent that they demonstrated obedience to an instruction rather than inhibiting a response. It could be argued that self control is a form of inhibition, but it was felt that in the institutional setting and in the presence of the researcher, the results were indicative of the application of a social rule. The results of this test may have been different if it had been conducted in a more naturalistic setting such as the child's home and if the researcher had left the room.

It may also have been informative to control for verbal ability in the participants had this data been available in order to establish how much of the variance between the typically developing children and the "at risk" children was linked to their verbal ability. It is notable that Henry et al., (2012) found low executive function abilities in children with DLD even after controlling for verbal ability. In this regard, the bilingual "at risk" participants were regarded as a homogeneous group, but it may have been informative to analyse the data with reference to whether the child was a simultaneous or sequential bilingual and to factor in the length and quality of exposure to English. Also, the researcher was not aware of any specific motor problems in any of the participants, but it is well documented in the literature

(Corriveau & Goswami, 2009; Finlay & McPhillips, 2013; Powell & Bishop, 1992) and it is was a finding from the qualitative study that some children with DLD can have motor coordination problems (e.g. holding a pencil). Had this data been available, it may have shed light on the extent to which motor problems affect the carrying out of executive functions and enabled an interpretation to be made of any differentials which may be present between verbal and nonverbal abilities in the "at risk" children. The effects of any motor deficits on the tests which require a motor response (the nonverbal inhibition test, prospective memory test) could have been compared with the results on tests which require a verbal response (verbal inhibition task, nonword repetition test). Indeed, on reflection, it is questionable as to whether the selected tests actually tested inhibition exclusively or did they in fact require the children to focus attention as well as inhibiting a response. It is noted that it is virtually impossible to design a pure test of any specific executive function and that even tests intended to be a measure of nonverbal abilities rely to some extent on verbal input. The main limitation in the study is that the researcher was only able to test children who had been identified as being "at risk" of language impairment. An additional longitudinal study to follow up these same participants may reveal whether the inhibition deficits identified at age 3 to 4 were effective in identifying later language impairment or whether for some children their language inhibition difficulties subsequently resolved.

4.5. Implications

The implications of the findings from this study are considerable. They have direct practical relevance, both in terms of the assessment and diagnostic criteria for DLD and in the advice given to practitioners on how assessment, diagnosis and therapy are conducted. Current assessment tools such as the CELF (Wiig, Secord & Semel, 2013) include a small number of subtests which are designed to measure working memory and elements of executive functions, but the findings from the current study would suggest that there is a large scope to extend this area of assessment and this would contribute towards increasing the validity of such tools. A further important implication is that if such assessments were used, therapy could be directed towards improving nonlinguistic alongside linguistic skills. The findings of the current study also have implications for the diagnostic criteria for DLD which in their current versions do not include any executive function deficits. This research suggests that in early screening, executive functions such as inhibition and prospective memory may be useful in identifying children at risk. Future research is clearly needed to build upon the findings presented in the current study.

4.6. Future Research

Based on the findings from the quantitative study, a number of possibilities for future research may be considered. Firstly, the concept of “inhibition” is multi-layered and it would be fruitful to separate out the precise nature of the deficit in children in terms of response inhibition and resistance to internal or external distractors. Future research, based on tasks which separate these aspects may provide additional insight leading to implications for early assessment and therapy. A deeper understanding of the precise nature of the deficit may increase our understanding of other executive functions. It would also be interesting to investigate whether children with DLD exhibit distinctive or merely slower developmental trajectories in different types of inhibition and other executive functions such as switching, planning or sustaining attention relative to typically developing children. There is a need to investigate a greater range of cognitive processes in DLD in order to determine the specificity of the disorder. In particular we need to have a closer understanding of how monolingual and bilingual children may differ in this respect. For example, it may be that bilingualism confers compensatory advantages on children with DLD which may mitigate the effects of limited processing abilities. On a more general level, there is also a need for future research to identify which executive function deficits are associated with disorders such as ADHD, ASD and DLD exclusively and which are associated with a range of disorders. Greater knowledge in this area would inform our understanding of how children could be screened to enable potential problems to be identified early.

The outcomes of such future research on DLD could potentially lead to more tailored treatment for children with the disorder based on more accurate assessment tools which incorporate elements of executive function testing alongside language based tests. Research may also be able to shed light on whether the strengthening of specific executive functions can improve language performance or vice versa. This may lead to different intervention strategies which focus on building working memory and a range of executive function abilities instead of simply focusing on language and verbal short term memory skills. The quasi-universal nonword repetition test which was used in the present study could be further enhanced through large scale testing and used more widely to good effect, particularly as nonword repetition is much less affected than other tests by the experience of the child. This would also aid in the education of the public and parents to understand that bilingualism is not a cause of DLD and reverting to monolingualism will not cure it. Greater knowledge of the inhibition difficulties which children with DLD experience could also lead to different classroom practice which would involve reducing distracting information in order to enable the children to focus on the relevant material. This should form an essential part of future

teacher training programmes and would go some way to increasing awareness of DLD. Understanding the role which inhibition plays in how monolingual and bilingual children with DLD process language is a step towards this.

4.7. Conclusions

This research has added to the literature on the experiences of language clinicians involved in the assessment and diagnosis of DLD in the UK and has provided further evidence of the executive function deficits in preschool children who are “at risk” of developing a language disorder. The implications of this work are far-reaching and impact on the future assessment of children with language disorder. It would be advisable to consider more widespread use of executive function tests in assessment procedures for language disorder and these could potentially be incorporated into a screening tool which could be used with both monolingual and bilingual preschool children. The types of task used in the current study were designed for use with very young children and would be suitable for such a tool. Using such tests alongside language tests would be firmly in line with the holistic approach which has been adopted by language clinicians. Given the difficulties of developing suitable assessment tools for the range of languages spoken by bilingual children in UK primary schools, it would be more fruitful to focus on the executive function deficits which can be observed in the preschool period and this would contribute towards earlier and more effective intervention for all language impaired children, with consequent benefits for their life chances.

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APPENDICES

Appendix A Ethics Forms

UNIVERSITY OF HERTFORDSHIRE

HEALTH AND HUMAN SCIENCES

M E M O R A N D U M

TO Sheila Thomas

CC Nuala Ryder

FROM Dr Richard Southern, Health and Human Sciences ECDA Chairman

DATE **4 November 2013**

Protocol number: LMS PG UH 00145

Title of study: Linguistic and pragmatic deficits in children with Specific Language impairment.

Your application for ethical approval has been accepted and approved by the ECDA for your school.

This approval is valid:

From: 15 November 2013

To: 30 November 2013

Please note:

Approval applies specifically to the research study/methodology and timings as detailed in your Form EC1. Should you amend any aspect of your research, or wish to apply for an extension to your study, you will need your supervisor's approval and must complete and submit form EC2. In cases where the amendments to the original study are deemed to be substantial, a new Form EC1 may need to be completed prior to the study being undertaken.

UNIVERSITY OF HERTFORDSHIRE
HEALTH & HUMAN SCIENCES

ETHICS APPROVAL NOTIFICATION
TO Sheila Thomas

CC Nuala Ryder

FROM Dr Richard Southern, Health and Human Sciences ECDA Chairman

DATE 19/08/2014

Protocol number: **aLMS/PG/UH/00145**

Title of study: Linguistic and pragmatic deficits in children with Specific Language Impairment
Your application to extend and modify the existing protocol LMS/ PG/UH/00145 as detailed below has been accepted and approved by the ECDA for your school.

Modification: The questionnaire will be distributed to Speech and Language Therapists who are members of NAPLIC.

This approval is valid:

From: 01/09/2014

To: 31/12/2014

Please note:
Any conditions relating to the original protocol approval remain and must be complied with.

Approval applies specifically to the research study/methodology and timings as detailed in your Form EC1 or as detailed in the EC2 request. Should you amend any further aspect of your research, or wish to apply for an extension to your study, you will need your supervisor's approval and must complete and submit a further EC2 request. In cases where the amendments to the original study are deemed to be substantial, a new Form EC1 may need to be completed prior to the study being undertaken.

Should adverse circumstances arise during this study such as physical reaction/harm, mental/emotional harm, intrusion of privacy or breach of confidentiality this must be reported to the approving Committee immediately. Failure to report adverse circumstance/s would be considered misconduct.

Ensure you quote the UH protocol number and the name of the approving Committee on all paperwork, including recruitment advertisements/online requests, for this study.
Students must include this Approval Notification with their submission.

UNIVERSITY OF HERTFORDSHIRE

HEALTH & HUMAN SCIENCES

ETHICS APPROVAL NOTIFICATION

TO Sheila Thomas

CC Dr Nuala Ryder

FROM Dr Richard Southern, Health and Human Sciences ECDA Chairman

DATE 29/1/16

Protocol number: **cLMS/PGR/UH/02248**

Title of study: The role of inhibition in language impairment

Your application for ethics approval has been accepted and approved with the following conditions by the ECDA for your School.

Approval Conditions:

Participant Information and Consent Form to be amended prior to recruitment and data collection as indicated by the Committee – see below

This approval is valid:

From: 29/1/16

To: 30/6/16

Please note:

Your application has been conditionally approved. You must ensure that you comply with the conditions noted above as you undertake your research. You are required to complete and submit an EC7 Protocol Monitoring Form once this study is complete. Available via the Ethics Approval StudyNet Site via the 'Making an Application' page http://www.studynet2.herts.ac.uk/ptl/common/ethics.nsf/Homepage?ReadForm

If your research involves invasive procedures you are required to complete and submit an EC7 Protocol Monitoring Form, and your completed consent paperwork to this ECDA once your study is complete.

Failure to comply with the conditions will be considered a breach of protocol and may result in disciplinary action which could include academic penalties. Additional documentation requested as a condition of this approval protocol may be submitted via your supervisor to the Ethics Clerks as it becomes available. All documentation relating to this study, including the information/documents noted in the conditions above, must be available for your supervisor at the time of submitting your work so that they are able to confirm that you have complied with this protocol.

Approval applies specifically to the research study/methodology and timings as detailed in your Form EC1. Should you amend any aspect of your research, or wish to apply for an extension to your study, you will need your supervisor's approval and must complete and submit form EC2. In cases where the amendments to the original study are deemed to be substantial, a new Form EC1 may need to be completed prior to the study being undertaken.

