Assessing British Sign Language Development

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Declaration

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Abstract

Sign bilingualism is one of several approaches to the education of deaf children in the UK. Sign bilingualism seeks to introduce British Sign Language (BSL) to deaf children from an early age in order to establish a first language from which English, the majority language, can be acquired. However, there is little concensus on how deaf children's BSL development should be measured and no practical tools available to assist practitioners in this task. BSL assessments are needed to make baseline assessments, facilitate identification of language difficulties, indicate targets for remediation and evaluate the outcome of educational and therapy programmes for deaf children.

This study describes the development of an assessment of British Sign Language development. Issues relating to the type of test required and which aspects of BSL to include are raised. Selection of subjects upon whom to base test development and standardisation are discussed.

The BSL test of receptive grammar was initially piloted on 40 children from native signing backgrounds. Revisions were made to the test procedure and a number of unsuccessful items were eliminated prior to standardising the test on 135 children aged 3-13 years. Subjects were carefully selected from the wider population of deaf children as being those who were in optimal language learning contexts. Although this may be considered a small sample for standardising a test, it reflects a high proportion of the population of children who are developing BSL under ideal conditions.

Following publication of the test, analysis of data from its use with a larger unselected sample of deaf children allowed comparisons to be made with those in the standardisation study. The results provide insights into the conditions under which deaf children may acquire BSL naturally, even when BSL is not the home language. Areas explored by the study include the comparative language acquisition paths, as measured by the test, of deaf and hearing children from deaf families and deaf children from hearing families with diverse experiences of BSL input.

1

Assessing British Sign Language Development

1.1 Introduction

The difficulties experienced by deaf[1] children in the acquisition of spoken and written language are well documented (Conrad 1979, McAnally *et al.* 1994, Powers *et al.* 1998). Researchers have repeatedly noted that academic and linguistic under-achievement has far-reaching negative social and employment consequences. In spite of different communication approaches in deaf education and continuing improvements in hearing aid technology, the situation remains fundamentally unaltered.

However, deaf children of deaf parents where the home language is a sign language are known to develop their mother tongue in a parallel way to that of hearing children acquiring spoken languages). Similar findings have been reported for children developing BSL (Kyle & Woll 1989) and ASL (Kantor 1980, Newport & Meier 1985, Petitto 1988). These children are reported to achieve greater success on a number of measures, including mastery of written language, in comparison with deaf children from hearing families (Paul & Quigley 2000, Strong & Prinz 2000). Indeed, recent research suggests that native signers' performance in English as their second language parallels that of hearing children who had learned English as a second language at the same age (Mayberry & Lock 1998). Such research highlights the fact that the difficulty for the majority of deaf children is not with language development per se, but rather with the acquisition of spoken language to which a hearing impairment precludes access (Brennan 1999).

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[1] *'Deaf' is used here to mean any child with a hearing loss which impinges on the ability to access and develop spoken language. The term is often used interchangeably in the literature with the term 'hearing impaired'.*

Findings such as these emerged at a time when linguists began to explore the nature of sign language, in particular American Sign Language or ASL (Stokoe 1960, Klima & Bellugi 1979, Baker & Cokely 1980, Lane & Grosjean 1980). The revelation that ASL possessed its own grammar and rules comparable to those of other languages played a major part in elevating the status of sign languages. The cumulative effect of research into sign language and its development in children from deaf families prompted a move among educators towards a new approach for deaf children, namely bilingualism. Bilingual education seeks to establish a mother tongue in sign language for all deaf children, whether from deaf or hearing families, thereby providing a firm basis for subsequent learning which includes the acquisition of literacy and, where possible, spoken language (Kyle 1987, Johnson *et al.* 1989, Pickersgill & Gregory 1998).

Although well established in Sweden (Mahshie 1995), bilingualism is a relatively new approach in the UK and its implementation is not without difficulties (Pickersgill 1990b). Principal to these has been the shortage of qualified teaching staff with fluent sign language skills. A further complication is that 90% of deaf children have hearing parents with no prior experience of deafness. There is an urgent need for parents to achieve competency in a non-native language in order to develop their children's communication; however the extent to which non-native signing input from hearing parents is sufficient is not known. Increasingly, educational services are employing native signers to work with families as well as with children in schools to further develop children's sign language skills. It is as yet unknown whether or not such measures are effective.

An assessment of sign language would provide a yardstick against which to measure deaf children's sign language development. Such an assessment would allow us to evaluate the adequacy of bilingual programmes and the input they provide. Furthermore, it would enable us to credit the achievements of deaf children in an area of potential strength, rather than only looking at spoken language achievements, as is currently the case, which typically reflect areas of deficit.

An objective measure of sign language development would assist in informing decisions about appropriate educational placements for deaf children. Current legislation dictates that we must assess deaf children's strengths and needs at strategic points (Education Act 1993). The chief area known to present difficulty to deaf children, language development, is precisely the area which is currently the most difficult to assess. In practice, assessments are usually made of deaf children's achievements with spoken and written language, where a range of available measures may be used. However, the lack of either standard measures of sign language development or professionals who feel equipped to approach the task (Herman 1998a) means that information about this crucial area of ability is typically inadequate and may even be omitted altogether.

The need to assess and monitor deaf children's language development at increasingly younger ages is becoming an issue. The use of cochlear implants is now becoming more widespread among children under the age of two years. With the advent of universal neonatal hearing screening programmes (Institute of Hearing Research 2001), deafness will in future be identified in infancy. In the early stages of language development, and especially after cochlear implantation, deaf children may fluctuate in their choice of preferred language. A comprehensive language assessment should include all modes of language in order to reveal patterns of language dominance. Children who receive a cochlear implant may initially be BSL users; indeed, this is increasingly encouraged as early language acquisition is crucial for deaf children (Coerts *et al.* 1996). However, as speech perception develops post implantation, development of spoken language in preference or in addition to sign language is targeted. It is important that changes in communication are carefully observed as they will have implications for decisions concerning appropriate language input and educational placement.

We also need an assessment to identify children who have specific difficulties with language over and above those related to their hearing loss. The success of intensive care for pre-term babies has resulted in the survival of increasing numbers of children with multiple handicaps. Among these handicaps are deafness and language disorders; however the co-existence of these conditions is clinically notoriously difficult to determine. This is partly due to the complex range of factors impinging on a deaf child's language development and also because of the lack of any assessments suitable for the purpose. There remains a dearth of research in this area and limited acknowledgement that the problem exists. Gregory *et al.* (1995) interviewed a group of young deaf people about their experiences, using a range of communication options reflecting the participants' communication preferences. Of this group, 17% were individuals who could not take part because they had no usable communication, despite having received specialist education. The difficulties of this group suggest that deafness is not the sole issue affecting communication. Cases such as these arise in most practitioners' experience; however the diagnosis is often made retrospectively and with considerable uncertainty. A standardised, norm-referenced measure of sign language development would allow diagnostic decisions to be made with greater confidence. This would in turn lead to more accurate prognoses being provided and provide an argument for the provision of additional specialist intervention for these children.

Finally, an assessment of sign language development would be an invaluable adjunct for researchers in the field of deafness since it would further inform us on a key subject variable and allow comparison of sign language abilities with other areas of ability.

This study seeks to explore the area of sign language assessment in deaf children. The process of designing an assessment of BSL development is described and results of its use with different samples of deaf children are discussed. Theoretical and methodological questions raised include the following:

- to what extent can language assessment sample real communicative behaviour?
- what design issues need to be addressed when constructing a test of sign language?
- how can knowledge of spoken language assessment inform the assessment of sign language?

- what principles guide selection of aspects of BSL to be assessed?
- upon which sample of deaf children should test development and standardisation be based?
- what can use of a sign language assessment tool tell us about sign language development among children from the wider deaf population with different patterns of language exposure?

In order to address these questions, we initially provide some background on deafness and sign language, beginning below by describing the heterogeneous nature of deaf children, their experience of oral language acquisition, communication methods used in deaf education and the nature of sign languages. In Chapter 2 the focus shifts specifically to assessment. We discuss the design of language measures and consider literature relevant to language testing. Chapter 3 provides an account of methodological issues inherent in research on sign language acquisition and outlines stages in sign language development. The chapter ends with a review of current approaches to the assessment of sign language development.

Chapter 4 contains the research questions and their related hypotheses that this study intends to address. In Chapter 5 we present the research methodology and describe the early stages of the project where decisions about test materials and methods were made prior to the development of a pilot assessment procedure. Chapter 6 is an account of the aims, methods and findings of the pilot study and their impact on the next phase of the study, the standardisation phase, which is covered in detail in Chapter 7.

Collection of data from more widespread use of the test has allowed for further analysis of both the quantitative and qualitative performance of different sub-groups of deaf children. The contribution of this data to the investigation of test validity and the original rationale for selection of certain of the test items is discussed in Chapters 8 and 9. Chapter 10 concludes the study with an evaluation of its limitations and directions for future research.

1.2 The deaf child in a hearing world: contributory factors

Approximately 90% of deaf children are born into hearing families (Mallory *et al.* 1993). Almost all of these children will encounter communication difficulties in understanding and using their family's native spoken language because of impaired and often delayed access to speech as a result of their hearing loss. In the remainder of this chapter we firstly review the complex range of factors that impinge on a deaf child's success in spoken language acquisition. Although this inevitably invokes a medical approach to the auditory deficiencies of deaf children (which is diametrically opposed to socio-cultural accounts of deafness, e.g. Padden & Humphries 1988), it does provide an explanation for the observed difficulties in accessing speech which have repercussions throughout the developing linguistic system.

The degree and type of hearing loss experienced by a deaf child each have a bearing on the quantity and quality of speech which can be perceived, which in turn determine the extent to which spoken language can develop. The *degree of hearing loss* in any individual ear is categorised by the British Society of Audiology (1988) as normal, mild, moderate, severe or profound according to the deviation (in decibels) from normal hearing. *Type of loss* is classified according to the site of lesion. A problem in the outer or middle ear will lead to a conductive loss which is typically mild to moderate in degree and often of temporary duration. A problem in the inner ear leads to a sensory loss; damage to the auditory nerve results in a neural loss. These types of loss can be more severe than conductive losses, affecting the quality and intensity of signal perceived, and are permanent in nature.

The *cause of deafness* is often difficult to determine and, unless associated with other concomitant difficulties, may have less of a bearing on the prognosis for language development than the *age at onset of deafness.* Deafness that is present before birth, i.e. prenatally, may be due to heredity factors or maternal infection such as rubella. Perinatal deafness, which occurs at or shortly after birth, is more likely to be due to birth trauma. Postnatal deafness may develop at any later stage in the first few years of life and can be due to heredity, trauma or infection. The first months and years of life are known to be crucial for laying down the neural pathways necessary for auditory processing which form the basis of spoken language (Bamford & Saunders 1991). As a rule, the earlier the onset of deafness, the more severe will be the consequences for spoken language acquisition.

Although there are general trends associated with features of the hearing loss and subsequent success with the development of oral communication, no simple equation can be drawn between hearing impairment, disability and handicap in a deaf child. The extent of communication difficulties will vary due to a complex interaction between a range of factors relating to the hearing loss, factors specific to the child and family, and the presence of any additional difficulties. Consideration of all these factors forms the basis of professional predictions about oral success in deaf children (Geers & Moog 1987).

In considering *child specific factors*, Geers & Moog (1987) note individual differences between deaf children in their propensity for spoken communication. Whether a factor of ability or motivation, some children seem to be more inclined to communicate orally than others and this will influence their success.

The *family* plays a significant role in assisting the child's communicative development. The success of early intervention programmes is generally rooted in early and appropriate family involvement with the child and pre-school provision (Bench 1992). Where families are committed to supporting their deaf child and making use of the available services, there are generally positive effects on children's early reading skills and socio-emotional adjustment. The quality and quantity of language provided in the early years have been found to be among the strongest predictors for deaf children's progress in language development (Calderon 2000).

The presence of *additional difficulties* such as a cognitive deficit will militate against a deaf child's progress with language acquisition. Many hearing children with generalised learning disabilities or specific neurological damage are known to experience problems with language development. When difficulties are combined, the effects are compounded. The value of sign as an alternative or augmentative communication system with such groups has been documented (von Tetzchner & Jensen 1996).

1.3 Spoken language achievements of deaf children

There is a large body of literature documenting the language development of deaf children (see Bench 1992, Powers *et al.* 1998 and Quigley & Paul 2000 for recent reviews of this literature). Most of this research reports on language development among deaf children from hearing families and focuses largely on spoken language ability, sometimes assessed in the written form (Powers *et al* 1998). Studies of sign language acquisition have almost exclusively looked at children in deaf families, whose development is reviewed in detail in Chapter 3. The remainder of this section seeks to summarise the oral language achievements of deaf children in hearing families.

Although exceptions are often cited, there is general agreement that, as hearing losses become more severe, problems with oral language acquisition become more marked, although a high degree of variability is known to exist among deaf children. A hearing impairment interferes with the initial stage of language processing, that of speech perception. The nature of the loss will affect which aspects of the acoustic signal are undetected or distorted. Typically, a sensori-neural loss affects perception of the intensity and frequency of the signal. The quieter sounds of speech (typically the consonants) and particularly those in the high frequency range (e.g. /s/, /t/, /p/) are the most difficult to perceive, relative to other more robust aspects of the spoken message. The result is reduced intelligibility of language input (Markides 1983), with consequences for subsequent language processing.

One consequence of increasing difficulty with auditory speech perception is a shift in emphasis from an auditory to a visual language processing bias (Campbell *et al.* 1998). As a consequence, many aspects of spoken language can only be accessed visually via speech-reading. Although popular belief holds that deaf people are all excellent speech readers, the reality is quite different. Much of speech is invisible on the lips (Erber 1974a) and despite increased reliance on speech-reading, when compared with hearing people, levels of speech-reading ability among deaf people are in fact reduced (Dodd 1980a, De Filippo 1984). Some deaf people do have excellent speech-reading skills; however they tend to be in the minority, representing cases where deafness was of late onset. In these cases, language acquisition has been largely established and use of speech-reading proves to be a relatively efficient method of maintaining oral communication.

However, as a method of developing spoken communication, speech-reading is less than adequate. As mentioned above, much of speech is impossible to perceive visually. In addition, speech-reading is easier when contextual cues are available. For the young child developing language, working out the linguistic context presents a particular challenge and is related to the problem of joint reference. Joint reference is the process whereby child and adult share a focus of interest, generally child-led, about which communication takes place. Research on interaction between deaf children and their hearing parents has reported difficulties in establishing joint reference (Wood 1981, Gallaway & Woll 1994). In the deaf child-hearing parent dyad, a conflict arises in the need of both conversational partners to visually locate the referent and the deaf child's need to visually access speech. Hearing parents tend to talk whilst looking at the referent, often failing to realise the deaf child's difficulties with access. As a result, the deaf child misses many communication opportunities and may be unaware that the parent is talking. Alternatively, communication is intercepted midstream and may not be perceived by the child as relating to the previously viewed referent.

Incomplete access to the full speech signal, either auditorily or visually, impacts on phonological coding. Phonological coding is a linguistic rather than an auditory process, retaining linguistically salient detail at the expense of other aspects of the signal (Bishop 1997). Phonological representations are normally relayed to the mental lexicon, linking sound patterns with meaning. From the developmental viewpoint, such links must be established to create the reserves for later processing and for links to be made with other stages of representation in order to understand and produce spoken language. In addition, phonological coding is vital to the development of literacy.

Impaired processing affects perception of the speech of others and of one's own speech. Thus the profile of language development in deaf children involves deficits in speech perception and production. The impact of reduced and degraded input has consequences for lexical and syntactic development. In turn, there are repercussions for the success of communication exchanges and the development of age appropriate pragmatic skills (Jeanes *et al.* 2000). Although research has suggested deaf children demonstrate the same range of communicative intent as hearing children, conversational strategies are generally limited and less successful, regardless of communication method. Jeanes *et al.* suggest that this may partly be explained by an impoverished communication experience but also because of the strategies adopted by hearing people trying to facilitate communication, which effectively reduce the deaf child's opportunities to develop their conversational skills.

1.4 Communication approaches

Due to variations in the range of factors outlined above, deaf children must be viewed as a highly heterogeneous group. This heterogeneity is reflected in patterns of language development and educational achievement. Nevertheless, the history of deaf education can be viewed as an attempt to apply one or other educational approach to the education of *all* deaf children (see Lynas 1994 for an overview).

Following the Conference of Milan in 1880 and the advent of the first hearing aids in the early part of the 20th century came a move to educate all deaf children orally. *Oralists* were determined in their use of speech alone, in either structured or naturalistic approaches, to develop spoken language. In an extensive study of the achievements of deaf children, Conrad (1979) revealed alarmingly low levels of literacy and unintelligible spoken communication among significant proportions of British school-leavers. Studies in other countries have replicated this finding (see Powers *et al.* 1998 for a review). This prompted many disillusioned oralists to move towards using multi-modal input to facilitate language development, termed 'Simultaneous Communication' or 'Total Communication' (TC). In 1980 in the UK, 40% of deaf children were attending schools and units where a TC approach was used (Jordan 1986); by 1989, this number had increased to 69% (Child 1991).

The philosophy of *Total Communication* invokes use of all available channels of communication such as gesture, signing, lipreading and the written word to achieve spoken language. Criticised by many as a 'shotgun approach', which is difficult to evaluate, in practice most TC programmes in the UK use BSL signs to accompany spoken English grammar and word order. A term used in the literature to refer to bimodal presentation of English is Manually Coded English (MCE). Different systems used in the UK under this title vary from Signed English (SE) to Sign Supported English (SSE). SE is a communication system comprising lexical signs borrowed from BSL combined with invented signs used for function words and morphological inflections. SE seeks to present a full grammatical version of English through the oral/aural and visual channels. SSE uses key lexical signs alongside spoken English sentences; thus only a portion of the message is conveyed manually.

Several researchers have criticised MCE from a theoretical viewpoint in that presentation of simultaneous information in two modalities leads to a cognitive overload both for recipients (Goetzinger 1978) and users of the system (Marmor & Petitto 1979). Such claims were upheld by research investigating the communication of teachers who were skilled MCE users. Studies documented the lack of precise relationship which existed between the spoken and signed counterparts of teachers' MCE output and noted significant gaps in the linguistic structure of language presented to deaf children (Wood & Wood 1992a, Johnson *et al.* 1989).

Although signing combined with spoken language is often used by deaf adults to facilitate their communication with hearing people, the value of MCE in developing language among deaf children remains in dispute. Research on the comparative outcomes of oral and TC programmes which use MCE (Geers *et al.* 1984, Delaney *et al.* 1984, Harris & Beech 1992) has indicated no advantage for TC over oral approaches in the acquisition of English. However, research by Supalla (1991) suggests that the problem may be that deaf children do not process MCE input as English. He found that deaf children exposed to MCE adapted the input they received "into a system more appropriate for the visual/gestural modality" (Supalla 1991:109) creating sign language-like structures even when they were absent from the input. Thus, although the aim of TC programmes is to develop English skills, many deaf children process the linguistic material they can most readily access (the signs) and produce output that approximates sign language. This does not mean that MCE has no place in deaf education, indeed Mayer & Akamatsu (1999) suggest it may have an important role to play in bridging the gap between sign language and the teaching of literacy.

As we have suggested to at the start of this chapter, disappointment with the results of TC programmes in the wake of oralism coincided with a number of significant developments in related fields. Research findings on the structure and acquisition of sign language were emerging alongside studies reporting better achievements among deaf children in deaf families (Stuckless & Birch 1966, Meadow 1968). At the same time, the Deaf Community began to demand rights as a minority linguistic group and for sign language to be used in deaf education (Johnson *et al.* 1989). Thus began the move towards bilingual education for deaf children.

Bilingual programmes propose that sign language should be offered to all deaf children as it is a fully accessible language, developed naturally by deaf people (Pickersgill & Gregory 1998). As natural languages, sign languages maximise the opportunities inherent in the visuo-spatial modality. Use of simultaneous processing to counter the time constraints of sign production (Klima & Bellugi 1979) overcomes many of the flaws of MCE which tried to depict an auditory-oral temporal-sequential language in the visual mode.

Bilingual programmes seek to introduce all deaf children to sign language from the moment their deafness is identified with the aim of developing this as a fluent mother tongue. Thereafter, acquisition of the majority language may develop more readily, as is evidenced by children who are fluent in two spoken languages (Baker 1996). The place of spoken English in bilingual programmes and whether written English is the form through which deaf children access the majority language continue to be debated and may vary for individual children. Pickersgill & Gregory (1998) suggest that, although opportunities must be provided for both English and BSL to be acquired early, children may demonstrate a preference for one or other language and it is competency in the child's preferred language that is the primary aim.

A key difficulty facing bilingual educators is the fact that most families are hearing with no prior experience of deafness and no familiarity with sign language. Exposure to sign language must therefore be achieved via signers with near-native fluency who visit families at home and teach the whole family sign language and deaf interaction patterns (Sutherland 1993). Later sign language exposure is provided in the nursery or school setting (Knight 1996). However, a difficulty faced by the deaf child is the highly variable nature of input provided, depending on the fluency of those in the home and school environment. Acquisition of a mother tongue under these circumstances is different from the normal experience where the child learns the language of the home directly from immediate family members who are fluent in that language. It is clearly important to have some way of monitoring the success of language acquisition in such programmes and this is one of the issues that the present study attempts to address.

1.5 Sign language

Sign languages have developed wherever groups of deaf people have come together and are as different from each other as are spoken languages; indeed regional variation in signs from the same sign language may be apparent in the same way that spoken languages differ in dialect. Viewed in the past as crude, gesture based systems with no grammar, linguists have now shown sign languages to possess an equivalent structure and the same range of communicative functions as spoken languages (Klima & Bellugi 1979, Marschark 1993). A striking difference is the visuo-gestural modality in which sign languages operate.

Spoken languages are made up of sounds originating in the vocal tract that are combined into increasingly larger units as syllables and words. These, in turn, are ordered sequentially in time and are perceived as complex transient auditory signals. In comparison, sign languages are visuo-gestural systems involving handshapes and movements, facial expressions, head movements and body stance. Arrangements and locations of the hands in space are modified simultaneously by movements of the upper body and face, many of which have a grammatical role, unlike the incidental gestures that accompany spoken language.

To the naïve observer, a sign language may appear to be related to the local spoken language. Although occasional use is made of spoken lip-patterns to disambiguate otherwise similar signs, sign languages such as BSL generally use the mouth for different purposes, e.g. to provide information about manner. What the naïve observer has probably noted are the modifications made by fluent signers when communicating with non-fluent signers in order to facilitate understanding. These include producing signs in English word order and mouthing English words simultaneously with signs. Nevertheless, there are both individual and regional variations in the use of spoken lip-patterns to accompany signs (Sutton-Spence & Day 2001).

Because of the nature of representation, many signs base their form on the visual appearance of referents. An example from BSL is the sign BALL[2] which is articulated by both hands tracing the shape of a ball. Thus many signs resemble aspects of the visual world to a greater degree than words, a feature referred to as *iconicity*.

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[2]Capital letters are used to provide an English gloss for the meaning of a sign. Where more than one English word is needed to translate the meaning of a sign, words are linked with hyphens, e.g. DOG-EAT.

However, individual sign languages select different features of objects on which to base signs. For example, the sign for TREE in BSL is a one-handed sign based on a representation of the trunk and spread branches of a tree typically found in the UK. In some Asian sign languages, the equivalent sign is produced with two hands and focuses solely on the shape of the trunk (Klima & Bellugi 1979). Thus, each of these signs reflects different features of trees, yet each is incomprehensible unless something is known of the context in which the language developed and of the history of the language. Pizzuto & Volterra (2000) have shown that recognition of any relationship between form and meaning may also depend on the wider culture in which the sign language is cited. Additionally, although a relationship between form and meaning may exist for some signs, many others are completely abstract, rendering comprehension of a sign language by non-signers virtually impossible.

A feature intrinsic to sign languages is the use of space. For example, in referring to the arrangement of furniture in a room, it is possible to map out a representation of the room in space and then locate different objects within it, maintaining the real world relationships of the objects in the room and to each other. A further use of space is exploited by verbs of motion (Sutton-Spence & Woll 1999). Persons or objects may be represented as moving towards and away from pre-specified locations in space; the type or rate of movement depicted provides further linguistic information relating to manner or aspect.

1.6 Summary

This chapter has introduced the context of the present study and provided a rationale for the development of an assessment of BSL development. We have outlined some of the key issues relating to deaf children and their difficulties in acquiring spoken language and considered alternative approaches to communication currently in use in the UK. Finally, we have attempted to give an introduction to the nature of sign language, to which we return in Chapter 3.

2

Issues in Language Testing

This chapter considers the theory of assessment and its application to different methods used to measure language development in general and sign language in particular. We consider the psychometric properties that are central to test design and evaluate current language testing approaches. Finally, we discuss variables that the subject brings to the test situation and variables related to the test, the tester and the test environment.