Should adverse circumstances arise during this study such as physical reaction/harm, mental/emotional harm, intrusion of privacy or breach of confidentiality this must be reported to the approving Committee immediately. Failure to report adverse circumstance/s would be considered misconduct.

Ensure you quote the UH protocol number and the name of the approving Committee on all paperwork, including recruitment advertisements/online requests, for this study.

Students must include this Approval Notification with their submission.

University of Hertfordshire

UNIVERSITY OF HERTFORDSHIRE
HEALTH AND HUMAN SCIENCES

ETHICS APPROVAL NOTIFICATION

TO Sheila Thomas

CC Dr Nuala Ryder

FROM Rev Dr Kim Goode , Health and Human Sciences ECDA Vice Chairman

DATE 29/06/2016

Protocol number: acLMS/PGR/UH/02248(1)

Title of study: The role of Inhibition in language impairment

Your application to extend and modify the existing protocol as detailed below has been accepted and approved by the ECDA for your School.

Modification: Adjustment at the beginning of the assessment as detailed in the EC2.

This approval is valid:

From: 30/06/2016

To: 31/12/2016

Please note:

Any conditions relating to the original protocol approval remain and must be complied with.

Approval applies specifically to the research study/methodology and timings as detailed in your Form EC1 or as detailed in the EC2 request. Should you amend any further aspect of your research, or wish to apply for an extension to your study, you will need your supervisor's approval and must complete and submit a further EC2 request. In cases where the amendments to the original study are deemed to be substantial, a new Form EC1 may need to be completed prior to the study being undertaken.

Should adverse circumstances arise during this study such as physical reaction/harm, mental/emotional harm, intrusion of privacy or breach of confidentiality this must be reported to the approving Committee immediately. Failure to report adverse circumstance/s would be considered misconduct.

Ensure you quote the UH protocol number and the name of the approving Committee on all paperwork, including recruitment advertisements/online requests, for this study.

Students must include this Approval Notification with their submission.

University of Hertfordshire UH

HEALTH AND HUMAN SCIENCES ECDA

ETHICS APPROVAL NOTIFICATION

TO Sheila Thomas

CC Dr Nuala Ryder

FROM Dr Richard Southern, Health and Human Sciences ECDA Chairman

DATE 25/11/16

Protocol number: acLMS/PGR/UH/02248 (2)

Title of study: The role of inhibition in language impairment

Your application to extend and amend the existing protocol as detailed below has been accepted and approved by the ECDA for your School.

Modification: extension to the end date stated below;

Change of proposed locations

This approval is valid:

From: 31/12/16
To: 30/6/17

Please note:

Any conditions relating to the original protocol approval remain and must be complied with.

Approval applies specifically to the research study/methodology and timings as detailed in your Form EC1 or as detailed in the EC2 request. Should you amend any further aspect of your research, or wish to apply for an extension to your study, you will need your supervisor's approval and must complete and submit a further EC2 request. In cases where the amendments to the original study are deemed to be substantial, a new Form EC1 may need to be completed prior to the study being undertaken.

Should adverse circumstances arise during this study such as physical reaction/harm, mental/emotional harm, intrusion of privacy or breach of confidentiality

this must be reported to the approving Committee immediately. Failure to report adverse circumstance/s would be considered misconduct.

Ensure you quote the UH protocol number and the name of the approving Committee on all paperwork, including recruitment advertisements/online requests, for this study.
Students must include this Approval Notification with their submission.

UNIVERSITY OF HERTFORDSHIRE

FORM EC7 – PROTOCOL MONITORING FORM

Ethics Committee with Delegated Authority (ECDA): HEALTH SCIENCE ENGINEERING & TECHNOLOGY

Name of Principal Investigator (or name of class protocol holder): SHEILA THOMAS

Student/Staff ID: 12239263

Programme of Study or Module Name: PhD (PART-TIME)

Title of study (or name of class protocol): THE ROLE OF INHIBITION IN LANGUAGE IMPAIRMENT

UH Protocol Approval Number: aCLMS/PGR/UH/02248(3)

Date: 20/11/17

Has data collection for this project been completed? (YES/NO)
If NO, please explain why:

If an extension is required, a Form EC2 will need to be completed and submitted.

Have any of the participants within the study experienced or reported any of the following: (if you answer YES to any of these, you must provide the details)

Physical reaction/harm	YES/(NO)
Mental/emotional harm	YES/(NO)
Intrusion of privacy	YES/(NO)
Breach of confidentiality	YES/(NO)

If the UH Protocol Approval you were originally sent included any conditions (for example supervisor to approve interview schedule prior to data collection), were all conditions complied with? (YES/NO).

If NO please include any documents and/or information with this form"

DECLARATION (overleaf)

DECLARATION

Staff applicants

Declaration by staff applicants:
I confirm that I have followed the approved Protocol for this study and, where appropriate, the relevant code(s) and/or practice(s) that apply

Signed (staff) .....
Date .....

.....

Student applicants

Declaration by student applicants:
I confirm that I have followed the approved Protocol for this study and, where appropriate, the relevant code(s) and/or practice(s) that apply

Signed (student) ..... S. Thanet .....
Date ..... 20/11/17 .....

Declaration by supervisor:
As far as I can ascertain, the above student has followed the approved Protocol for this study and, where appropriate, the relevant code(s) and/or practice(s) that apply

Signed (Supervisor) .....

Please print name: ..... N RYDER .....

Date 23.11.2017 .....

This completed form, together with any relevant documents (where applicable) must be returned to the relevant ECDA (ssahecda@herts.ac.uk hsetecda@herts.ac.uk) when you submit your project/dissertation. Failure to submit this Form may result in a breach of the University's regulations (UPR RE01, 'Studies Involving Human Participants', refers)

Appendix B Questionnaire

Q1. How do children come to be referred to you?

- ☐ Parents
- ☐ Health Professionals
- ☐ School
- ☐ Other

Q2. How important is it that you get the right diagnosis of SLI at an early age?

Q3. On a scale of 1 to 10 – where 1 is 'completely ineffective' and 10 is 'excellent', what would be your rating of current assessment procedures for SLI?

	1	2	3	4	5	6	7	8	9	10
current assessment procedures	○	○	○	○	○	○	○	○	○	○

Q4. The following are suggested to be reliable indicators for assessing the possibility of SLI:

a) non-word repetition
b) word order errors
c) word finding problems
d) verb errors

On a scale of 1 to 10 – where 1 is 'not very strong' and 10 is 'a very strong indicator', please show by the side of each one how reliable you think they are?

	1	2	3	4	5	6	7	8	9	10
non-word repetition	○	○	○	○	○	○	○	○	○	○
word order errors	○	○	○	○	○	○	○	○	○	○
word finding problems	○	○	○	○	○	○	○	○	○	○
verb errors	○	○	○	○	○	○	○	○	○	○

Q5. Are there any other indicators you would regard as reliable or potentially reliable when assessing a child?

Q6. Is there a gut instinct for assessing whether a child has SLI?

Q7. What differences do you notice in the use of language in children with SLI and ASD?

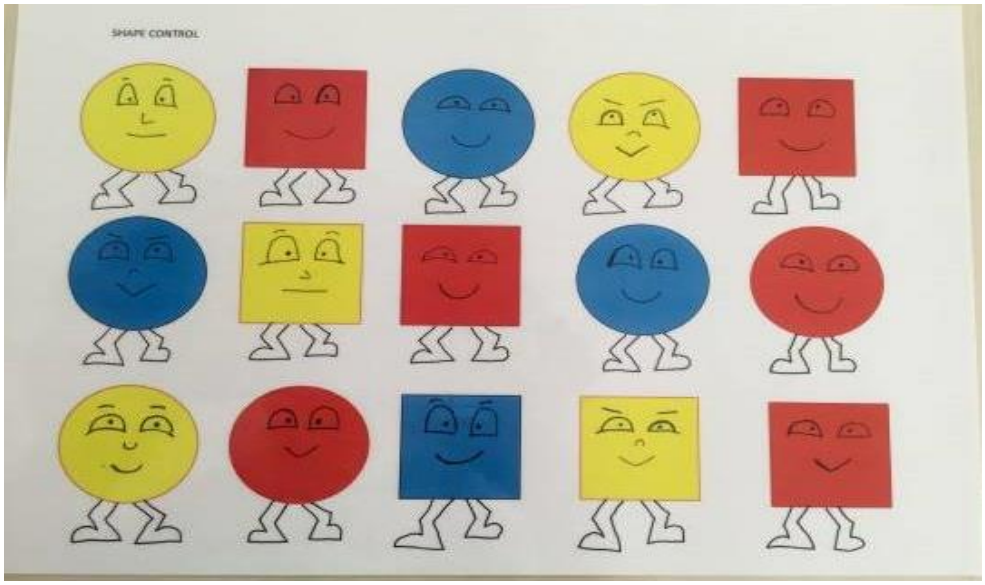
Q8. Are there any non-language difficulties which you notice, such as problems with every day memory [i.e. remembering to do something in the future]? Please give details.

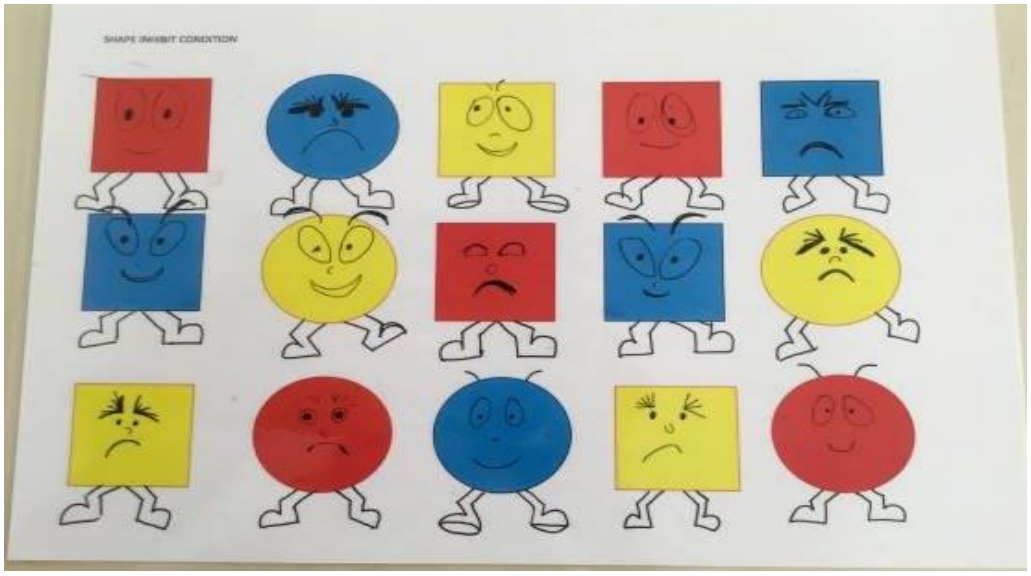
Q9. If you were to design a screening tool for SLI, what would be the most important features you would want to see in it?

Q10. Any additional comments?

Appendix C Shape School Materials

[verbal inhibition test]





Appendix: Crosslinguistic Nonword Repetition Framework: British-English version (Chiat, Polišenská & Szewczyk, 2012, re-produced from Chiat, 2015, pp.149-150)

	Crosslinguistic Test	Prosodically-Specific Test	Language-Specific Test						
			Stress	Complexity	Length	Transitional probability / Ngram frequency (TP / NF)[1]			
Length						High	TP / NF	Low	TP / NF
2 syll	ˈzi ˌbu	ˈzibe	Typical	No cluster	2 syll	daɪlən	11 / 4.56	ˈrɒləp	8.8 / 3.12
	ˈdu ˌlə	ˈdulə			3 syll	sænərɪ	16.8 / 3.42	ˈzumwɪs	4.6 / 2
	ˈnɒ ˌgi	ˈnɒgi			4 syll	pɒnəˈvɛskə	13.9 / 2.5	kɛfəˈmɒspə	10.7 / 1.6
	ˈlu ˌmi	ˈlumi		Initial cluster	2 syll	spɒdəl	9.6 / 2.96	fræʃək	7.1 / 2.72
3 syll	ˈsi ˌpu ˌlə	ˈsipəˌlə			3 syll	ˈstɒfəlɪ	15.9 / 2.79	ˈsmʃəˌtəʊ	8.5 / 2.28
	ˈbɑ ˌmu ˌdi	ˈbɑməˌdi			4 syll	ˌskʊməˈkædə	10.4 / 1.94	ʃɒnəˈmʊzə	8.8 / 1.79
	ˈmɑ ˈlˌtu	ˈmɑltˌtu		Medial cluster	2 syll	nɒskət	12 / 3.15	ˈbsnɒk	5.6 / 2.44
	ˈluˈmi ˌgɑ	ˈlumɪˌgɑ			3 syll	mɒspəˌdəʊ	8.8 / 2.25	ˈziəpəˌgɔɪ	4.8 / 1.35
4 syll	ˈziˈpɑˈlˌdɑ	ˈzipəˌlɪdə			4 syll	ˌtɒskəˈlɪmə	8.7 / 2.1	ˈvɒsnəˈrɒʊdə	7.6 / 1.81
	ˈmuˈkiˈtəˌlə	ˈmukɪˌtələ	Atypical	No cluster	2 syll	rɪˈvæsk	12 / 3.63	nəˈbʃ	3 / 2.28
	ˈkɒˈsuˈluˌmi	ˈkɒsəˈlumi			3 syll	pəˈzɛmə	11.7 / 2.88	ləˈvʊgə	9.4 / 2.05
	ˈlˈdiˈsɑˌku	ˈlɪdɪˌsɒkə			4 syll	rəˈnʊsədɒ	5.3 / 1.96	zəˈdɒgənə	3.6 / 1.49
5 syll	ˈsiˈpuˈmɑˈkiˌlə	ˈsipəməˈkɪlə							
	ˈduˈlˈgɒˈsuˌmu	ˈdʊlgəˈsumə							
	ˈmɑˈluˈziˈguˌbɑ	ˈmɒləˌzigəbɛ							
	ˈlˈtɑˈpiˌmʊˌl	ˈltəˌpiməl							

[1]Transitional probability and Ngram frequency derived from the corpus biSubtlex-US (Brysbaert & New, 2009)

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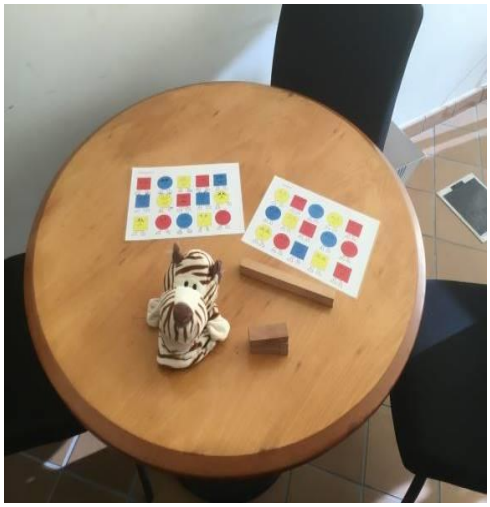
Appendix E Images from Inhibition Tests



Appendix F Focus Group Transcripts

Focus group "A" – Held September 5th 2014

Present - Researcher and Supervisor, 5 Speech and Language Therapists

Researcher: First of all thank you all for coming to the focus group today. I would like to ask you a few questions starting with how do children come to be referred to you?

Speaker 1: Does this refer to speech and language therapy?
Researcher: Yes

Speaker 1: Well, anyone can refer a child for speech and language therapy in Hertfordshire so it could be parents, Health Visitors, teachers, anyone really but we have also just started doing drop ins where they can be seen by an assistant for a screening test. For those children who are already in school, they would be referred on paper and the therapist attached to that school would do an assessment of that child and determine if they need SLT input.
Researcher: So what would be the typical age for referral?

Speaker 1: Well, I mean we see children from 2 and we extend up to 8.
Speaker 2: We have a lot of 2 to 3 year olds who are referred by Health Visitors but the most common age is 3. We do get a lot of primary school children 5 to 7 year olds because sometimes the problems don't show up until later. Some children, especially bilingual children tend to be referred later because the fact that they are bilingual tends to mask the SLI and the assumption is that the child is not talking so well because it's bilingual and it's learning bilingually, which is the problem, whereas it is a language problem , so those children can be referred later.
Researcher: Yes, in the bilingual children, is the level of impairment the same in both languages?

Speaker 1: That's the idea.
Researcher: Do they make the same mistakes in both languages?

Speaker 1: Well, that's difficult because we can't always get interpreters and it obviously depends on the structure of the language but if we can get an interpreter then it does appear that it is very common for the same mistakes to be made in both languages.

Researcher: Yes, OK, now this is a very broad question but I hope you will have plenty to say. What do you think of current assessment procedures.
Speaker 1: Do you mean standardised assessment?

Researcher: Yes, well any assessments that you might use that you have decided to bring into your practice.
Speaker 1: (to another member of the focus group) Would you like to say something here?
Speaker 3: Well, I always use a mixture of standardised and non-standardised tests, so if there are various gaps that standardised tests don't pick up on, I can use informal assessment.

Researcher : Anything specific?
Speaker 3: Well, it's generally the functional use of language, so talking to the teacher, parents, other schools, so more general things that you would pick up in a conversation.
Speaker 4: Yeah, I use a lot of informal assessments because I always feel that the assessments are there just to test what they are designed to test and you can't just do 1 assessment to make a diagnosis.
Speaker 1: Yes, in fact, what I feel is that you need a list of indicators and we are trying to launch this across our system, so using indicators which might suggest a language impairment and using this to guide things into having a talk with a specialist and then using the assessment to support that. It is important to look at the holistic picture. I saw a child recently who was widely recognised as having learning difficulties but when I looked more closely at how he was behaving, he was actually age appropriate in lots of nonverbal activities such as picture matching and the problem was really a language one. He could use a computer very well. The Ed. Psych came in and said that was actually correct.
Speaker 4: A test might show you that there are language difficulties but it is really important to look at the nonverbal as well.

Researcher: You mentioned indicators. What type of indicators would you be looking at here?

Speaker 1: Erm, well that would be…you'd have to divide them into ones such as comprehension, expressive, speech, pragmatic and so on. There are loads…would you like examples?

Researcher: Well, we are familiar with what it says in the literature but it would be nice to hear what you encounter in practice.
Speaker 1: Word order errors are very common.
Speaker 2: Often, on tests you can still get the mark even if the order isn't quite right.
Speaker 1: Children often produce verbs in an incomplete way such as "listening the radio". That is something which is never picked up in tests. It's this sort of things which you have to be good at picking up. So that's on the expressive side. In terms of comprehension, they can't hold onto stuff, so if you try to teach new words no matter how often you repeat the word they simply cannot retain it and that's something which is difficult to assess in a test.

Researcher: In one of the other focus groups someone mentioned time, so you can get a mark on tests even if you take any length of time getting to the answer, but real life isn't like that.
Speaker 1: And SLI children have slow processing anyway. I had a conversation with the parent of a boy in year 2 this morning. When he is asked a question on the carpet he always leaves a long delay before answering and that can be very difficult. It's very difficult getting children to wait. They do manage but it's very challenging because he processes so slowly.

Researcher: What differences would you pick up between ASD and SLI? Can you differentiate between the two?
Speaker 1: Well, thay often have shared characteristics
Speaker 4: The main difference is that the SLI child is really keen to communicate but isn't able to do so effectively but the child with ASD is only keen to communicate when it serves their needs. They are keen to communicate but on topics that interest them. So they can be quite narrow in what they talk about. That is a very key marker and then I think the behavioural response to their difficulties can be equally traumatic but I think that in SLI children it is because that are frustrated or they become withdrawn. Whereas with ASD children it's much more to do with not understanding appropriacy in a social setting, not understanding how to behave in a social context.

Researcher: Do you notice any differences as time goes on between ASD and SLI?

Speaker 1: Yes, the SLI children make progress and learn to use strategies whereas the ASD child finds it more difficult to take on board strategies. They can't inhibit, whereas the SLI child can learn to inhibit and manage their response.

Researcher: Does anyone else have any views? Any examples of how the pragmatics differ in ASD and SLI in terms of what you would observe?

Speaker 3: I think the ASD child tends to want to go and play on their own, so it might be to do with their obsessions, Lego, cars or whatever. The SLI child wants to play, they may hover, wanting to join in so you can see them wanting to join in. They might be making eye contact, trying to get in there but not sure how to do that or worried, whereas the ASD child doesn't seem really bothered about communicating with other children.