2.1 Theory of assessment

An assessment is a measurement of some specified dimension – in the present study we are concerned with the assessment of linguistic behaviour – for a particular purpose. The concept of testing in classical test theory assumes that people have specific amounts of underlying or latent traits. Certain traits are directly measurable, but measurement is always imprecise because of the variables involved. Bartram (1990), considering the measurement of height, states the need to define precisely what is being measured, for example are we talking about height with or without shoes, and from what point near the feet to what point near the top of the head? How we make the measurement, i.e. what units are counted, the accuracy of the measurement instrument, under what conditions etc., must also be stipulated. Even a relatively simple dimension such as human height is known to vary at different times of the day.

When we consider a trait as complex as language and the range of situations in which it may be assessed, the difficulties of achieving an accurate measure are multiplied. Measurement must necessarily be based upon a limited sample owing to the impossibility of measuring all of human communicative behaviour.

Assessment generally involves fractionating the process in order to evaluate the different components, e.g. syntax, semantics, pragmatics, etc. Although a useful exercise, it must be remembered that separating out the components necessarily distorts the picture. The skills of the experienced tester lie in selecting the components to evaluate and the appropriate methods to use but also in reintegrating the information obtained into a picture of the whole multidimensional communication process. Although much of the following discussion focuses on methods of assessment, the central part in the assessment process played by the skilled assessor should not be forgotten.

2.2 Purpose of assessing language

Assessments are designed to provide answers to specific questions, here, related to a child's language abilities. The type of assessment may be determined by the ultimate goal of the assessment process. Baker (1996), considering assessment in an educational context, distinguishes summative from formative assessments. A *summative* assessment measures the language proficiency of a person, for example, a test of a child's ability to understand or use language in comparison with his or her peers. A *formative* assessment is a test, such as a profile of ability, which gives feedback during learning and may aid further learning.

Teachers are most likely to adopt curriculum based assessments e.g. looking at the language demands of the curriculum and setting assessment targets based on these. This is an important consideration in measuring progress for an individual child and allows comparison of deaf children with their hearing peers in the majority (spoken) language; however, it fails to take account of language development in BSL and norms of BSL development. This may be particularly an issue with deaf children whose delayed language development prevents access to the language of the curriculum.

Emerick & Haynes (1986) consider the relative contributions of different types of assessment to the assessment process. They identify the most basic question in language assessment as relating to whether or not a problem with language exists, for which a norm-referenced measure of language proficiency is best suited. Once it has been determined that a problem exists, there is a need to explore the nature of the problem in greater detail, and here formative assessments may be most useful (*ibid*).

Wiig & Semel (1984) expand the assessment process to include the ongoing evaluation that is part of intervention. They identify the following five stages in language assessment which relate to the aims of the language specialist:

1. Screening for initial identification of children "at risk".
2. Diagnosis to assess language and communication strengths and weaknesses.
3. Extension testing for in-depth assessment of specific areas to assist in programming intervention.
4. Ongoing assessment to determine the need for programming changes and suggest future intervention objectives.
5. Assessment of progress.

It is the first two stages that are of primary concern in the context of the present study. Screening tests are formal assessments designed to be used with large numbers of children for the purpose of identifying those children with difficulties. Screening assessments may be used with all children at certain key stages in development, e.g. developmental screens carried out by health visitors (Law 1992), or only with children felt to be at risk of having difficulties with language. For example, in certain areas of the UK, all children attending day nursery provision are screened by speech and language therapists; in other areas, only children with peri- or post-natal complications who constitute an 'at risk' group for the development of communication difficulties may be screened.

Screening assessments compare a child's overall performance on a set of stimuli with other children of the same age who are assumed to follow normal developmental language patterns. Key considerations in developing a screening measure are *sensitivity* and *specificity*, i.e. that children developing language normally will pass the screen and that only those with difficulties will be identified.

In order to be practicable for use on a large scale, screening tests are generally brief and contain relatively few items. One immediate disadvantage is that a screening test cannot give a detailed picture of an individual child's strengths and needs in particular areas. Once the presence of a child's difficulties are identified on a screen, more in depth testing is required, termed diagnostic testing. Wiig & Semel (1984) outline three approaches to assessment at this stage, relating to test designers' underlying theories of language development and disorder. These are: process or ability approaches, task analysis and interactive-interpersonal approaches.

The first of these approaches looks at the *processes or abilities* underlying language in order to explain language difficulties. Memory, discrimination abilities, psycholinguistic abilities, play, etc. may all be assessed. Tests that adopt this approach include the Illinois Test of Psycholinguistic Abilities (Kirk *et al.* 1982), the Auditory Discrimination and Attention Test (Morgan-Barry 1988) and the Test of Pretend Play (Lewis & Boucher 1997).

In *task analysis approaches* to diagnostic testing, particular areas (or modules) of language, i.e. phonology, morphology, semantics, syntax, pragmatics, are the focus and it is the complexity of language that the child can handle, receptively or expressively, within each domain which is investigated. Tests that look at specific linguistic domains in this way include the South Tyneside Assessment of Syntactic Skills (Armstrong & Ainley 1989) and the Test for the Reception of Grammar (Bishop 1989a). Where such analytical tests are used, it is important to look for possible interactions between results obtained in different linguistic areas, thereby re-integrating the perspective on the child's communication system (Yoshinaga-Itano 1997).

Interactive-interpersonal approaches describe the child's ability to communicate in context in relation to the pragmatic functions of language, e.g. controlling, informing, imagining, etc. Typically, assessments of this type tend to be non-standardised, e.g. the Pragmatics Profile (Dewart & Summers 1995) and Lund & Duchan's (1993) approach to naturalistic assessment; however, structured interviews, role plays and story-telling offer opportunities to examine these forms of communication in more rigorous ways.

Following diagnostic testing, more informal 'extension testing' seeks to determine "the variables that seem to be primary contributors to the child's errors" (Wiig & Semel 1984) with a view to planning intervention programmes. Once intervention commences, the assessment procedure continues in that the child's response to intervention is constantly monitored and the programme amended accordingly. Finally, assessments may be used after a period of intervention to review progress or, following a period of time without intervention, to monitor spontaneous change.

2.3 Methods of assessment

Although more descriptive, child specific, forms of assessment have their place, our initial purpose in assessment in the present study is the measurement of deaf children's proficiency in sign language acquisition, for which a standardised instrument is most appropriate.

A *standardised assessment* is typically a statistically based test that samples selected behaviours under specified (and often unnatural) conditions. Bartram highlights their importance in providing "an objective source of data, unbiased by subjective feelings" (1990:3). The purpose of standardising a test is to set up norms whereby an individual subject's score can be compared with that of the appropriate standardisation population (Kline 2000). In test standardisation, consideration of the size and representativeness of the sample is crucial. Although ideally in psychological testing a sample size of several hundred is required, when testing special populations this is rarely achievable. However, what is important is that the size of the sample represents a significant proportion of the total population. This is an issue of relevance to the current study as the population of children acquiring BSL is in itself a small one. It is therefore important to take as large a sample as possible from this population. However, problems with small sample sizes include increased likelihood of error.

Statistically based tests may be norm referenced or criterion referenced. *Norm referenced tests* "provide information about where an individual lies on a particular ability or attainment in comparison with peers of the same age" (Dockrell & Henry 1993). Such tests define a continuum or performance from lowest to highest and the score obtained by an individual locates their position on that continuum by rank or standardised score. Results from standardised assessments can readily be compared with results on other measures. Emerick & Haynes (1986) comment that 'this type of testing emphasizes group similarity and minimizes individual variability'. As such, they are of value in identifying the existence of a problem, but may be limited in the information they can provide about an individual's strengths and weaknesses and what steps may be taken to remediate any deficits.

Criterion referenced tests "help identify whether an individual does or does not possess some particular skill or competence" (Dockrell & Henry 1993). The quality of a criterion referenced test depends on the extent to which item content reflects the domain from which the items were derived and the developmental progression. The value of such tests is in the detail they provide and the direct links that can be made with intervention.

The administration and scoring of statistically based tests is standardised and results yield in the main quantitative information about a child's performance in comparison with their peer group. Results of formal assessments are only directly applicable to individuals who meet the same criteria as those on whom the assessment has been standardised. However, in practice, standardised tests are frequently used with groups that differ substantially from the reference group, e.g. children with learning difficulties or language disorders. In such cases, extreme caution must be used in interpreting test results.

2.4 Psychometric properties of tests

The psychometric properties of tests are important in informing us about the known qualities of the assessment tool in terms of its validity and reliability. Each of these is now discussed, along with their relevance to the development of a test of BSL development.

2.4.1 Reliability

The reliability of a test is that property which ensures that use of the measure, assuming that this occurs under carefully specified conditions, will always yield the same results. There are several ways of assessing reliability: test-retest reliability, scorer reliability and measures of internal consistency.

Test-retest reliability involves administering a test to the same group of subjects on separate occasions after a specified time interval. Scores on each testing are then correlated. Among the factors that influence test-retest reliability are factors specific to subjects (e.g. mood, physical ailments, fatigue) and those that are characteristic of the test (e.g. poor test instructions, scoring and guessing), which should be monitored and limited where possible. In repeating any test, mean scores are likely to be elevated due to practice effects and in children, maturation effects. However, the elevation in mean scores should be constant across subjects rather than varying unpredictably, therefore not affecting the reliability calculation. If the test is reliable, subject scores should maintain the same distance from each other and yield a perfect correlation of 1.0. Invariably this is difficult to achieve and a reliability coefficient approaching 0.9 is deemed acceptable, with 0.8 generally agreed as a minimum figure (Kline 2000:9).

Opportunities for error to be introduced into testing can arise when scoring correct responses as incorrect or vice versa, or in calculating the number of correct responses. When the tester is scoring at the same time as administering the test, the demands of the situation may lead to errors being made. It is essential that the scoring method adopted is straightforward to use and clearly explained to testers to maintain scorer reliability. Scorer reliability is measured in two ways: *inter-scorer reliability* involves two judges scoring the data independently and correlating their scores; *intra-scorer reliability* requires the same assessor to score the data on two separate occasions.

The *internal consistency* of a test is a measure of the degree to which individual test items are correlated with the score on the test as a whole. This can be performed by an item analysis procedure used to compute the alpha coefficient. Alternatively, a split-half analysis can be used where items are paired and separate test scores are obtained for odd and even-numbered items (Beech & Harding 1990).

2.4.2 Validity

The validity of a test is concerned with whether it is in fact measuring what it is supposed to measure. As with reliability, there are several types of validity to consider: face validity, content validity, criterion-related validity and construct validity.

Face validity refers to the subjective judgement of whether or not the test appears to be measuring what it is meant to. This may be assessed from the title of the test and a review of the test items.

Content validity "concerns whether a test samples from the entire domain of that which is to be measured" (Powell 1989:38). Clearly when assessing something as complex as language it is important to look at a range of language behaviours rather than focusing on an isolated feature. However, in practice, it is rarely possible to assess every aspect of language and decisions must be made and justified.

Criterion-related validity establishes the way in which a test relates to an independent measure of a similar task that is already known to be valid. In looking at tests of spoken language, one would correlate scores of tests that set out to measure the same linguistic domain. When the independent measure is carried out at the same time as the original assessment, the measure is of *concurrent validity*. When the independent measure is carried out later, a measure of *predictive validity* is obtained which indicates the extent to which the assessment predicts performance on the future measure, for example whether an assessment of language is an accurate predictor of later literacy level.

When developing an assessment of BSL development, a difficulty arises in establishing criterion-related validity as there are no other language measures of BSL available which would enable correlation of test scores. Following release of the test for widespread use, data returned included (for a small sample of children) reading test scores as well as BSL test scores and tester ratings of children's BSL skills (Chapter 8.3.5). These data were used as a preliminary measure of the concurrent validity of the BSL test.

Construct validity "is concerned with the psychological meaning of test scores" (Powell 1989:39), i.e. the degree to which the assessment measures the theoretical construct it is intended to measure. This may be measured in a number of ways, such as expert judgement that the content of the test is relevant to the construct; a demonstration of the consistency of test items (where a test may be broken down into unrelated groups of items, it would appear to be testing several constructs rather than one); high correlations with other measures; studies of group differences and prediction of task performance. To investigate the construct validity of the BSL assessment during the test development phase, parent and teacher questionnaires and tester rating scales were developed to gain independent ratings of the subjects' BSL skills. The questionnaires asked parents and teachers to estimate children's understanding of a range of structures in BSL corresponding to the test items, yielding a score which could be correlated with BSL scores. The rating scales required testers (teachers and therapists) to provide subjective ratings of children's BSL abilities; test scores could then be analysed to investigate distribution of scores according to the rating adopted. Analysis of scores obtained by groups of children, distinguished by exposure to

BSL were also performed during the standardisation phase and also later when new data were collected following release of the test.