Speaker 1: Or, they may want to but the autism just makes it too difficult for them. The autistic child doesn't know how to interact whereas the SLI child does understand how to interact.

Speaker 2: The SLI children just have more understanding. When their communication improves they can fit in better. We notice that particularly when the language improves we are left with the social needs.

Researcher: Do you notice any difference in the narratives that SLI and ASD children produce?

Speaker 3: It depends whether those children…..for example I have a little boy in the infant base whose imagination is brilliant which is very unusual for an ASD child and it's not just to do with his obsessions. He's, you know, highly functional. Then we have SLI children whose imagination is not so good so it really depends on who they are so we have to do a lot of work on narrative stuff and exposing them to different stories. We do things, again it depends on the level of comprehension difficulties. We do a lot of work on narrative, so for example if you asked them to name a character in their story it would be their own name or their friend's name. It tends not to be anything more adventurous.

Speaker 1: SLI children have lots of problems with the structure of narrative so it doesn't make sense and they get the ideas muddled up and because they can't express themselves clearly they can get lost. With the ASD, they can produce a good narrative but it is very much their own agenda. You know they cannot stop themselves from bringing in their favourite figures so it can be very predictable.

Speaker 2: SLI children get very stuck for ideas, they can't generate, that's what I find so they can't generate anything.

Speaker 4: It tends to be the teacher's idea. They will take what you have modelled and then build their story around that.

Researcher : Are there any non-language difficulties, for example everyday memory?
Speaker 5: Well in my class, there are a lot of children with gross motor difficulties so In PE they need a lot of help. They find it hard to move around and to balance.
Speaker 3: Well, it's not just that either. There is a co-morbidity with SLI for hypermobility and motor difficulties. They often co-occur and lots of our children have additional needs.
Speaker 2: Yeah, for example I have a little boy in my class who cannot make his hand hold a pencil.
Speaker 1: A lot of them have fine motor problems. We have one little boy who cannot remember how to pick up a pencil. Every time he picks a pencil up he looks like he is doing it for the first time, so it's like remembering your motor programmes, but he also has a speech problem which is also about remembering your motor problems, so it's closely connected. It's very frustrating for him. He gets frustrated because he looks at the pencil and gets so frustrated.

Researcher: Are there any other related difficulties?
Speaker 2: There are lots of children with poor working memory. This becomes more evident once their speech improves so, for example numbers especially are a particular difficulty. We had one little boy who could NOT remember the number 7, but he also had word finding difficulties as well and then once he got the number 7, the number 9 had disappeared so we had to use similar strategies to help him with his numbers and his words. But, yet he had the most amazing situational memory. There was a puddle outside in the playground and I put some cones out there and whenever it rained he would go and get the cones yet the number 7 we had to work with him on every single day. Now, his speech and language are not his primary need.
Speaker 1: 20 and 12 are very often confused by children with SLI, as they start with the same sound. They cannot remember which is which. I must have to do that with almost every child as they cannot remember which one is which. They always need the visual number line or number square when they are doing mental maths because they can't hold the number in their head. If you say "Johnny has 22 marbles and he lost 3 - how many does he have left?" they've forgotten the first part of what you said. But is you say "22 marbles" and you put their finger on the number 22 then they can do the mental maths.

Researcher: OK

Speaker 4: And concepts as well. Doubling and halving…every year we have problems. You do doubling and they get that but then they get mixed up with halving. You have to use a very visual method.

Speaker 3: It is really very difficult in maths because you might work for several weeks on something and they really get it but then we come back to it, you realise they can't remember anything of what we did before. The test situation is how the primary school is measured and how the child is measured. It's really, really difficult. So you might have a child who you are teaching something different today…we tend not to do a unit of work and then have a test. We might work on Number, Shape, Measuring for a couple of days. SLI and ASD children find it really difficult to jump from one thing to another, so for example if we do addition, that might go well, but then if we do subtraction, they will just do addition again, because they can't move on to subtraction. They can't jump from one thing to another. That is a shared thing with both ASD and SLI.

Researcher: Any other difficulties?

Speaker 4: Inference! Reading comprehension and things like that. So parents will say the child can't read between the lines and you are like "Really?" So you have to teach inference. So even though they might be brilliant readers, they don't necessarily understand what they have read so we have lots of "barking at print".

Speaker 1: The SLI children have lots of difficulties decoding and with comprehension or they might have difficulties with decoding only and be brilliant at comprehension, but with the ASD children it's really much more about comprehension.

Speaker 3: And phonics can be especially difficult, because if they've got a speech disorder they recognise what the sounds are but they can't say them properly. They can't put sounds together such as consonant clusters and other short blends .There is no chance of them doing "tr" and "spr" they find it so difficult, so you tend to leave that out and concentrate on whole word recognition.

Speaker 4: Yes and then that's their way of saying it. That's really child specific. But there are phonic assessments, national assessments that we have to do.

Speaker 2: They are very difficult for our children because there are words they have to read which are not real words.

Speaker 1: Yes. That's really difficult as the child doesn't know if it's a real word or not.

Researcher: Do you find novel words are particularly troublesome?

Speaker 3: Yes.

Speaker 1: One of the other things is that when children are going back to mainstream, having had their input from SLT, they may be much better but they are always left with vocabulary difficulties. The difficulty is in learning and retaining new words and I mean every single child that goes back we have to go and explain that you are going to have to teach them vocabulary in a structured way or they won't remember it. So they all have word books in which they record words pictorially and they practise it so they retain the words, whereas the ASD they tend to pick up words but they don't necessarily use them appropriately.

Researcher: How about everyday memory? For example if you said to a child remember to pick up your PE kit later would the typical SLI child remember it?
Speaker 1: It depends on the child. That's how they make the world understandable and safer, some remember everything but for others they cannot.
Speaker 3: Organisation is generally poor but it can vary.
Speaker 5: We find that children with just speech disorder can do that but it's the ones with multiple problems which find it difficult. You know receptive, comprehension problems. They might just remember they've got PE but nothing more.

Supervisor: There's 2 elements to that. There's remembering that they've got PE i.e. past memory and remembering to do something in the future. What Sheila is asking is do you think it is individual or if they don't have a good memory for future things. So remembering your keys that's easy, it's something you do all the time but remembering to get milk on the way home that's future memory, you have to retain the instruction for the future. So if you said go and get your lunch box off the table outside when the bell goes would they do that?
Speaker 3: I have a group at 9 o'clock on Wednesday and I say after registration come back here, so they have that as their routine, that's what they do every Wednesday.
Speaker 1: And I also think that sort of prospective memory takes a lot of reasoning. Remembering to buy some milk on the way home takes a lot of reasoning. There has to be a reason why you need to get milk on the way home. It does take a level of verbal reasoning and because our children can't do the reasoning steps i.e. if you haven't got any milk then you need to get some, so the best time will be when I'm on my way home….they are bound to find it difficult.

Supervisor: Do you think you have to simulate that in your head? It depends what you mean by reason. Could it be because they don't simulate themselves actually going to where they should be or is it something else?

Speaker 3: I think it's because they can't do those logical steps. They don't have the language to simulate it. They could simulate it if they thought about it in pictures, so it's a bit like a drama. So when the bell rings "BRRRRIng!", then we get them to physically do it, then they might remember.

Supervisor: So you have to provide them with a strong nonverbal cue?
Speaker 1: Yes.

Supervisor: So it's a matter of how good you are at remembering what to do when you get the cue?
Speaker 4: Yes, so you could say "Oh, the bell's just gone. What do you do?"
Speaker 3: This ASD boy that I have is the worst at remembering, in fact he won't remember anything unless there is something in it for him.

Supervisor: The other thing you must have to do is give them cues to remember things so if the classroom is on the way to another classroom they might have the cue to think "I should go in there". So they would ask themselves "where should you be?"
Speaker 1: When we had a meeting in here earlier on today for another child, I had all sorts of questions in my head, so the child must, in order to be able to respond to,say, the classroom door as a cue they must be asking themselves the question "Do I need to go in there?" or "No, I don't need to go in there". He's not thinking of that even subconsciously as we might do. It doesn't make any difference. Coming back to the conversation we had today about that child's comprehension…he's just SLI so he is good at reading and likes reading but he can't say what the story is about and his Mum says he does that exactly with films as well. They love watching them together but he will say "what's the film about?" He can't talk about it, he has no idea what's happening but he's not bothered about that. She says he doesn't understand anything.

Supervisor: It's quite interesting because we have been doing some work with dementia patients and over time they may start off reading and the words go in but it's almost as if it's one of the first things to go, the ability to comprehend something.
Speaker 3: But I do that sometimes. I can be reading something and then realise I was thinking about something else. (laughter)

Supervisor: That's more divided attention. So if you read it and analysed it you would be reading for meaning. Some people lose the ability to do that.

Speaker 1: The child I was talking about wouldn't be able to do that. So if you asked them the name of the main character in a story he wouldn't be able to tell you. I think there is another thing about ASD children about remembering to do things in the future. We have a boy who is very high functioning and he talks as if he can't stop himself, this is more on the negative side, he says he can't stop himself and what he says is "I told my legs not to do it but they still did it" and it's as if he can't stop himself, he can't inhibit. He doesn't want to do it but he can't stop himself doing it. He's full of remorse afterwards, so he has actually verbalised that to us but he will carry on doing it.

Supervisor: So, if you took a bunch of ASD children would they all do that?
Speaker 1: No, but I do think that's an interesting aspect. If you can't inhibit your obsessions then behaviour becomes very difficult.

Supervisor: Well, there's 2 sides to that. There's also something about that if you think something you do it.
Speaker 1: Yes, well this boy does respond to social stories. He still struggles to do the right thing. As soon as he has done the wrong thing he will try to do the right thing.

Supervisor: Maybe the way in which their memory works i.e. the way they build their concepts is different. The way they make connections can trigger off lots and lots of other connections.
Speaker 1: We do a lot of stuff where we try to reorganise their brains because they are so disorganised, so they might have an animal file and anything to do with an animal they put in that file. That's something we do all the time but they don't so if something comes up about an animal they don't know where to look so we use forced alternatives a lot for example "is it a horse or whatever?"

Supervisor: So you think it's in their memory, they just have trouble retrieving it?
Speaker 5: That's something we have to do a lot of work on reorganising their brains.
Speaker 1: I think the other thing to do with "what do I have to do in the future?" is that I'm not sure it's in their brains at all.

Supervisor: Some people say there are 2 processes going on, one is a monitoring process and you can do rehearsal. There are also automatic processes going on so your brain is so used to doing certain things from childhood that things just come back to you, they just pop up and there's a debate about how that happens.

Speaker 1: I don't see any pop ups! (laughter) I mean some of them turn the wrong way when going out of the classroom even after being here for 2 years. They are the ones who have spatial difficulties in addition to SLI. One of our children lurches around, he's very disorganised, he can't walk because his brain is seeking "where should I be going?, what should I have with me?". Instead of asking himself those questions his brain just goes off but then he can be different on other days…it's as if he has shut down on some days. I think the effort makes him tired.

Supervisor: Yes, the effort makes them tired. Thinking back to what would be useful for you. What things frustrate you about standardised tests. Is there anything you wish to add?
Speaker 1: I wish I could remember what I was thinking of! I've been working a long time and the thing that I would say is that standardised assessments are limited in their use but they are useful to tap into specific things. But if you want a holistic picture you can't just do that you have to look at the child and how they perform in lots of different situations, so I'm not sure you could have a standardised test that would do that unless it was an observational test. They are good at picking up the verbal but not necessarily the nonverbal.

Supervisor: So if we're looking at more screening than diagnosing, because diagnosing is expensive what do you feel are the important things?
Speaker 1: Well, if you look at SLI, one of the most important things is that nobody knows what it is because it hasn't got a definitive set of characteristics. OK if a child does this, this and this then they are SLI. So, even the top researchers like Dorothy Bishop cannot agree on what it is exactly so therefore it's not in the public domain. You know that's why the RALLI campaign started off, so to me the most important thing is to get more people out there to understand what it is, to get it out there. I would say, if you could produce something like a checklist that says if the child has 10 or more of these things…. You know I quite like the checklist approach, so say if he' under 4 and he's got 3 or more of these things then he's a yes or if he's over 4 and he's got say 5 or more of these things then I think that sort of approach would be invaluable. I think it would also raise awareness.

Supervisor: Would you rely on parental report for, say the under 4 one, whatever it might be that might identify them? Would you trust parents to report accurately?
Speaker 3: The Health Visitors refer children to us based on what parents say, but there are a number of children who come to us with concerns and they're fine. So, I think any observation has to be based on factual things not judgements. For example, do they look at you? Can they ask for things? The nonverbal behaviours are just as important as the verbal.

Speaker 3: I was thinking of a family who have several children and they all have special educational needs and in the parent's mind the little girl who is here is doing really well and is really clever. Well, that isn't the case, she's not really clever but according to that parent's concepts she's doing brilliantly. She's talking so she's amazing and it's important the father has that concept of her. It wouldn't be fair to put him in the position of judging her.
Speaker 1: I actually don't think you can rely on parental report. I have to say, the paediatricians rely on parental report an awful lot and that leads to inaccurate diagnosis.

Supervisor: You can see how it happens though because if you have a 2 year old and you can take them in to a paediatrician and then let them run around for a bit you would see that they might be different, so you do have to rely on parental report.
Speaker 1: The NICE guidelines on autism are very, very clear. This is how you diagnose autism and it takes a lot of hours of work a lot of manpower but it's really important to have an accurate diagnosis. Now, we can work with a working diagnosis of SLI and we can raise concerns, put children in special classes and it doesn't have to be a totally accurate diagnosis for us to get on with our job, but I think we do need to have something like they have in autism for SLI.

Supervisor: Well you do, because of the way our systems work. If we get it out there to the general public and they get to know what it really is in the same way as they have for autism then that would help.
Speaker 1: But in my job it's the biggest frustration and it's the 1 thing that hasn't changed in all the years I've been working.

Supervisor: That's interesting.
Speaker 3: It would help to have something to help us in the assessments for maths and science. For SLI children mental maths is so closely linked to language, so we try to take away all the problems other than the 1 thing we are assessing, for example a child's ability to add and subtract. So, if we put a child's finger on the actual number then they can come out of the test in the same way that a mainstream child peer and that causes us great difficulty when we say a child needs a statement of special educational needs, because it wouldn't be right for us to put that child in the same position as Fred next door who you can just give the test to and say "get on with that". It would be appalling of us to do but it would be great if we could show what a child can do and where the SLI comes in to affect what they can do. So to be able to have something that shows what SLI children can do even though they are

different would be great. We often change the language, so we adapt it a lot more for the SLI child but they can do certain aspects.

Speaker 1: Of course with SLI you ether get better or you have a long term problem. The difficulty is showing that is also there. You can have residual difficulties even when you have had SLI. You could say you are not SLI any more and that causes difficulties for parents because they say "Well, I don't want you to take away that diagnosis because my child is getting some support". Or, on the other hand, if you keep it then I don't know if that's right. And that's not the same with autism, you know if you are autistic then you are always autistic, you are always dyslexic but with SLI you can mediate it in some cases.

Researcher: Do you think there could be some value in having an assessment tool that you can use, something like the CELF, that you can use over quite a large age range?

Speaker 1: I think you would have to divide it into age groups because you can track SLI and you should be able to because those are the children who are going to have more difficulties in life. I think that would be very useful.

Researcher: Is there anything else anyone wants to add that we've not mentioned?

Speaker 1: (to the other members of the focus group) Well, when you started teaching here had you heard of SLI? I'm just interested. You know, my son is doing teacher training and he had never heard of it on teacher training, he has now because he has me as a mother but, you know, these lot had never heard.

Speaker 6: Well, you learn about a big range of educational needs and you learn about the major ones like autism.

Speaker 1: Actually, there are more children with speech, language and communication needs, more than any other need and there needs to be something happening in teacher training and professional training.

Supervisor: That's interesting, I need to get more people involved , get the education people to include it.

Speaker 3: Jess and I have been doing something with the University of Hertfordshire and we talk about our career and people are thrown by the fact that there is a whole class of children with language difficulties or they get confused between SLI and dyslexia and I'm like no, it's completely different. With really specific needs like SLI, I think it largely depends on where you do your teacher training , because if you do it here you are going to have a really good idea of it but you may not somewhere else. It all depends on the county. But I did a PGCE and I can't remember hearing about it.

Speaker 1: Well, on PGCE they say this is SLCN and this is where you can find out more about it. We know that in every single class in every single school in Hertfordshire, there will be someone with a speech and language need.

Speaker 3: Most teachers will say, no we don't have any children with special educational needs but, no way, there is absolutely no way – it just hasn't been picked up. I suppose it also depends on the catchment of the class. It might be that it is really typical or there might just be one child who stands out.

Speaker 6: But it is difficult when children are so young, so it might be because they're still learning or is there something else going on? I don't feel like I've been taught, so it's difficult to see why they are low on language, especially the EAL children.

Speaker 7: And in some areas you've got a lot of deprivation which always makes things worse.

Speaker 1: It's a very difficult thing. Nobody can sort it out easily and that's why you have Speech and Language Therapists. You're not expected to do that. If you train the early years teachers to provide a language friendly environment then the ones who are not SLI will progress and the ones with SLI won't and sometimes that is a way of detecting problems. You can start to see the wood from the trees and that's why it's important that all schools provide language skills support for all children and I think that is diagnostic in itself and although it takes a lot of time, it can be slow, but the ones we need to worry about are those who don't improve.

Supervisor: So when you were talking about indicators, things you need to have such as nonword problems and missing out pronouns, do you mean these or are you talking more about behaviour related issues?

Speaker 5: Well, if those things prove through research that they are the indicators then there is no reason why you can't use them, is there? The nonverbal and the verbal need to be seen together.

Supervisor: Because it's not so clear in the research sometimes …all you can say from the research studies is that the children they looked at, at that time showed certain indicators but when you look closely…. It does seem to me, having looked at the data over several years that nonwords do stand up strongly.

Speaker 4: That's supposed to tap into sound, a different part of your brain. But some SLI children can be different.

Supervisor: You can learn words and they can go into memory and the idea that if you give a child the sounds of a nonword and they can't repeat it, then there's something which is not quite right. Most young children can do that.
Speaker 1: Well it's a very interesting aspect, but it's not the whole picture.

Supervisor: No, it's just the diagnostic…
Speaker 1: But, if there's any useful things like that, then they should be included because even though research only proves what it proves, it's still very valuable.

Supervisor: Yes, of course. If you can put lots of bits together and get an overall picture, then it can guide you.
Speaker 1: That ought to be included in a list of other indicators as well. When I think about colleagues that I work with, what I hear most often is "I've got a feeling that this child is SLI" and it would be an SLT who has just seen a child a few times and I say OK what is it that you have seen that gives you that feeling and now we have our own set of indicators which include both verbal and nonverbal things and I say go to the indicators and get some more information and then come back to me.

Supervisor: Sheila, you said you had that quite a lot in the other groups didn't you?
Researcher: Yes, this is something which came across very strongly because I've been to Dawn House and Meath and they kept saying "we have a gut instinct" and I would say" what is it based on?" and they would say "years of experience".
Speaker 3: I think we're very lucky here because we have lots of children with SLI but if you don't it could be quite difficult because you would say "Oh this child, is quite similar to one we had a few years ago".
Speaker 1: I know there are teachers out there working in isolation because there aren't enough specialists around so the teacher might have a programme for the child but they don't know what the diagnosis is. I've seen reports written about a child that suggest it is an SLI child but I can't see SLI written anywhere in the report and then there is advice sent to the school and the programme and they're just working blind. No-one has ever sat them down and said this is what SLI is and these are the kinds of interventions you can make, this is how you will need to do this, so it's not surprising that people get confused, really.
Speaker 4: It's difficult when you don't know why you're doing something, so there are so many things you could link to the curriculum but if you don't know why you're doing it you're not going to do it.

Speaker 1: I think it's really important to recognise the impact of improving a child's language, how it can impact on their future so that all the statistics and things you can get now such as the child's vocabulary at age 5, those sorts of things are really interesting and those sorts of things should be used in schools because otherwise they think why should I bother?

Supervisor: Yes.
Speaker 1: if they think, I want to improve my school's results….
Speaker 3: Yes, you need to be careful with a screening tool that they know it's about talking because at the moment it's all about writing in the school's results.