2.5 Testing expressive language

We now move on to looking in greater detail at methods of assessing different aspects of language in order to determine the type of assessment to develop. Assessment of language abilities frequently involves analysing a sample of expressive language. The validity of the sample is highly dependent upon the circumstances in which it is collected and whether it was spontaneous or elicited. A *spontaneous sample* initially presents as the most attractive option in that it purports to sample naturalistic behaviour. However, truly naturalistic behaviour is elusive to language testers and parents alike; it is notoriously difficult to predict children's responses due to a range of influencing factors. This has been reported for spoken (McCartney 1993) and sign languages (Kyle 1990a). Furthermore, guidelines for the collection and transcription of sign language have only recently been agreed (see Baker *et al.* 1999 for details).

The *environment* in which the sample is collected, whether or not the subject was at ease, and the presence and familiarity of other participants can affect the naturalness of sample. There has been some research into differences between language samples collected in different environments. Kramer *et al.* (1979) compared hearing children's language samples collected in the home and in a clinical setting and found that longer utterances were obtained in the home environment. Scott & Taylor (1978) noted the robustness of language forms, such as the variety of language structures used, between samples collected in two settings.

Deaf children are regularly exposed to a variety of language input, ranging from natural sign languages to sign systems influenced by spoken languages. The environment can be particularly significant if it is viewed largely as the domain of one or other type of language input. Erting (1988) considered an observation setting that was overtly associated with the use of an English based system of signing inappropriate for the collection of sign language samples.

The *characteristics of other participants* can be influential, depending on the subject's familiarity with them and the type of behaviour exhibited by them. Olswang & Carpenter (1978) compared language samples taken by experienced language specialists with samples taken by mothers of hearing language-impaired children. Although mothers elicited more language, the quality of language elicited by both groups was found to be similar. More recently, Bornstein *et al.* (2000) found many similarities between samples collected in diverse settings; however they reported differences according to the person to whom the child was communicating. Bornstein *et al.* suggest that the effects may be selective for specific characteristics of language, for example, Mean Length of Utterance (MLU) was relatively stable, whereas use of different English word roots proved variable.

Research on deaf children has revealed differences dependent upon the hearing status of their interlocutors. Erting (1988) investigated the communication skills of a deaf adult and a hearing teacher and their impact on the communication of three deaf children. Misunderstandings were noted to occur because of the hearing teacher's signing skills and this resulted in the children being less communicative with her, using shorter, simpler utterances.

In many circumstances, especially with very young children or bilingual children, it is preferable to obtain samples of the child interacting with family members or peers. Although it is generally reported that adults modify their communication to young children in systematic ways, the existence of individual differences as well as cultural differences is recognised (Lieven 1994). Diverse patterns exhibited between mothers, fathers and siblings (Barton & Tomasello 1994) have also been identified. Whether such differences are child or adult driven remains unclear, moreover the extent to which this influences the type of responses made by children in the long term is controversial (Pine 1994). For normally developing children, the robustness of the language acquisition process seems to militate against small differences in input. However, for children who are vulnerable to difficulties with language development, such differences may be more crucial (Snow 1994).

It must also be borne in mind that the artificiality of the test situation can affect participants' short-term behaviour, inhibiting the communication of some while others adopt verbose or interrogating styles. Such changes have been shown to produce direct effects on the quality and quantity of communication produced by children. For example, Haynes & Hood (1978), in a modelling task, showed that hearing children were able to use language of similar complexity to an adult, whether the model used extremely simple or highly complex sentences. Research has shown deaf children to be similarly responsive to the style of adult interaction (Wood *et al.* 1986). Deaf children were found to use more complex structures in direct relation to the complexity of language input of teachers. Child contributions were noted to increase when interlocutors reduced their conversational control by adopting a less questioning style of behaviour (*ibid*).

The *type of activities* in which children are involved may also affect the quality and quantity of language collected. Research on deaf children indicates that a free play activity will yield different responses and interactions when compared with more structured activities (Brackett & Henniges 1994, Cooper 1995). Minnett *et al.* (1994), reporting on communication between deaf and hearing peers, noted that this was most likely to occur during outdoor play using large equipment. This may be because games arising from such activities are more physical and require less language mediation or communicative accuracy to be successful.

Jansma (1994) evaluated the effectiveness of three different tasks in producing morphosyntactically rich samples of children's BSL. Children were asked to either retell a story after seeing a deaf adult tell it in BSL, retell a cartoon story after viewing it or describe a story told in a picture. Her results indicated that of the three tasks, the picture description task was least effective in producing verb modifications. Many of the target verbs were not elicited at all or were produced in unmodified forms. In addition, when retelling the story, children referred directly to the picture, incorporating reference points to parts of it in their narrative, rather than setting up locations in space, an important part of BSL grammar. This was first described in children using ASL by Galvan (1989). Of the remaining tasks, the cartoon task provided most opportunities to apply grammatical mechanisms in BSL. Jansma suggests that it was the story content rather than the elicitation method itself that was significant. These results suggest that materials and methods used to elicit samples of BSL need to be carefully selected in order to produce a representative sample. Picture description tasks may have a place for language elicitation with hearing children, although even here, very young hearing children have been observed to use less adequate referring expressions because they presuppose shared knowledge of information (Schneider & Dube 1997); however, their use with deaf children may be of less value because of the distorted view of a signing child's use of spatial grammar which is produced.

A critical question relates to the size of sample needed in order to obtain a sufficient range of desired behaviours. Crystal (1982) states that it is impossible to generalise about this, suggesting simply that sampling continues until a pattern emerges in the data. It seems reasonable to assume that the more data which is collected, the more likely it is to exhibit a full range of forms and functions; however, in any truly spontaneous sample it is difficult to predict what behaviours will and will not occur. The lack of a particular syntactic structure cannot merely be attributed to the child's lack of proficiency as it may simply reflect a weakness in the sample. Thus, there are dangers in that the sample may underestimate the child's true abilities.

An *elicited sample* can usefully supplement a spontaneous sample by targeting structures that did not emerge spontaneously; however used alone, elicited tasks may fail to capture naturalistic interactions. Elicited tests of spoken language such as the Bus Story (Renfrew 1997) or South Tyneside Assessment of Syntactic Structures (Armstrong & Ainley 1989) typically involve more limited sampling and a rudimentary analysis, providing less detail on the individual child or information on specific areas only, such as syntax. Further problems with elicited samples may be related to the materials used and the apparent reality of the communication situation to the child. Children will elaborate about pictures, objects and events that are not present to a greater degree than if they share visual access to the stimuli with their conversational partner (Strandberg & Griffith 1969, Longhurst & Grubb 1974, Haynes *et al.* 1979).

A further variable relates to how the data was recorded, by whom, and the extent to which the *recording method* impinged on the naturalness of the sample. An observer present in the situation and an observer-participant both benefit from seeing situations unfold from several angles. However, the observer is unlikely to capture much of the detail of the interaction as this is too onerous and unreliable a task. More selective observation and coding such as momentary time sampling approaches overcome the unreliability, but restrict what can be observed at any one time. Diary methods allow observers such as parents to record at intervals in the most naturalistic daily settings, but may be highly biased due to lack of training or may simply not be completed. Video has the advantage of capturing a permanent record of behaviour in context and additionally allows for reviewing and checking during transcription. Disadvantages include missed activity off-camera and being perceived as intrusive with consequences for participant behaviour.

The questions raised above all relate to the validity of the sampling procedure, that is, the degree to which our sample accurately represents the latent trait. A further consideration is the reliability of the sampling, i.e. the extent to which, were it to be repeated, it would yield a similar type of sample. Here, factors specific to individuals go beyond the control of the tester; nevertheless, this aspect of testing cannot be ignored.

We now move on to consider analysis of the expressive response and associated problems in transcription and scoring. The transparency of these procedures and tester training may each influence the reliability of the test.

Transcription of child language is a special skill that requires training. Untrained testers are more likely to write down what they thought was said rather than what was actually said by the child. An additional factor that arises with sign language is that there is no agreed method of transcription to use. The highly complex notation system originally described by Stokoe (1960) for ASL and by Brien (1989) for BSL is more suited to research on the phonetic analysis of sign languages than transcription of sizeable language samples. Signwriting (Sutton 2001) is an alternative transcription system, derived initially to transcribe dance movements, which is used in the USA to transcribe ASL and in Nicaragua to teach literacy. Its use in the UK to date has been limited to transcription by a few individuals involved in research (Woll 2001). The most widespread method is use of an English gloss with idiosyncractic diacritics; however this method remains crude and still fails to capture many of the nuances of sign language, especially non-manual features such as facial expression and postural movements. Although the meaning of sentences may be partially captured in this way, grammatical features will be lost, e.g. the signed phrase TOP SHORT DRESS-UP was noted in a transcript taken from a deaf child (Kyle 1990a), yet its meaning is obscure even when the context of 'dressing up' is provided.

At the stage of data analysis, the procedure used must be reliable and replicable. Consideration must be given to the skills of the tester here, as at the sample collection stage. Testers must be trained in use of the procedure in order to reach satisfactory levels of inter- and intra-tester agreement. To the inexperienced assessor who lacks near-native knowledge of BSL, the distinction between gesture and signs may be lost. As a result, immature gestures may be given undue credit as signs, whereas grammatical features of BSL may be wrongly identified as gesture or missed altogether.

Methods of analysing expressive spoken data used in clinical situations include syntactic parsing (Lee 1969, Crystal *et al.* 1976, Armstrong & Ainley 1989), semantic analyses (Crystal 1982), pragmatic analyses (Lund & Duchan 1993) and narrative analyses (Starczewski & Lloyd 1999). Use of mean length of but is known to be a poor measure of complexity beyond the early stages (Crystal *et al.* 1976). Its use with sign language has been explored; however there remain difficulties in determining the morphological make-up of signs, particularly in the domain of non-manual features (Kyle 1990a). Finally, without more information about norms of BSL development, any analysis of sign language samples must necessarily remain subjective.

2.6 Testing receptive language

Most attention has been given by researchers to children's language production rather than comprehension. In part, this is due to the relative difficulty of accessing and measuring receptive language. However, many of the difficulties of collecting and analysing samples can be overcome by looking at comprehension. Moreover, assessment of comprehension may be informative about a child's underlying competence and be less subject to the vagaries of linguistic performance.

The relationship between comprehension and production is not a simple one. It is widely held that comprehension precedes production and there is evidence that this may be true of naturalistic situations. However, there is also evidence of children producing linguistic constructions but failing on tasks that measure comprehension of the same constructions (e.g. de Villiers & de Villiers 1978). It also appears that the relationship between comprehension and production may vary at different stages in development (Shipley *et al.* 1969).

Marschark (1993) states that the relationship between comprehension and production is likely to be particularly 'domain specific' for deaf children:

"Initially exposed only to speech, many deaf children may understand more of a spoken message (using various cues) than they can produce. At the same time they use gestures in social communication, but may fail to comprehend those gestures when produced by others, as do hearing children."

(Marschark 1993:93)

Marschark adds that the reverse pattern is often apparent with reading and writing skills, commenting that this is a reason for careful assessment of all aspects of deaf children's language abilities in spoken and sign language, looking at comprehension and production, in order to fully explore the relationships existing between them.

There are a number of reasons to assess comprehension of language using a test. A prime reason is related to the difficulty of making accurate observations about a child's receptive abilities in context. In many cases, a child may respond primarily to contextual or non-verbal aspects (such as facial expression and gestural cues) rather than the language elements. This is particularly an issue when assessing deaf children, many of whom are specifically attuned to the available visual information because that is the modality most fully accessible to them, whether they use spoken or sign language. Other comprehension strategies used by children include processing the name of an object and associating the most likely action with it (Chapman 1978). For example, upon hearing the sentence 'switch on the light' the child may recognise the word 'light' and guess at the remainder of the instruction since that is what typically happens with lights, giving the impression of having understood the entire sentence.

Methods of testing comprehension include asking carers about the type of language which the child understands. More usually, the child is required to act out commands of increasing complexity, make grammaticality judgments, indicate via a picture/object pointing response or answer questions. It is widely acknowledged that such tests measure a child's ability to understand language in the absence of context. Although this is artificial because it does not directly relate to real communicative situations where context frequently contributes to comprehension, it does assess a child's ability to 'extract the literal meaning of a word or sentence' (Bishop 1997:12). Removal of contextual cues in some tests is taken to an extreme by use of anomalous sentences. For example, a child may be asked to 'sit on the ball' or 'kiss the phone'. However, we cannot assume that a child who fails on these sorts of sentences has a comprehension deficit. The child may simply disregard commands considered to be 'silly' (Emerick & Haynes 1986).