Supervisor: Do you think it's because the National Curriculum tests those 3 subjects, Maths, English and Science?
Speaker 3: Well, no, teacher assessments that we do include speaking and listening, so it has brought it to the forefront in that but it's nothing to do with national tests in year 6.

Supervisor: So Reading, Writing and Maths tests. Years ago, CAT tests. That was correlated strongly with IQ and later with GCSE scores and there are some people who say that you should make those correlations, perhaps not with IQ tests but there are others who say that all it does is give a snapshot of an individual at a moment in time.
Speaker 3: I wouldn't agree with that, because you are allowed to make all sorts of amendments to the National Curriculum tests, you still don't look at the child holistically, that's all. Even if a child can focus on the test paper, that doesn't tell you how that chid is going to function in the real world.

Supervisor: So the test might predict how well a child will perform in a GCSE test later but even GCSE tests are not a measure of function.
Speaker 1: The way the world is now, the job market is so competitive compared to, say 10 years ago. Your ability to network and for someone to offer you a job for no money until they decide they want you…

Supervisor: Yes, I deal with placements at the university and students trying to get work experience, it's very tough out there.
Speaker 1: If you think about it, who is going to have the most problems with that? It's going to be those who have speech and language problems. Those are the ones who are going to

fail most in those sorts of situations. In interviews they will give slow answers, their self esteem will be low…
Speaker 3: Like my interview! (laughter)

Supervisor: That is something I really worry about and worse still, companies are keeping people for 2,3 years or you get legislation brought in that says you can't keep someone for 12 months without giving them a job so companies get rid of them after 11 months. This just goes on all the time.
Speaker 1: I think that is the biggest problem for children with SLI. If they fall behind because of the way the world is, they are much more at risk.

Supervisor: And they are getting no support as young adults. They may be good at their job but, you could say they are better than other people because they have had such a battle.

Speaker 3: I'm sure it is included in some application forms but the employer is not going to take that into consideration when they're doing the interview.
Speaker 1: You have to tick the disability box on the form.
Speaker 3: Yes, but people might not know what that means…what is SLI to someone in the City, say?
Speaker 1: The HELLO campaign was trying to raise awareness but there's not a buzz. The ICAN charity was originally all about SLI but it's broadened its remit to include the range of speech and language needs and it has a universal approach which is great but it's kind of lost touch with SLI.
Speaker 3: The HELLO campaign was for everybody, encouraging speech which is what they should be doing anyway.
Speaker 1: The Bercow Report is all about the problems of language use across the board.

Supervisor: Absolutely.
Speaker 3: There was a programme on TV the other night about The Secret Life of Babies – really good and it covered communication and even children with hearing-impaired parents which was great. They also covered sign and they were amazing, the babies as they were picking up sign before speech and it was amazing how they were able to communicate.

Supervisor: We had a student who tried to teach sign to babies before they talked –her other supervisor was mad on gestures and they had this thing about sign being the precursor

to speech but their speech and language compared to babies who didn't learn sign was no different.

Speaker 1: I think signing reduces frustration- that's what parents have said. A child can make itself understood.

Supervisor: Karen Pine did a study looking at gestures in SLI…I always think of it as another string to your bow, so if you can't speak very well you can make yourself understood through sign. Do you think SLI children have impaired use of gestures? Would they understand you if you gestured?

Speaker 1: I think it really helps their comprehension if you use gesture. There are some children who can use it and others that don't and you can have 2 children with exactly the same type of SLI and one will use gesture and the other won't.

Speaker 4: I find that children refer back to it as a comfort sometimes. If they can't think of the word, then they might remember the action.

Speaker 1: We often say, "Can you show me what happened? " or "Can you draw it?"

Researcher: Do you find any children whose language development you think has been influenced by the use of technology at a very early age e.g. children using IPADs aged 2?

Speaker 3: Well, does it impair or delay it? I can think of one particular child who has been using a computer for a long time and it has definitely hindered his learning. I think his parents thought I don't understand what he's saying, he doesn't understand what I'm saying so let's just let him use a computer. So, he's brilliant at IT skills. At home it's happening because he finds understanding language SO difficult, it's just easier for him to see it in a visual way. I don't know but I think it has definitely prevented him from learning because the school he was previously at and his parents just gave up.

Speaker 1: I don't think technology can cause language impairment but it can definitely delay language development.

Researcher: The reason I ask is that I work in an independent school with a pre-prep and they are finding increasing numbers of little boys coming with language problems. They have been used to very articulate little girls who know lots of long words but the boys very often have 2 very hard-working professional parents who don't have a lot of time for them so the children may not be materially deprived but they are socially deprived. Children have IPADs and they may not get a bedtime story anymore and some of the pre-prep staff have suggested that these children stay at the afterschool club because they will get more input there than they ill at home.

Speaker 1: Are they definitely SLI or delayed?

Researcher: Well the parents are very reluctant to see it as a problem.
Speaker 1: I would suggest that they are delayed and if you enriched their language environment they would get better.

Researcher: This is a whole new phenomenon.
Speaker 1: Isn't there some research which looks at the long term outcomes of children with SLI and one of the findings is that the social media have a very beneficial effect because they can communicate more easily using text than they can with spoken words and so because they can use Facebook and things like that they are happier as a result. This is really helping some of the older children so, there's a balance to be had isn't there? But we do have children, one boy in particular who spent the whole of half term on the computer and didn't do anything else at all. He just got up, straight on the computer and then went to bed. We did all this work with him and it was an enormous struggle for me to get him back to where he was before half term. He's very fidgety and agitated and he couldn't find the level he had been at.
Researcher: How old is he?
Speaker 1: 6 (to other members of the focus group) What do you think?
Speaker 6: I know one girl, she goes to the IPAD straightaway. Mum doesn't speak good English, Dad works and because there isn't much language in the home, Mum and Daughter don't really speak. Her IPAD is her main channel of communication. But there's no talking involved in using the IPAD. Yes, she has speech difficulties.
Speaker 1: So it's compounded the SLI, it hasn't caused it.
Speaker 3: But it makes things harder to diagnose because you tend to think "Oh, it's because they're on the computer all the time", so it confuses delay and impairment. It's almost an excuse.
Speaker 5: It's more about the opportunities which children are given to talk in general rather than their use of technology. So, I can think of a child from a family where there is just no real talk- they just don't talk to each other so it's a similar sort of deprivation. SLI may be genetic but it's compounded by the lack of talking in the family, children can't practise their language.

Researcher: For some though technology can be joint attention .
Speaker 3: Yes, it can and children can talk about it so it can be a positive.

Supervisor: It's very odd because when they get to university we say read a book!

Researcher: Yes and there are some university lecturers who say people can't read a book anymore, they just skim read.

Supervisor: IPADs try to make it exciting and then they come to us and its books.
Speaker 3: But it's not as if you are ignoring one or the other, people use both IPADs and books.

Researcher: is there anything else anyone would like to mention?
Speaker 1: One of our teachers has only recently started working with SLI. What do you think?
Speaker 6: When I first arrived I had no idea what the language base was. I thought I would never get on top of it. I had so much to learn and I'm still learning it.
Speaker 3: On my interview day, I went into your classroom and I thought I wouldn't be able to understand what the children were saying but I sat down and had a conversation.
Speaker 1: Yes, That's quite common. People think it's going to be speech problems and often those are the most obvious ones to refer but it's often the quiet , co-operative ones who are the easiest to miss.
Speaker 3: Yes and they copy other children, so they tend to fit in so you might say "Oh it's really hot outside" and they will say "hot outside"- it's that sort of thing. It's a conversation but it's always related to what you've just said. They're absolute masters at denying so we've got denial going on too! "No I don't need a speech therapist!"
Speaker 1: It is interesting though….I was speaking to someone at Moor House- they do have that problem at Moor house even though everyone has speech and language therapy, they still have people who opt out but they tend to have co-occurring difficulties and that fits with most of the ones we have here who are doing it.
Speaker 5: And the copying. The thing I would say is that every child is different-they are so quirky and their behaviour can be so strange and that's why you can't just do the one assessment. I think that is one thing that is really difficult with SLI. You know with autism you have the triad of impairments and a child will fit into one or more categories but with SLI it's much more difficult to do that and therefore it's more difficult to spot.
Speaker 4: When you do your maths lessons you are having to meet the needs of all the children so it's not just 1 maths lesson or 5 maths lessons it's more like 25! You have to adapt everything to each child. And every year is different, you can't use your plan from last year.

Speaker 1: Sometimes, you have a morning when you start off doing one thing and you find out that no-one knows what fog is so you go out and you've been distracted from what you were planning to do. Is it like that in Reception?
Speaker 4: Yes, it can be.
Speaker 3: I forget that this is completely different from how another teacher's day might be.
Speaker 1: One other issue I would like to raise is the difference between having a specialist provision for those with SLI and mainstream provision, because obviously there are loads of other counties in the UK that don't have any specialist provision and that makes you wonder shouldn't everybody have this? In Herts some of the people in the LA don't think that language units are necessary. We have them and now we are going to have to prove with statistics the benefit of this type of provision which is quite difficult. What do you use to show it's beneficial?

Supervisor: Yes.
Speaker 1: Do you have the results of assessments? With a checklist you can't necessarily show a child's progression. I suppose you could look at the next age bracket and show that they don't have a particular language trait anymore. But, if they are going to question the benefit of the provision that's an interesting question.
Speaker 4: I think the only thing we can do is show the numbers of children who go back into mainstream.
Speaker 1: But then, that doesn't account for the group who will be here a long time and they will need support all the way through school.
Speaker 3: I think the other thing is that parents don't know about us. They have to ask "is there any specialist provision for my child?" and the minute you talk about that they think you mean special school.

Supervisor: Yes.
Speaker 3: And it's not really publicised so they go "Oh It's completely different to what I thought! " They don't realise that children can just come to us for an intensive morning and then go into mainstream. When they hear "special school" they think "I don't want my child to go there".
Speaker 1: They do sometimes say "Yes!"
Speaker 3: It's actually getting parents through the door.
Speaker 1: We spend a lot of our time trying to mention it and not mention it. You can't say "We can offer SLT". The parents have to say "Can you tell me what is available for my child who has SLI?" If they don't know we exist it's very difficult for them to ask.