Performance on comprehension tests where the content is carefully controlled may explain difficulties that the child is experiencing outside the test situation, where the amount of contextual information is more difficult to predict and the sheer volume of language to be understood is problematic. In other words, formal tests of comprehension serve to isolate the relative contributions of language and context to understanding.

There are a variety of levels of language that can be investigated receptively: vocabulary, sentence structure, narrative, conversation. Comprehension of each is important, but comprehension of any one area does not imply comprehension of the others. For example, failure on a sentence comprehension task may be a result of unfamiliarity with the test vocabulary rather than difficulty with specific sentence structures.

An advantage of a formal test of comprehension is the degree of control held by the tester. Unlike a naturalistic sample where aspects of language can be missed or avoided by the subject, a test of comprehension allows the tester to determine which aspects to investigate, allowing a greater chance of capturing the subject's underlying competence in these areas. Furthermore, the subject can make a behavioural response to the stimuli, avoiding the situation where the accuracy of response is confounded by expressive difficulties.

2.7 Criticisms of language tests

A significant factor accounting for the decline in test use among practitioners is psychometric inadequacy. McCauley & Swisher (1984a) produced a scathing review of a range of eight preschool language tests. None of the tests met all the required criteria and the majority failed to demonstrate even basic measures of validity and reliability. The authors urge test users to scrutinize test packages carefully before use as the information gained from many tests may fail to be accurate or relevant.

Limitations of comprehension tests were highlighted by Millen & Prutting (1979), who compared the same group of children on three different assessments: the Test for the Auditory Comprehension of Language (Carrow 1973), the Northwestern Syntax Screening Test (Lee 1969) and the Bellugi-Klima Comprehension Test (1971). Their findings indicated that although overall scores on the NSST and TACL were consistent, differences emerged between the three tests for children's performance on specific grammatical features. They conclude that the tests cannot be considered to be equivalent and emphasize the dangers of extrapolating results obtained on formal tests when planning intervention.

Howlin & Cross (1994) carried out a similar study more recently on 35 normally developing children aged 3-4 years using a wider range of expressive and receptive language tests: the British Picture Vocabularly Scales (Dunn *et al.* 1982), the Test for the Reception Of Grammar (Bishop 1989a), the Reynell Developmental Language Scales (Reynell 1985), the Expressive One Word Picture Vocabulary Test (Gardner 1979), the Action Picture Test (Renfrew 1989) and the Bus Story (Renfrew 1997). Comparing age-equivalent and standard scores, the tests used yielded different scores for the same children, some indicating low abilities while others suggesting abilities within the normal range. The authors comment that standardised test results on very young children may be particularly difficult to interpret due to the wide range of normal performance at early stages in development. As such, there is a risk that use of an isolated test may yield misleading results. It is therefore important that we have information about the relationships between different tests and their accuracy in identifying children with problems, but also that use of tests should be counterbalanced by the tester's skill in interpreting the test score in the light of what else is known about the child.

In hearing children, it is probably safe to say that satisfactory performance on a language test is indicative of normal abilities. Among deaf children, an apparently age-appropriate performance (i.e. a false positive result) may more readily be attributed to other factors, such as the iconicity of signs used when tests are directly translated (see 3.3). There may also be a range of reasons to account for a poor test performance (i.e. a false negative test result). These variables are discussed more fully below.

2.8 Variables in language testing

In assessing communication, there is inevitably a standard set for the test or test situation from which comparisons may be made with the individual being assessed. For example, in assessing spoken English, Standard English models of language are mainly used. Regional or social variations in pronunciation, vocabulary, language structure or use must be taken into consideration when assessing individuals from "non-standard" backgrounds. Failure to do so penalises such individuals by wrongly identifying them as having problems. Below we consider the variables inherent in any assessment situation. These include subject variables, test variables and variables relating to the tester and the test environment.

2.8.1 Subject variables

A number of subject-specific factors may introduce variables in language development that may influence test performance. Research has revealed variations in spoken language that exist relative to *race and ethnicity*, e.g. the linguistic characteristics of Black English (e.g. Williams & Wolfram 1977). A language assessment that fails to take account of such factors may underestimate linguistic abilities. Not enough is currently known about the existence of such variations in BSL; however differences in sign language chiefly related to vocabulary used by the Black and Asian community have been referred to (James 2000) and merit consideration.

Wiig & Semel (1984) note that there are many factors which interact to produce differences in language and behaviours associated with *social class and education*, for example: "family interaction patterns and codes of communication, child rearing practices, maternal teaching styles, poverty and deprivation, experience and travel". They refer to Bernstein's (1971) work on class-related codes that found lower classes to use a more restricted context-dependent code, whereas upper classes made use of more elaborated context independent codes. Of relevance to the present study, among the population of deaf children are subgroups whose parental hearing status relates significantly to their socio-economic status and education. Deaf parents are likely to be underemployed because of their linguistic difficulties and lack of academic qualifications, hence measures of their socio-economic status and education will tend to be restricted towards the lower end of the scale status in comparison to hearing parents.

Bilingual children, who are acquiring or using more than one language, are at some stages in development likely to present with different language patterns to monolinguals. This does not mean that a child whose first language is not English has language-learning difficulties. However, it is important to be aware of the unique language behaviours that may occur among bilinguals. For example, language interference is a process whereby rules from one language are erroneously applied to the other (Hamers & Blanc 1989). The specific type of interference that occurs will be related to the particular languages being acquired and norms on interference are not available. Another feature of bilingualism is code alternation, where languages are switched in the course of a stretch of dialogue (Muller *et al.* 1981, Nicoladis & Secco 2000). Here, the child language starts an utterance in one language and intersperses it with chunks from the other, alternation generally occurring at specific syntactic junctures. Also, due to variations in type and degree of exposure, one language may be more dominant than the other.

The range of languages, language-like systems and modalities of language to which deaf children are exposed at home and at school is almost always complex.

Different forms of language (spoken, written and sign language) and combinations of these (Signed English, Sign Supported English) may be used depending on the context (Maxwell 1989, Mallory *et al.* 1993, Denwood 1999). This is certainly significant in contributing to the heterogeneity of language development within deaf children. It is therefore vital to have information about the types of language(s) and the exposure to each that has taken place when contemplating using a test with a deaf child and when interpreting test performance.

Gender differences have been reported in that girls have generally been observed to achieve linguistic milestones before boys (Bornstein *et al.* 2000). Other differences in communication are also apparent between males and females, ranging from use of emotive adjectives, use of tag questions and observation of word taboos (Wiig & Semel 1984).

Children differ in other ways that may impact on test performance. Haynes & McCallion (1981) looked at performance on the Test of Auditory Comprehension of Language (Carrow 1973) relative to *cognitive style.* Their findings indicated that children who took longer to make decisions performed significantly better than impulsive children. Thus poor test performance may be explained by factors other than language.

There has been discussion in the research literature about the advantage in *intelligence* found among children in deaf families. Whether this is genetic or a result of early language stimulation is much debated (Conrad 1979, Marschark 1993). Use of the SON with children from deaf and hearing families allows us to address this question. Moreover, the existence of such an advantage among the sample upon whom a test is standardised carries implications for the interpretation of test scores obtained from children involved in subsequent testing.

Children with *additional difficulties* are rarely included in test standardisation samples and separate standardisations on such groups are rare. However, the presence of learning difficulties, physical or sensory disabilities or attentional/behavioural problems may adversely impact on language development and as such must be acknowledged both prior to testing and when considering the value of test scores where tests have been standardised on samples of 'normal children'.

Where children have specific impairments, the test procedure may need to be modified in order to administer the test. However, such modifications will invariably invalidate the test standardisation, e.g. use of fewer objects or pictures serves to facilitate eye pointing responses in a child with cerebral palsy, but increases the likelihood that correct responses are at chance level. Repeating test instructions for a child with a hearing loss may ensure the child has perceived the spoken response but also gives the child an additional opportunity that is generally denied by standardised procedures.

Some children with learning difficulties may find pictures too abstract or difficult to respond to. Poor attention control is a further variable that can negatively influence assessment findings. In these situations, the use of norm-referenced standardised tests may be wholly inappropriate.

2.8.2 Test variables

Tests may themselves contain inherent biases. Taylor (1982) lists sources of possible bias in speech and language tests that may disadvantage the child taking the test. Of relevance here are the formal rules of the test situation that violate normal interaction between the child and the test administrator. For some children, such formality imposed on an existing relationship may inhibit participation in the test situation.

The format of the test may confuse the child in that s/he does not feel confident in knowing what is expected, or directions may be inadequate, leading to unreliable performance. Practice items should be included to build confidence and ensure satisfactory co-operation. The items themselves may include words used in a highly specific way, structures that are unfamiliar to the child or pictures that are ambiguous. Pictures, especially line drawings, are more abstract than 3D stimuli and may therefore be less appropriate for use with very young children.

Cognitive variables need to be carefully controlled. A test item targeting a linguistic structure that is embedded in a long and complex sentence may not prove effective because of the memory and processing load required to understand it. Sentence length and word frequency need to be considered in designing effective items.

The test should take account of the attention span of children of different ages in that testing time should ideally be brief. This may be achieved in two ways: firstly, the total number of items must be limited. Secondly, where items are ordered developmentally, older and more able children may enter the test at a higher level, and younger children can stop before reaching the end once they have failed a predetermined number of items, thereby shortening the testing time needed for different age groups. If items are not sequenced in order of difficulty, discontinue rules cannot be applied and younger children are likely to lose interest before the end of the test with the result that their performance on certain items will be unreliable.

Finally, the likelihood of correct responses occurring due to chance must be minimised. In practice, this means having a range of possible alternative responses that may be selected by the child. In summary, it is essential to ensure that the language, materials and format used in language tests are appropriate to the age, background and interests of children for whom the test is intended.

2.8.3 Tester variables

We have already suggested above that the results of any test are only as good as the tester who performs the assessment. Assessors should be adequately trained in administering tests. Where the tester has not been sufficiently trained, test results may be invalidated. Testers must be familiar with the test procedure and scoring protocol to ensure the test is administered in the standard format advised in the test manual. Error may be introduced through poor administration of the test, inadequate observation of the child's responses or in faulty scoring of responses. Furthermore, testers must be skilled at enlisting children's participation in activities and have knowledge of a broad range of areas in order to interpret test results. Each of these will be discussed below.

A key skill of any assessor is the *ability to establish a friendly rapport* with an unfamiliar child. This is essential in order to engage the child and motivate him or her to comply with the requirements of the test situation. Among the many skills required to achieve this are skills in communication. When assessing deaf children, the *ability to communicate* comfortably in the child's preferred language is essential not only to enlist the child's co-operation but also because of the influence it will have on the child's behaviour. We have already noted the range of communication styles to which deaf children are exposed. Deaf children are responsive to the communication of their interlocutors and will amend their own communication accordingly. Thus, a fluent sign language user will elicit sign language from a deaf child. However, an inadequate signer will be more likely to elicit a modified, English-based form of signing from the same child, producing a very different picture of the child's communication skills (Strong 1988).

Familiarity with the tester can be both an advantage and a disadvantage. It is often helpful in ensuring co-operation with test requirements if the tester is already known to the child. However, in these circumstances the tester brings his or her own knowledge of the child to the test situation and needs to be aware of bias. A child who knows the tester in a different capacity outside the test situation may find the formality of the test disturbing and fail to perform to the best of his or her ability.

The *inexperienced tester*, unwittingly or consciously, is likely to introduce error through unfamiliarity with either the test or the test situation. S/he may be preoccupied with carrying out the test to the extent that s/he fails to engage the child's attention before presenting the test stimulus and the child misses instructions or the target sentence. S/he may miss the fact that the child was not attending due to outside distractions or be unaware of a reticent child's attempts to signal a response through use of eye-pointing. In such situations, a low test score may be less indicative of the child's abilities than of the tester's competence.

Assessors need to fully understand the principles of language testing if they are to obtain reliable results and avoid *errors in test administration.* It is important that they have been trained in administering tests and are aware of clues that they may unintentionally pass to the child taking the test. For example, eye-gaze directed by the tester to the target picture or object may be detected by some children and enable them to score above their abilities. Alternatively, production of the stimulus sentence by the tester with undue emphasis on the target word will give an unfair advantage by highlighting the correct response. Inadvertent tester feedback, for example, facial expression, may enable the child to track his or her progress with the test which, in the case of a failing child, may reduce motivation to continue.

Most tests have specific rules regarding repetition of the test stimuli since this allows the child several opportunities to get the right response. The inexperienced tester may not adhere to such rules, thereby awarding higher scores to the child than is merited.

Finally, in the hands of an experienced tester, observations made during the assessment process provide useful information with which to supplement and qualify test scores. This may include how well the child attended to the task, how able s/he was to co-operate with task requirements, confidence in responding etc. Such information is useful in pinpointing reasons for poor test performance when it comes to considering the relevance of test scores beyond the test situation, in explaining test scores to others and in providing guidelines for intervention where this is indicated.

2.8.4 Test environment

Where the assessment takes place can itself influence test results. This is particularly the case with very young or reserved children who are less co-operative in unfamiliar settings and with people they do not know. Ideally, assessment should take place over several sessions and in a variety of settings, allowing a comprehensive observation of the child's communication environment. This is only practicable where a detailed diagnostic assessment is required and even then, time may not permit such practice. Of prime importance is that at least some testing takes place in a distraction-free environment and in surroundings that are familiar to the child or conducive to the child feeling relaxed and prepared to participate. This enables the tester to feel confident that an accurate picture of the child's abilities has been gained.

With regard to assessing bilingual children, the effects of the environment on the child's language use deserve particular consideration. A child whose minority language is assessed in an environment that s/he normally associates with use of the majority language may feel uncomfortable using the home language in that context. Many deaf children are educated in mainstream schools where sign language is not used by teaching staff. Although this need not prevent deaf peers signing amongst themselves, an adult wishing to assess sign language in this context may fail to elicit it because the child may not feel that it is appropriate.

2.9 Summary

In this chapter we have considered the purposes of assessment, the requirements of test design and methods of assessing receptive and expressive language skills. An underlying assumption in language testing is that information gained from an assessment is representative of an individual's linguistic abilities outside the test situation. To obtain the most accurate measure, the assessment process should ideally cover all areas of language and include both formal and informal methods. However, time rarely allows for such comprehensiveness and so language tests are designed to allow us to sample behaviour more economically, albeit artificially.

Interpretation of test findings must necessarily be cautious. The relevance of tests for specific groups such as those from different ethnic backgrounds or those with additional learning difficulties must be carefully considered. In addition, the skills and experience of the assessor come to play in considering how assessment findings inter-relate with evidence from a range of communicative situations before appropriate conclusions may be drawn. Although the present study investigates the assessment of receptive skills in BSL, it must be remembered that the results from such an assessment can only give partial information about the communicative abilities of a deaf child.

3

Sign Language: Acquisition, Assessment and Linguistic Structure

In Chapter 1 we considered the heterogeneous nature of the population of deaf children, their (oral) language achievements and the communication approaches used by educators to foster language development and literacy. In this chapter we return to focus more specifically on the language experience and language acquisition by children for whom a visual language is acquired naturally in deaf families. The ability to achieve normal milestones of language acquisition in sign in this group has implications for deaf children in general and reinforces the view that deaf children's problems with language lie not with language per se, but with accessing spoken input. Moreover, patterns of language acquisition among this group serve as a guide to the optimal sequence of sign language development. Finally, findings from the acquisition of a language in a different modality to the majority of the world's languages can offer unique insights into the nature of language and its development.

The broad stages of sign language acquisition are outlined, in comparison to what we know of the normal development of spoken languages. A more detailed description is provided of the morphological and syntactic structure of BSL with evidence from the research literature where this is available. Such research forms the basis for selection of areas to include in the assessment to be developed. Finally, we consider current approaches to the assessment of sign language development, in the UK and internationally, which further determine the form and purpose of the BSL assessment.

3.1 Studies of sign language acquisition: methodological issues

The vast majority of acquisition research has been carried out on ASL. Although many findings are relevant to other sign languages (such as BSL), individual sign languages are distinct from each other and merit research in their own right. Norms of development found for ASL cannot be directly applied to BSL. From the perspective of linguists and language specialists, there remains a need for further information about the normal sequence and process of development of sign languages other than ASL.

Of the available research, there are few longitudinal studies of sign language acquisition. These are particularly important in allowing researchers to link early behaviour with later results, to trace through developmental patterns and consider individual differences, both from the child's perspective and that of the carer who provides linguistic input.

In addition, methodological issues are raised by the existing body of research in relation to subjects. Common to almost all research in sign language acquisition is the problem of small numbers of subjects, many studies relying on single cases or extremely small groups. This is in part because of the intensive nature of this type of research, but also because the population of deaf children in deaf signing families is itself a small one: approximately 5% of deaf children have deaf parents[1]. From studies of spoken language development, we know that there is a high degree of individual variation in developmental patterns among young children (Cross 1978, Wells 1986c, Richards 1990c, Fenson *et al.* 1994). We therefore need to be particularly cautious about interpreting findings taken from a limited number of small-scale studies. Above, we referred to children who are developing sign language naturally in deaf families. A methodological issue arises in defining what constitutes a deaf family and what factors engender the natural development of sign language.

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[1] *If we consider that 840 children are born each year in the UK with a permanent hearing loss (NDCS 2001), this suggests that only 42 children will have deaf parents.*

3.1.1 Deaf families

Padden & Humphries (1988) are among others in suggesting that it is not audiological measures of deafness that determine whether or not a person considers him or herself to be deaf, but affiliation with the Deaf Community and the use of sign language. The terms 'deaf' (audiologically deaf) and 'Deaf' (culturally deaf) have been used to distinguish these perspectives.

Not all deaf people choose to use sign language, but among those who do, few deaf adults today will have acquired sign language as a native language because of the hearing status of their parents and past attitudes to deaf education (Lynas 1994). Many deaf adults report their first exposure to sign language occurring at school from other deaf friends or as adults in their encounters with the Deaf Community (Kyle & Woll 1989). Even though they may use sign as a preferred language, few deaf adults' BSL skills are fully native-like. Furthermore, varying forms of signing may be used in deaf families depending on the hearing status or language preferences of family members (Mallory *et al.* 1993, Denwood 1999, van den Bogaerde 2000). For example, signing may approximate sign language grammar or English grammar and may or may not be accompanied by English lip-patterns (Jackson 1989).

This raises the question of who may be considered a suitable subject for the study of sign language acquisition. Potential subjects include hearing and deaf children in families where deaf parents are either native or non-native signers. In addition, deaf children in hearing families who sign must also be considered; however, we do not include reference to deaf children who generate homesign in the absence of any exposure to sign language (Goldin-Meadow & Mylander 1998).

3.1.2 Non-native signing input provided by deaf parents

Research from Nicaragua may shed light on this question. The establishment of the first educational programme for deaf children in Nicaragua meant that deaf children who had previously been isolated came together for the first time. Kegl and her colleagues have documented the creation of Nicaraguan Sign Language among the first of these groups of children, termed first generation (Kegl 1994, Senghas 1994). More recently, Kegl *et al.* (1999) report the emerging sign language patterns among second generation children. This group, exposed to highly variable pidgin signing input at school from first generation deaf children, have been observed to produce signed output that exhibits increasingly abstract, rule-bound linguistic structures. Kegl *et al.* use this evidence to illustrate the child's ability to construct sign language as long as the minimum requirements are met: modality-specific input (even when this is impoverished) within a critical time frame plus a community using the same linguistic system with whom the individual can communicate. This evidence suggests that children in deaf families exposed to sign language from birth from deaf parents who are non-native signers will develop native sign language skills.

3.1.3 Signing input provided by hearing parents

The issue concerning deaf children from hearing families where signing is used is less easily answered. Hearing parents may learn to use sign language, albeit imperfectly, thereby providing modality-specific input; however there are still likely to be differences between the language environment they provide and that provided by a deaf family. Firstly, the child will only be exposed to sign language input once the diagnosis of deafness has taken place and parents have agreed to use sign language with their child. In many cases, these two events do not co-occur.

There is a small but growing body of convincing research investigating the effects of later exposure to sign language. Galvan (1989) reported on the acquisition of complex morphology in ASL in 30 deaf children who were either early or late signers. Subjects were termed early signers if they had deaf parents (age groups 3, 5, 7 and 9 years) and late signers if they had hearing parents (age groups 5 and 9 years). The study used a story telling task based on the picture book "Frog, where are you?" (Mercer Mayer 1969).

Galvan noted very similar patterns in the overall numbers of signs used by late and early signers with development. However, striking differences emerged when analysis considered the morphological complexity of verbs.

Among the native signers, the youngest age group (3 year olds) made extensive use of uninflected forms. Between the ages of 5-7 years, the frequency of uninflected forms increased, then decreased rapidly at the age of 9, at which point the native signers were able to establish spatial loci for various referents and maintain loci over several utterances (1989:109).

A feature of the 5 year-old late signers was the frequent lack of systematic placement of signs in signing space to which verbs were inflected. This was in contrast to the low numbers of verbs inflected to a point to which there had been previous reference. Galvan suggests correct inflection to a point of previous reference to be indicative of the linguistic use of space.

Galvan also investigated handling classifiers and observed that late signers made greater use of unanalysed forms than early signers. Galvan cites an example whereby a 9 year old late signer used a prototypical sign for OPEN, as used to show the action of opening a small cardboard box, to refer to both the opening of a window and the opening of a beehive. This suggests that the verb OPEN had not been analysed by this subject (1989:111).

Finally, Galvan compared the development of aspectual inflections between early and late learners. His data suggests native signers incorporate aspectual inflections relatively early. In contrast, late signers fail to make such modifications; indeed by 9 years, there is a sharp drop in the frequency of aspectual inflections used by late signers as a group.

Newport (1990) looked at adult signers who had been exposed to ASL at different ages: native signers exposed from birth, those first exposed between the ages of 4 and 6, and individuals exposed after the age of 12. Her findings show the age of exposure to have highly specific effects. Basic sign order in ASL was unaffected; however comprehension and use of morphological structures was significantly reduced in later learners.

Emmorey *et al.* (1995) investigated language processing in early and later learners of ASL. Early learners were consistently faster at recognising isolated signs and more sensitive to errors in verb agreement and classifier usage than later learners, the age of 4 appearing to be critical in distinguishing groups.

Studies on ASL such as these and those of Mayberry *et al.* (1983) and Newport (1984) concur in their finding that late signers appear to use signs as unanalysed wholes, rather than incorporating the required morphological inflections demonstrated by native signers. This finding appears to apply equally to BSL: in one of the few studies of BSL development, Kyle (1990a) noted the absence of verb inflections in samples of sign language from deaf children who were mostly late learners.

Newport (1984) explains this phenomenon as a consequence of children's cognitive processing abilities at different ages of acquisition. A native signer acquiring sign language in infancy with limited processing abilities is only able to comprehend isolated components of a sign, e.g. the handshape or movement; this limitation is ideally suited to the acquisition of morphology. In contrast, an older child at the same stage in language development, while able to process the whole sign, may fail to isolate the morphologically significant parts and thereby fail to master the morphological complexity of the language (Galvan 1989:107). Mayberry (1993) suggests that only if input is provided via fluent language models before the age of 5 years can native-like acquisition of signing skills be achieved.

As well as timing of exposure to sign language differentiating children in deaf and hearing families, a second distinguishing feature in hearing families is the presence of a hearing majority, leading to a predominance of spoken language being used over sign language. Although language addressed to the deaf child may be in sign, the majority of language in the environment is likely to be in the form of speech. Since the deaf child in a hearing family is denied opportunities to learn language incidentally from watching sign language addressed to others, this suggests that the need for access to a community using the same linguistic system cannot be adequately met. Much must then depend on the amount of sign language to which the child is exposed outside the home.

Thirdly, hearing people at early stages of proficiency tend to produce signing that is heavily influenced by their first (i.e. spoken) language. The older deaf children in Nicaragua were not influenced in this way as the pidgin sign they used was their first language.

Finally, most research into the sign language abilities of deaf children from hearing families has viewed these children within a TC educational context. Much of this research has indicated that deaf children use the available input to generate sign language-like structures in their output (Davidson *et al.* 1996, Guy 2000). However, it is also clear that language acquisition among this group proceeds at a different rate and in different ways to that of children in deaf families. In part, this is due to the age of exposure to sign language, a known significant variable (Mayberry 1993).

Few studies have documented sign language development among bilingually educated deaf children from hearing families, largely because bilingualism is a relatively new approach in deaf education. Although it is more likely that this group will succeed in developing sign language along normal lines, this has yet to be proven. Further research is also needed into the quality and quantity of signing provided by hearing parents and consequent effects on deaf children's sign language development.

3.1.4 Hearing children in deaf families

Studies of sign language development often use hearing children from deaf families as subjects. This is primarily because they are more numerous than deaf children in deaf families; however, the assumption that the two are directly comparable requires further consideration.

Although no acquisition studies have been carried out to date, brain processing studies have indicated differences to exist between adults who are hearing native signers and deaf native signers (Neville *et al.* 1998; Söderfeldt *et al.* 1997). It is theoretically possible that differences will be apparent at the language acquisition stage, particularly when we consider that the two learning situations are in fact quite different.