Speaker 4: So you end up saying “I work in a Language Unit” and hope they pick up on it. We say very positively “this is where children can come to learn the same things but in a different way”. And they nod and you want them to say “Would my child be suitable?”

Supervisor: You have to pretend you misheard. What is going through my head is a Radio 4 programme or a documentary.
Speaker 1: Well, there have been documentaries done in the past about 10 years ago about a child with dyspraxia who was a Hertfordshire child.

Researcher: I was talking to someone from Meath at the NAPLIC conference and they said they have had cameras in recently.
Supervisor 1: There’s some good stuff on Youtube. There’s a girl who had a stroke at 21 who has documented what the difficulties have been over time.
Speaker 1: We really need a celebrity. There may well be celebrities with a child with SLI who we just don’t know about.
Speaker 3: Well there was the guy on Eastenders who’s dyslexic.
Speaker 1: What about if royal George had SLI?
Speaker 3: But with John Bercow, you see it came from his experience. Perhaps we need to look into it.
Supervisor: Well, we have Doctor Dance, he will go anywhere and there’s a guy called Richard Wiseman who is on telly a lot and knows people in telly, perhaps we can persuade him?
Speaker 1: Or what about Professor Winston?
Speaker 3: He spoke at my graduation.
Speaker 1: There’s Jean Gross who was the Champion in the National Year of Communication and she did a lot.

Supervisor: The trouble is when you say “communication” it’s not like autism. Everyone thinks they know what communication is and then you start to tell them what it is and then you might mention phonology and they get turned off by it or they get the wrong idea. It’s a challenge that we need to face….
Researcher: Last chance to add anything! No? Well thanks you so much for all you contributions. It has been most interesting.

Focus Group B - Held 27th November 2013

Present: **1 Researcher and 5 Speech and Language Therapists**

Researcher: Well, can I first of all thank you all for coming to this Focus Group. As you are aware, the purpose of this focus group meeting is to find out about your experience as front line speech and language therapists working with children with language difficulties. My research focuses on Specific Language Impairment, a language disorder which I am sure you are all familiar with in your daily work and I would just like to put a few questions to you to try to find out the kinds of issues you experience on a practical level. Is that OK? (general nodding) So, if I could start by asking how do children come to be referred to you?

Speaker 1: Well, it can be through a variety of routes, but it is generally when children may have already experienced communication problems in a pre-school environment or perhaps in the early years of school, because this school takes children from the age of 5 through to 19, so their previous school may have raised concerns with the parents and then these have been acted on.

Speaker 2: Yes, that's right…I would say we get very few direct referrals from parents…..it tends to be a situation where the child may have been having problems for some time and parents have thought that the child would eventually pick up language normally but that hasn't happened and so the child has been about to go school or is even at school before the problem is picked up. The child may have been struggling for a while before anybody notices that it is not getting any better.

Speaker 3: I would agree and it can also have knock on effects to behaviour because if a child has been trying to communicate or misunderstands what has been said, then it may be that it has been their behaviour that has been thought to be the real problem rather than their language. The adults' focus is on what is more of a problem for them rather than the child.

Researcher: That's interesting, so in your view what would be the ideal age for referral?

Speaker 4: Well, it would depend on the child, but the earlier the better before behavioural problems become the main problem and so the proper assessment and help can be given to help that child develop. Wouldn't you agree?

Speaker 1: Yes, it's a real shame when we see children who have struggled and perhaps been quite unhappy, so I would agree with what Speaker 4 has just said…that in every case it has to be that early detection is essential.

Speaker 3: You do get some parents though who are quite unwilling to think that their child has a problem.. they think they will grow out of it or it will somehow resolve itself because they have never had anything like this before perhaps with other children, so it's a new thing for them to deal with so I think it would have to be a case that the professionals pick up these children at an early age as it may not always happen if you leave it to parents but I would strongly agree that early assessment is one of the main things.

Researcher: So, would you say there is an ideal age for referral?
Speaker 1: Well, I would say, definitely pre-school, say 3 or 4? What do the others think?
Speaker 3: Yeah, I would say that's about right because you don't want to leave it until they get in the classroom and find they have got real problems and also there's the behavioural side of it.

Researcher: Would everyone agree? (general nodding of heads)
Speaker 4: Yeah, I think it would be great if you could look at all the 3 and 4 year olds and make sure their language is coming along as it should and then you could do something about it early rather than later when the problems may have all sorts of knock-on effects in terms of behaviour and academic progress or rather lack of it.

Researcher: So, what do you think of current assessment procedures?
Speaker 5: Well, I do quite a lot of the assessments here and the thing I find is that you end up using a mixture of tests because it depends on the type of problems the child has so, for example, it might be that some of the subtests of the CELF are suitable but others aren't, so it's down to you to choose the ones you think are appropriate, that will pick up on things, but you might go with something like the CCC if you feel that would be useful. So I find that I rely on my own judgement in choosing appropriate bits from a variety of assessment tools.
Speaker 2: Yeah every child is different and also you need to take the time factor into account. I always feel that with some of the tests the time factor should be taken into account in the assessment, so if a child can do the test but it takes them 2 hours to do it then that isn't really passing the test is it? In the real world you couldn't take 2 hours could you? Language has to be much more rapid than some of the tests allow for and to me that isn't really passing the test if you get there in the end but you take a long time to do it.

Speaker 3: Yes and then you get some children on the autistic spectrum who positively enjoy doing tests and see it more as a fun puzzle task than as a proper language task, so I'm

never entirely convinced that the test is actually measuring their language ability because they seem to treat it more as a problem solving task.

Speaker 2: Yes, I would strongly agree and in fact the tendency of some children on the spectrum to come up with unusual answers can also mean that they don't always seem to pass the test as it has been designed, yet some of their answers are acceptable if a bit unconventional….and in fact this led to us developing our own version of the equivalent of Family Fortunes where the child would come up with the sort of answers that, say only 2% of the population would think of but which could be seen as correct if you think closely about it.

Researcher: So would you regard that type of answer as indicative of ASD and are there any reliable indicators you would look for in a child who has SLI?

Speaker 2: Well, personally, I think that just from talking to the child and observing how they interact with their family and other children you can get a feeling for what the problem is with the child and I think that is something you can only get through seeing lots of children and building up experience over many years.

Researcher: So, would you say there is such a thing as a "gut instinct" for whether a child has SLI?

Speaker 2: Yes, I think a "gut instinct" is just another way of saying that you make a judgement based on a long experience of a wide range of children who have presented with various language problems either receptive, expressive or both and you can generally tell in their whole communication style.

Speaker 4: But we would also listen to what parents say about how the child is at home or with other members of the family and take that into consideration alongside their performance on specific language tests such as the CELF sub-tests. So, yes we would be looking for grammatical errors which the CELF picks up but we would also want to think about the child's whole communication style, so do they seem as if they really want to communicate but can't get the words right or is it more a behavioural issue in that the child may not look as though talking to other people is something they are interested in. It's really important to look at the different behaviours in each child. It's difficult to pinpoint exactly but I would say it comes down to something like a "gut instinct".

Researcher: So, what would you notice in the use of language in children with SLI compared to a child with an ASD for example?

Speaker 2: Well, what I notice is the whole mismatch between something which a child with an ASD could do such as if you ask them what is 2 plus 2, they will tell you 4 but what they can't do is work out how much John will pay if he buys 2 sweets and they cost 2p each. It seems as though the embedding of the same thought process in a real life scenario gives them real problems and you can see it in their play and in the classroom, for example in maths where the question might be applied to a real life example which uses words to describe what is happening. I find this particularly noticeable and it's something which teachers report, for example when children are in the playground and the game might involve swapping or pretending to buy something.

Speaker 1: I would go along with that and I would also add that I see a big gap in the receptive and expressive language of SLI children, whereas you don't tend to get so much of a difference in the ASD children, for example in the children we get here, you can see they have problems understanding but they also have problems in some of the higher order language skills even though they might be quite good at basic language skills whereas with the SLI children you seem to get the understanding but it is always or nearly always their expressive language that causes the most problems. Having said that there can be wide variation amongst the children we see.

Speaker 1: Yes and I think as they go through this school the improvement we see in ASD children can be quite good on the whole but I would say, although some children with SLI really do make huge strides forward, they don't improve as much as the ASD children in terms of language use.

Researcher: Do you see any non-language difficulties which would be noticeable?

Speaker 3: Well…basic organisation is generally quite poor so children are very often forgetting to pick things up when they go home for the day so we have a very large collection of lost property or someone will forget that they were going to do sport after school and so they will forget to go to the sports pitch.

Researcher: Would you say their everyday memory is poor and this is what underlies the poor organisation?

Speaker 2: It obviously depends on the child but I would say that some of our children are quite good at remembering things as they get older, but, yes in the younger age group it can be a problem.

Researcher: Would the others agree?

Speaker 4: Yes, organisation in general is a problem for younger children but I do think forgetting things seems to be particularly common, certainly among the children I come across.

Researcher: So, if you could design a screening tool for SLI what would be the most important features you would want to see in it?
Speaker 2: Well, personally my main requirement would be that it should be short because we are facing increasing numbers of children who are presenting with language difficulties and it is really important that the assessment should be fairly short because also children get bored easily, especially with tests, apart from some of the children with ASD who actually seem to enjoy the testing procedure and want it to go on as long as possible, actually most children have quite a short attention span so it is asking a lot for them to sit through a long test which for them is boring. Having said that, the test need to pick up both verbal and nonverbal aspects of the child's profile.
Speaker 5: What I would suggest is that it should be something which can be used longitudinally across the whole age range so, a bit like with the National Curriculum you can say that at age 5 the child was at Level 1, but by age 7 they have gone up to Level 4 and so on through the age range because at the moment we have to deal with a mixture of tests which are not testing the same things at different ages, so the child can't really see any progress and neither can the parents.

Researcher: Would anyone else like to say anything?
Speaker 1: Yes, I think we need something that is reliable that doesn't require the therapist to make a lot of subjective judgements…very often these may be right, but it would be nice to have a single assessment which gives an overall picture of a child's language abilities, both their strengths and weaknesses, whereas we tend to concentrate on being selective in our choice of tests which we think are going to bring something to light. I feel that we never really pick up on the nonverbal side of things in the tests.
Speaker 5: I would just like to say that I think whatever is developed needs to be short but it also needs to be accurate and I'm not sure if it's possible but yes I think it would really help if we had a single assessment rather than having to come up with a mixture of different tests, but if it is to be a proper assessment it wouldn't necessarily be short would it? But no I do think there are bits missing in the tests which are available and we tend to rely on our instincts regarding things like nonverbal communication as well as taking into account the results of the tests.