Hearing children in deaf families are almost always in a bilingual bicultural environment (Singleton & Tittle 2000). As well as access to sign language, they can also access spoken language (via family members, pre-school programmes, television), thus exposure to a second language takes place from a very early stage and is concurrent with exposure to sign language. Early research on hearing children in deaf families ignored this factor, focusing solely on spoken language skills and reporting these children to be at risk of language delay. However, in the majority of cases where hearing children are exposed to spoken and sign languages, few instances of delayed spoken language are found (Schiff-Myers 1988).

Deaf children from deaf families are more likely to be monolingual, at least until they start school. Even where there is exposure to spoken language, in the home or at school, speech perception is difficult and spoken communication that is not directed at them is generally inaccessible. Development of spoken language by deaf children therefore frequently occurs after the acquisition of a sign language.

The literature on bilingual language acquisition is ambiguous about the degree to which bilinguals and monolinguals may be compared, and on the relative language skills of simultaneous versus sequential bilinguals. At a relatively early stage in the debate, Volterra & Taeschner (1978) proposed three stages in the development of simultaneous bilingualism. They suggested that, prior to achieving bilingualism, children combine lexical items from each language to form one system. Later, when two separate lexical systems have been established, children apply the same set of syntactic rules for both before fully differentiating the separate languages. Although subsequently disputed (see de Houwer 1994), the suggestion that bilinguals may exhibit linguistic differences due to interference from a second language input, has been reported among sign bilinguals. In a study of bilingual narrative development (BSL and English) in hearing children in deaf families, Morgan (1998) reported such interference to occur. With reference to the present study, there has been no research looking at the comparative effects of bilingualism versus monolingualism on receptive language skills. The question that remains to be resolved is whether hearing and deaf children with deaf parents will exhibit differences in their receptive sign language development, deaf children perhaps possessing an advantage due to their monolinguality.

However, other researchers disagree with the concept of a single language system based on the evidence of linguistic interference, suggesting that grammatical development in each of the languages follows the same pattern as that of monolinguals (Kessler 1984) and that language differentiation may occur from as early as 1;05 years (Nicoladis & Secco 2000). Genesee (1989) states further that, although examples of interference may be taken to mean that children cannot differentiate two languages, an alternative interpretation may be related to the context in which children are observed. Children in a bilingual context are extremely likely to receive input containing codeswitching, hence children's codeswitching responses are entirely appropriate.

Where acquisition of a second language occurs sequentially (depending on the child's age), more formal learning and meta-linguistic skills are involved which impact on the acquisition of the second language. Kessler (1984) suggests that differences are likely to occur, although only for the language acquired at or after school age. In the context of the present study, BSL is the first language of both deaf and hearing children in deaf families, so no difference should be expected. Findings from studies such as Jones & Quigley (1979) and Siedlecki & Bonvillian (1993) add further support to this view. These studies compared hearing children in deaf families with hearing and deaf peers on grammatical and phonological measures and both report no difference between groups. Jackson (1989) reported on a single case study of a hearing child of deaf parents. She examined the development of pronouns and negation and found grammatical development in each language to be separate, concluding that the bilingual child she observed did indeed appear to be developing much like all other bilingual children. In comparing hearing children's BSL and English development, using a test of comprehension in English, we would expect to find similar results.

Kessler's (1984) proposal of parallel grammatical development in simultaneous bilinguals implies that hearing children in deaf families will acquire each of their languages at the same rate as monolinguals. Comparison of English and BSL abilities among this group were examined in the present study for the purposes of investigating this area.

3.2 Stages of sign language development

In this section we provide an overview of the stages of sign language development. Evidence is provided which supports the view that language acquisition among native signers proceeds in a similar way to hearing children's acquisition of spoken language. Thereafter, we describe more fully the development of morphology and syntax, upon which current test design is based.

3.2.1 Prelinguistic communication

The search for the starting point in language development has moved ever earlier from the most obvious achievement, the first word or sign. Patterns of parent-child interaction have been identified as forming the basis for the development of prelinguistic dialogues from as early as the first few weeks of life. Comparative research on early patterns of interaction between hearing and deaf parents and their (same hearing status) infants has revealed exchanges to develop appropriate to the communicative medium. Initially, similarities are apparent, both sets of dyads making significant use of eye contact and facial expression in proto-dialogues (Gallaway & Woll 1994). Deaf parents have also been found to vocalise to their infants (Woll & Kyle 1989), which is somewhat surprising when normal adult sign communication is vocally silent. This has been explained as use of the voice for the communication of affect, rather than for true linguistic communication. As soon as parents identify the infant's readiness for the onset of linguistic communication, use of the voice generally disappears, although the use of spoken components may persist in some cases, particularly if the child is known to be hearing (Van den Bogaerde 2000).

An important feature of early communication is joint reference, which we have already noted (see 1.3) to present a challenge to interaction between a deaf child and a hearing parent. In hearing parent-child dyads, the parent can talk about the child's focus of attention while the child is looking away. Hearing babies seem to develop an early awareness of when they and their parents are focusing on the same object or activity; by the age of 9-12 months, they are able to follow their parent's line of vision and make use of pointing gestures (Baldwin 1995). This assists them in beginning to match the language they hear with the focus of attention. Indeed, where same hearing status parents follow the infant's focus of attention when providing language, hearing infants' (Tomasello & Farrar 1986, Akhtar *et al.* 1991) and deaf infants' (Harris *et al.* 1989) vocabulary acquisition has been shown to proceed at a faster pace

When communicating in sign language, both partners need to look at each other to access communication. Thus, when the child looks away, communication must halt; when communication resumes, the child must relate the adult's input to the previous referent. Some have viewed this as cognitively more demanding for the child (Wood 1981); however, deaf parents are able to facilitate the development of joint reference in their children. As soon as infants have sufficient head control, deaf parents engage in a systematic approach to visual tracking (Kyle 1990b). Typically, the deaf parent teaches the infant to follow a manual point to a referent and then return eye gaze to the parent's face, allowing access to communication about the referent. This serves to establish the patterns of eye contact which are essential for turntaking in a visual mode and which form the basis of joint reference, upon which subsequent language development depends.

Deaf parents are thus highly sensitive to their children's visual attention, communicating only within the child's visual field. However, the quantity of linguistic input provided by deaf parents seems impoverished in comparison to that of hearing parents until we consider the limitations posed by the young child's capacity for attending. Van den Bogaerde (2000) makes the useful distinction between the language 'input' provided by parents, the child's 'uptake', (the amount of language to which the child actually attends) and the child's 'intake' (the language which the child processes). In hearing children, the difference between these is difficult to determine as we cannot tell how much of what the adult says is actually received by the child, the ears being always potentially 'open' to input. With the deaf child, it is somewhat easier to assess, in that if the child is not visually attentive to the adult, language input cannot be perceived, let alone processed. Thus, it appears likely that much input from hearing parents is not attended to by the hearing child, whereas the input from deaf adults which is provided is generally more equivalent to the deaf child's uptake.

In the same way that hearing parents use 'motherese', deaf parents modify their signing to young children to make it salient and more accessible. Methods include parents moving their hands into the child's visual field, signing on the child's body, shaping children's signs, changing the size and rate at which signs are presented, repeating signs, and using simpler linguistic structures (Maestes y Moores 1980, Harris *et al.* 1989, Baker & Bogaerde 1996, Masataka 2000, Holzrichter & Meier 2000).

3.2.2 First signs

There is relatively little research on the development of babbling in sign language, corresponding to the vocal babble observed in hearing children.. Children exposed to ASL input have been observed, before the emergence of their first signs, to produce sequences of hand gestures which phonologically resemble signs, but which are not otherwise recognisable or meaningful (Petitto 1987b, Petitto & Martenette 1991, Marschark 1993, Petitto *et al.* 2001). However, a key difficulty with this type of research is the range of hand patterns that are considered to constitute manual babbling, to be distinguished from the hand play in which children not exposed to sign language engage. Further research is needed on this phenomenon.

In contrast, there has been a body of somewhat contentious research documenting the emergence of signs. The controversy surrounds the age at which children exposed to ASL produce their first signs, some studies reporting this to occur significantly earlier than children typically pronounce their first words (Schlesinger & Meadow 1972, Bonvillian *et al.* 1983a). One explanation for this has been the earlier maturation of the musculature relating to manual dexterity compared to the oro-motor system (Bonvillian *et al.* 1983a). However, Kyle & Woll (1989) suggest that the argument chiefly rests on the linguistic status assigned to these early forms, in part because of the close relationship between gestures and signs. Gestures and signs occur within the same modality and often share many formational parameters. It is often difficult to tell if early gestures are in fact primitive signs and deaf parents are likely to attribute linguistic status to gestures in the same way that hearing parents interpret vocalisations as words. Meier & Newport (1990), in a review of the sign advantage issue, conclude that there may indeed be a small advantage at the one-word stage of vocabulary development. However, this advantage disappears at the onset of two-sign utterances, once syntactic and semantic factors come into play (see 3.2.3 below).

A well studied area of potential overlap between gesture and sign is index pointing. Index pointing is used for grammatical purposes in sign language but also occurs frequently among the early gestures of both deaf and hearing children. Petitto (1983) noted that young hearing children use points to indicate objects but do not point to the self until the age of 18 months, the age at which pronouns begin to be used. The deaf child, on the other hand, uses self points at 10 months. Petitto presents this as evidence for points to be given the status of signs rather than gestures in young deaf children as deaf children appear to be using them linguistically rather than just communicatively from an early age.

Research into the content of the young signing child's lexicon has revealed it to be largely the same as that of a speaking child (Newport & Ashbrook 1977). Although iconicity may be a factor facilitating adults' learning of sign language, it does not convey an advantage to the child learner (Orlansky & Bonvillian 1984, Bonvillian & Folven 1993).

3.2.3 Early sign combinations

Despite the controversy surrounding the age at acquisition of the first signs, there is general agreement that syntactic development commences and subsequently progresses at a remarkably similar rate to that of spoken languages (Meier & Newport 1990).

The range of semantic relations expressed by two-sign combinations has been reported to be the same as those found among speaking children and to develop thereafter in a comparable way. These comprise the existence/non-existence of objects, actions on objects, state relations, location, datives, instruments, causes and manners of actions, possession, etc. (Marschark 1993).

Early sign combinations comprise an index point plus a lexical sign; however only children exposed to sign language input have been observed to go on to combine 2 referential signs (Volterra 1994). Despite the flexibility of sign order found in adult sign language, related to the high use of inflections, sign order in children is relatively fixed prior to the onset of morphology. Nevertheless, research indicates that children acquiring sign language do appear to demonstrate sensitivity to sign order (Hoffmeister 1978b, Coerts 2000).

3.2.4 Morphological and syntactic development

In reviewing the research on morphological and syntactic development in sign language, an early difficulty to be encountered is one of terminology. For reasons of clarity, we have adhered to the terminology used in the fullest and most recent account of BSL grammar, that of Sutton-Spence & Woll (1999).

Woll (1998) provides a useful timetable of sign language development based on the available research literature (see Appendix 3.1). Until the age of 2 years, uninflected forms are used. Thereafter, the first attempts to mark morphological inflections typically begin to emerge, although full mastery takes longer to achieve. Indeed, studies of ASL suggest that development of the full morphological complexity of verbs may continue until the age of 10 years (Newport & Meier 1985).

Selected features of syntax and morphology in BSL are now described and discussed further where studies have reported on their development.

Verb morphology: Sutton-Spence & Woll (1999) describe 3 classes of verbs in BSL:

i) invariant/state verbs, e.g. RUN, (BE)-HAPPY, LIKE, where the order of signs is fixed and the verb forms may be inflected for manner, aspect and class of direct object
ii) agreement verbs, e.g. ASK, GIVE, which may be modified for manner, aspect, person, number and class of direct object
iii) spatial verbs, e.g. TRAVEL, HAND-OVER, PICK-UP, which may be modified to show manner, aspect, location, movement and related noun. Spatial verbs also make use of a handshape, known as a pro-form, which changes depending on the class of object referred to, e.g. TRAVEL-BY-FOOT, TRAVEL-BY-CAR, TRAVEL-BY-BICYCLE; or PICK-UP-A-SMALL-THIN-OBJECT, PICK-UP-A-THIN-FLAT OBJECT.