Researcher: Would anyone else like to add anything? No? Ok well, perhaps if I can just summarise the discussion we have had this afternoon. You are currently using a variety of sub-tests from existing assessment tools to test the language difficulties which children present and this tends to be combined with your own judgement about the type of language problems the child is experiencing. You would say that the accumulated experience you have has enabled you to develop a "gut instinct" for detecting whether a child has SLI and you have pointed out some instances of how a child with SLI and how a child with ASD might differ. You have noticed problems in basic organisational skills amongst children with SLI and a tendency to forget things which they have to do, although this may vary from child to child. Any screening tool should ideally be short and have a longitudinal aspect to it, so that progress can be measured using the same assessment tool. It should be accurate as far as possible and should include elements which are currently left to the judgement of the assessor. Would you all agree that this is a fair summary?
All: Yes, that seems fine.

Researcher: Thank you for taking part in this Focus Group. The points you have mentioned have been extremely interesting and I will be very pleased to let you know the progress in my work in this area.

Focus Group C - Held 20th November 2014

Present: 1 Researcher and 7 Speech and Language Therapists

Researcher: Well, can I first of all thank you for coming to this Focus Group. As you are aware, the purpose of this focus group is to find out about your experience as front line speech and language therapists working with children with language difficulties. My research focuses on Specific Language Impairment, a language difficulty with which I am sure you are all familiar in your daily work and I would just like to put a few questions to you to try to find out the kinds of issues you experience on a practical level. Is that Ok? (general nodding). So, if I could start by asking how do children come to be referred to you?

Speaker 1: By the time they come to us, children generally have had various assessments done – it depends very much on the age of the child, sometimes they may have come to us quite late when they already have a track record of behavioural and/or language problems. To be referred to us it would have to be the case that it was primarily the language that was a problem but as it impacts on behaviour so much we see the two as being very much interlinked. So, I would say there can be a variety of ways that a child can come to us but it would generally be the case that an assessment of their difficulties has already taken place for them to be considered appropriate.

Speaker 2: Yes, I would agree, in fact because we cater for such a wide range of language issues from the very complex issues through to children who have a profile of medical and behavioural difficulties and children who are in need of help with sensory and motor co-ordination difficulties, we tend to see a number of different referral routes.

Researcher: What would be the ideal age for referral?

Speaker 3: Well, I think it's probably obvious but the earlier referral is made, the better it is for everyone, the family, the child and we can do more to assess and help the child. Of course, it depends at what age the problems start to show up in the child but I would say, generally a child of 3 or 4 who is not developing language as they should be, ought to be referred or perhaps children with some doubt over their language capabilities should be screened to raise important issues with the family about their language development. Very often, families hope that things will turn out OK and their child is just language delayed whereas it may be that the kind of deficits they are showing would point towards a deficit rather than a delay.

Speaker 4: I would agree, I think if you look back in the history of the kind of children who come to us at the age of 7 and later you would see that there were early signs of things not

being right and these were just never picked up on at the time by parents or by teachers, so yes, the earlier the better and definitely by the age of 4 or 5, so before the child starts school ideally.

Speaker 2: Parents tend to be overoptimistic or in denial.

Speaker 1: Yes, they are hoping that things will turn out OK, but that isn't always right.

Researcher: What do you think of current assessment procedures?

Speaker 5: Well, if I could jump in here as I have been involved in a lot of assessments both here and in my previous job. I think it relies very heavily on the skill of the SLT which is OK if you have a lot of experience and you feel you are aware of the kinds of problems that children can present with, but it always a matter of putting something together which you think is going to pick up on the kinds of problems which you think are there – you might have missed something because you haven't included a particular sub-test of the CELF for example, but, by and large, this is OK to get a language profile of the child overall. I still think it is a bit hit and miss – we obviously like to think we do a good job here but across the country you can't be sure that everyone is approaching things in the same way. We could do with some sort of "gold standard", in the same way that you would use a set procedure to diagnose autism – we have children with autism here and really all children should be treated with a gold standard procedure and it should not be that if you happen to have a language disorder you should have something less.

Speaker 6: Yes and in fact I would add that assessment should carry on throughout the child's school career, so to have something that could follow a child through from the earliest years up to when they move on it would help us to monitor progress in different areas of language such as grammar and pragmatics.

Speaker 3: Yes, in fact I still go back to the Canterbury and Thanet Test to help me assess the pragmatics of a child's language and this has been around years but I find it really useful.

Researcher: What is this? Could I have a copy of this?

Speaker 1: Yes, of course. It was basically designed by the SLTs in Canterbury and Thanet as a tool which they could use as they felt that the assessment tools available at that time were just not picking up on the pragmatics side.

Speaker 2: Yes, in fact quite a few of us still use it. They made it available generally and we still refer to it.

Researcher: Thanks, so would you say there are reliable indicators of Specific Language Impairment?

Speaker 2: It can vary from child to child but there are the obvious grammatical difficulties.
Speaker 5: Yes and I would say that once you have verified the grammatical problems e.g. getting verbs wrong or not using the correct word order, it is very typical of SLI children that they cannot deal with repeating longer words.
Speaker 6: Yes, so something like "crocodile" might give enormous difficulty and this also applies if you ask the child to repeat made up words like the name of a character in a story. This can give real problems too.

Researcher: So, is there a "gut instinct" for whether a child has Specific Language Impairment?
Speaker 7: If you mean by that, lots of experience which enables you to detect a child with SLI then, yes I would say there is a "gut instinct" but it's something that only comes with years of experience because that's what a "gut instinct" equates to in this type of assessment work.
Speaker 1: Sure, I would agree. I would say there is a "gut instinct" and it's something to do which you don't necessarily use just in an assessment situation, you would be looking for other indicators such as their general behaviour and a big gap between their verbal intelligence and their nonverbal intelligence because if there isn't that gap there then it's not SLI it's a general deficit which cuts across verbal and nonverbal abilities.

Researcher: Thanks. So what differences do you notice in the use of language in children with SLI and ASD?
Speaker 2: It depends largely on their behaviour I think because the ASD children don't see any point in using language or if they do as in for example when they have to in an assessment, they see it as a means to an end or some sort of puzzle or game which they are doing, so I would say it is largely in the intentional use, in the pragmatics.
Speaker 4: Yeah, but if you look at some of our ASD children, they have fantastic reading skills but if you do some work on what is in the story, they start to find it much more difficult, whereas you don't tend to get that with children with SLI.
Speaker 5: Having said that, it does vary according to the child and it is encouraging for us to see, for example how interventions and strategies can really change a child's understanding of language and how they express themselves. I find with SLI children there is usually no great problem with understanding so in most children their receptive language is OK but then, even though they have understood the story, they can't talk about it or make up a similar story of their own afterwards.

Researcher: Are there any non- language difficulties which you would notice in children with Specific Language Impairment?
Speaker 2: How do you mean? Do you mean nonverbal intelligence?

Researcher: Well, possibly or do you see any problems with everyday memory such as remembering to come and see you at a certain time?
Speaker 2: Oh, I see, well as we've just mentioned I think in Specific Language Impairment it should be noticeable that the problem is with the language specifically and that nonverbal language performance is age-appropriate. But, having said that, I would say that basic organisation is a problem for some of our children here. Not all, for example I do make arrangements to meet children at a certain place after school has finished for the day and I can be certain that they will remember but then there are others who do seem to have a problem with remembering tasks so we give them strategies that they can use to try to remember things, so, for example the older ones have a school diary that they write important things in and we encourage them to look in it regularly during the day. But, no I would say that the language problems do go together with memory problems in some of our children here.

Researcher: Thank you, so if you could design a screening tool for Specific Language Impairment what would be the most important features you would want to see in it?
Speaker 6: It needs to be short because we have a lot of children presenting with language difficulties now and it is just impossible to spend a long time on each individual child, so yes I would say concision is the most difficult thing but then it might be difficult for a short test to be very accurate since you won't be able to test every aspect of a child's language profile, so I'm not sure if it would work as a screening tool as such.
Speaker 4: Yes, but I think if it is a screening tool rather than a diagnostic tool, then you could administer the screening tool first and then follow up with a more formal diagnosis. It definitely needs to be short and I personally would like it to pick up on some of the things included in the Canterbury and Thanet test as that is the part that is lacking in some of the tests available and that is why we go back to the Canterbury and Thanet as it was developed to fill that gap.
Speaker 3: Yes and I would like to add that I would like something that could be used across different age groups a bit like the CELF which has a version for the early years and can then be extended into the later years and so have some continuity of assessment, a bit like in the National Curriculum where you move up the levels.

Speaker 2: I would agree and I think it would make life a lot better for SLTs if there could be a single instrument rather than having to pick out various sub-tests of other assessments – if there was just one thing that would be better.

Researcher: Would anyone else like to add anything?
Speaker 1: Yes, it should focus on the gap between verbal and nonverbal intelligence as that is what makes it specific to language.

Researcher: OK, thank you. Any other comments? No? OK , then, so if I could just summarise the discussion we have had this afternoon. You are receiving children into the school after they have had assessments done elsewhere but you do your own assessments based on your judgement of which sub-tests from existing assessment tools are appropriate. You feel there is such a thing as a "gut instinct" for picking up a child with SLI but this is something which develops over lots of years of experience. You have reliable indicators which you look for such as grammatical problems and difficulties with longer words and names and you would also look for a large discrepancy in the child's verbal and nonverbal IQ as this would indicate an impairment which is specific to language. A new screening tool should ideally be short and should pick up on the pragmatics element which is currently being covered by the Canterbury and Thanet test. It should also have a longitudinal, follow on aspect and may include references to everyday memory problems as this is a problem you have noticed in some children. You mentioned throughout our discussion the diverse nature of SLI and how the issues discussed may vary from child to child and from age to age. Would you consider this to be a fair summary?
All: Yes

Researcher: Thank you very much for taking part in this Focus Group. The points you have mentioned have been extremely interesting and I will be very pleased to let you know about the progress in my work in this area.