Agreement verbs: Meier (1981, 1982, 1987) has documented the acquisition of agreement verbs in ASL in a series of illuminating studies. He notes that many agreement verbs seem remarkably transparent, e.g. in signing 'I give (something) to you', the movement of the sign from the speaker to the listener looks very much like the action of giving. However, such iconicity fails to influence the pattern and age of acquisition. Before the first productive use of verb agreement emerges at 2;06, the pattern of errors made by children suggests that they are processed morphologically rather than as iconic wholes. Children begin by producing uninflected forms and points. Thus, whereas an adult would sign I-GIVE-YOU as a single sign, incorporating person agreement, young children begin by using three signs: I GIVE (uninflected) YOU. Misagreements (which are often counter-intuitive) are also found and can only be disambiguated by context (Meier 1982). Patterns of overgeneralisation occur, whereby children inflect verbs for agreement when such marking is ungrammatical in the adult language (Bellugi *et al.* 1988). Errors are made in movement of the verb form towards the wrong argument, e.g. inflecting GIVE towards the object to be given, rather than the intended recipient (Bellugi *et al.* 1988).

The production of verb agreement with present referents appears to be largely mastered by the age of 3;00 (Bellugi *et al.* 1988). Children appear to express an early preference for object agreement, generally the only obligatory requirement, with subject agreement emerging later. However, agreement verbs present additional problems when talking about referents that are not present: children may pile several referents onto the same location, rather than allocating each a separate spatial locus using an index point (Loew 1984). Another immature strategy noted by Bellugi *et al.* (1988) was to contrast spatial loci by using different sides of the face. By the age of 6 years, children consistently used verb agreement appropriately with the correct referential loci (*ibid*).

Fewer studies have followed the developmental pattern of verb agreement comprehension. Bellugi *et al.* (1988) carried out verb agreement comprehension tests on 51 deaf children from deaf families aged 2-8 years. Children demonstrated their comprehension of verbs taking two arguments (subject and object) using toys to act out the action signed by the experimenter. By the age of 5, children were able to score 80% correct on these tasks, indicating good comprehension of the verb agreement system.

Spatial verbs: Newport & Supalla (1980) describe the development of spatial verbs, termed 'verbs of motion' in ASL. They note that children begin to use these verbs by marking the movement of the verb in signing space, from 2;09 years, but without the accompanying pro-form. The use of pro-forms emerges later, between 2;11-3;06 years; however the child is initially only able to mark either the moving object or a secondary object, rather than both objects. The simultaneous representation of two referents, e.g. a car passing a tree, begins to be used from 3;04-4;04 years, but may not be fully mastered until the age of 8 years.

Aspect refers to the duration or frequency of an event. In BSL, lexical signs may be used to signal aspect, but more often, the movement of signs is modified to indicate a range of aspects, e.g. habitual, iterative, ongoing. According to Newport & Meier (1985), children develop aspectual marking on verbs in ASL between the ages of 3-4;09 years.

Handling classifiers are signs where the handshape represents how a noun is handled. For example, the equivalent BSL sentence for "the boy ate pizza" would be PIZZA BOY EAT-PIZZA$_{CL}$, where the sign EAT adopts a handshape indicating how a pizza is usually handled, in contrast to "the boy ate a hamburger" or "the boy ate chips", etc. Galvan (1989) noted native signers developing ASL to use a variety of handling classifier handshapes from an early age and to increase the frequency of classifier use with maturity.

An earlier study on the development of three different classifiers in ASL was carried out by Kantor (1980). Kantor compared three age groups of children from deaf families (3;00-3;11, 5;08-6;00 and 6;00-7;00) using production, imitation and comprehension measures. Her findings show that by 3 years, children are aware of the need to use pro-forms, even though errors of deletion or phonological modification occur. Comprehension was noted to be in advance of production abilities.

In the middle age group, overgeneralisation to include items within a similar semantic domain were observed, whereas children in the oldest age group demonstrated the most consistent patterns in all tasks. However, once the basic use of classifiers was mastered, errors persisted when pro-forms were embedded in more complex linguistic structures. Kantor concludes that the order of acquisition is clearly related to structural rather than purely motoric complexity. Parameters influencing acquisition were organised hierarchically: location was acquired first, then motion and finally handshape and orientation.

Abstract indexing: Integral to the spatial syntax of sign languages is the assignment of a noun or noun phrase to a specific but arbitrary spatial locus for subsequent reference using an index point. The signing space may be marked with one or more locations, depending on the number of referents. The correct usage of abstract indexing is essential to establishing referents in narratives, e.g. who did what to whom, and for the correct inflection of verbs. However, indexing may also be used simply to locate objects.

Bellugi *et al.* (1988) looked at children's comprehension of index points to investigate whether children were able to understand the connection between nouns and arbitrary locations in space before they were observed to produce them. Using a comprehension test, children were asked to either identify the location of a specific noun that had been previously established or to name the noun associated with a particular location. Two and three nouns were used in different parts of the test. Children between the ages of 1 and 10 years were tested and the results indicated that by the age of 3 years, many of the children were able to perform well on the test. Loew (1984) suggests more specifically that the use of a single locus is seen at the age of 3;06, whereas marking of multiple loci appears between 3;09 and 4;04 years of age.

Derivational morphology: Many nouns and verbs in BSL are derivationally related, for example, AEROPLANE/FLY, CARPENTER/SAW, CAR/DRIVE. In most pairs, the noun has a short movement, finishing with a brief holding of the sign, whereas the verb incorporates a longer movement that tapers off.

Launer (1982) describes the emerging noun-verb distinction in ASL. Between the ages of 2 and 3 years, children begin to mark nouns and verbs appropriately, but do not do so systematically. At this early stage, children may adopt a distinctive facial expression or body posture or speed of movement rather than the correct adult form. By the age of 4 years, 71% of productions show partial or full adult morphology. Between 4-5 years, alongside the more systematic use of these morphological distinctions, there is evidence also of overgeneralisation to unpaired forms and lexical innovations, e.g. extending the ASL sign PICNIC using a verb marker to sign *TO-HAVE-A-PICNIC[2].

Number/distribution: The equivalent of plurals in English are morphologically more complex in BSL. Most frequently, the sign is articulated and followed by a pro-form that is then repeated, each repetition being located along a line or arc. For example, "beds" is produced by signing BED, followed by the 'B' proform (a flat hand, palm down) that is moved slightly downward. This movement is repeated several times, moving from left to right. In other cases, a number or quantifier sign follows the unmarked sign, e.g. MANY. Although there is research on the development of classifier handshapes (Schick 1990), there is no information available on the development of these mechanisms to express plurality.

Size and shape specifiers: BSL uses a class of signs that are modified to identify size and shape characteristics of nouns. These are often found where adjectives would be used to modify nouns in English, for example, 'small square spots' becomes SMALL-SQUARE-SPOTS, where the shape is outlined by the hands.

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[2] * *indicates an ungrammatical sentence.*

Schick (1990) describes a study to elicit size and shape specifiers (SASS) in 24 deaf children in deaf families aged 4;05-9;00 years, in comparison with other types of classifier handshapes. Each type was elicited using picture materials at two levels of difficulty. The difficult level was morphologically more complex in that the predicate was part of a complex spatial relationship, rather than just a simple predicate adjective. The results indicated significant effects of age and complexity, although no effect of individual handshapes was observed. This was due to the age of the subjects, suggesting that handshape alone is an inadequate measure of linguistic maturity beyond the age of 4;05 years. SASS were more difficult to produce than classifiers (pro-forms) which required no handshape modifications corresponding to the physical characteristics of objects, despite the partial iconicity of many SASS forms.

Negation: In BSL, negatives are expressed through a combination of facial expression, a negation head turn or side-to-side shake, negation signs and changes in the movement of verbs (in particular in experiential verbs such as LIKE, KNOW, WANT, Sutton-Spence & Woll 1999). Negation signs include circling 'O'[3] or 'F' hands (meaning 'nothing' or 'nobody') and a flat hand facing the mouth and moving across it, accompanied by the mouth pattern 'poo' (meaning denial of possession, presence or existence). Verbs which have their own negation form such as NOT-LIKE are often used alongside other negation features, e.g. with the appropriate facial expression and a head turn.

There is a lack of any empirical research on the development of negation in BSL. The process of development can therefore only be inferred from extensive studies of the acquisition of English and the stages mentioned by Jackson (1989) in her research on ASL development. Jackson's (1989) case-study was based on a hearing child of deaf parents acquiring English and ASL. Her interest was in whether the apparent similarity between the ASL

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[3] *Single capital letters refer to particular handshapes – see Appendix 3.2 for illustrations of selected handshapes referred to in the present study.*

signs and non-verbal (English) gestures for negatives and possessives conveyed an advantage for learners of sign language. Jackson (1989:211) refers to the following stages in the development of negatives that exist across languages:

1. one-word negation, often used to negate the assertion previously stated;
2. a negative element that is positioned externally to a sentence (often sentence-initial in position);
3. intra-sentential negation (negative element embedded in the sentence);
4. addition of negative modals.

In her observations on ASL acquisition, Jackson notes the absence of the first stage altogether, followed by the negative element preceding the subject, and finally the use of embedded negation.

Questions: BSL makes use of the eyebrows to contrast different types of question form, an upward movement of the eyebrows indicating a yes/no question whereas a downward movement signals a wh- question. Development (reported in ASL) follows a specific sequence: children first raise their eyebrows for yes/no questions at 18 months of age; however, wh- questions are not marked on the face until approximately 3;06 years (Reilly *et al.* 1991), even though wh- question words (e.g. WHAT, WHEN, WHERE) are used well before this time.

Topicalisation and conditionals: Non-manual features are also important in the linguistic expression of topicalisation and conditionals in BSL. A brow raise is used to signal the topic-comment structure of BSL. A brow raise plus an optional head-tilt may be used to mark a conditional clause. The facial behaviour required to mark the topic in ASL is generally acquired by the age of 3;00 (Reilly *et al.* 1991). Conditionals take longer to acquire and begin to appear only from 3;11 years (*ibid.*)

Referential shift: Referential shift is an integral part of storytelling in sign languages. It is a mechanism for expressing reported speech and enables the signer to show the perspective of different participants in a story. The signer adopts the role of each character by shifting eye gaze to a different point accompanied by a change in body posture and orientation (Bahan & Supalla 1995). Children engage in referential shift from the age of 3;06 years; however competence in reporting a dialogue comprising several characters takes longer to achieve. Loew (1984) suggests mastery is accomplished by 4;04 years.

3.3 Assessment of sign language development

In Chapter 2 we considered issues surrounding the design and use of language assessments in general terms. The final section of this chapter focuses specifically on the assessment of sign language. We begin by reviewing current approaches to BSL assessment in the UK and move thereafter to describe assessment tools used in international research studies.

3.3.1 Current approaches to BSL assessment in the UK

With the exception of the pioneering work of Kyle and colleagues at Bristol University (Kyle 1990a, Jansma 1994), there has been little research in the UK on the assessment of BSL. At the start of this study, there were no standardised measures used by professionals working with deaf children to assess children's developing competence in sign language. In order to be better informed of typical practice and of the perceived needs of practitioners in the UK, a small-scale postal survey was conducted and the results reported in Herman (1998a). A questionnaire was distributed to those schools indicated in the Royal National Institute for the Deaf directory (1996) as using BSL as part of the school's communication approach. Questions were asked about school communication policies, the current approach to the assessment of children's sign language skills, personnel involved in assessment and perceived assessment needs (see Appendix 3.3).

The type of communication approach adopted by schools clearly influenced the approach to taken to BSL assessment. All schools that were not attempting to assess children's BSL development operated a TC communication policy. In TC environments, BSL signs are typically used in combination with spoken English as SSE. In such cases, assessment of sign language separately from English may not be considered because the focus is on monolingual use of English. A danger here is that important aspects of language will be missed: non-English communication may be ignored or wrongly labelled as gesture when it may in fact be linguistic; conversely, gesturing may be interpreted as being linguistic.

Research on the language development of deaf children exposed to English-based sign systems has suggested that many go beyond the input they receive to create language structures which more closely resemble sign language than English (Gee & Goodhart 1988, Supalla 1991, Hoffmeister 2000). Knowledge of sign language, its development and assessment cannot therefore be ignored by any professionals concerned with deaf children's language development.

A variety of assessment methods were reported, including observation or video of a conversation with either another child or a deaf adult, analysis of a video of unspecified sign tasks and adapting existing tests. All of these methods raise issues of validity and reliability related to sampling issues and, in view of the lack of reported tester training, tester variables (as discussed in 2.8.3). In addition, as different assessments were developed and used within individual schools, it was not possible to compare BSL development between children attending different schools.

In many educational settings, translations of tests of spoken English were used. It should be noted; however, that there are problems with this approach. Vocabulary frequency has never been recorded for BSL, so direct borrowing of English vocabulary assessments is not appropriate. In addition, vocabulary differences exist between spoken and sign languages, e.g. an English word may not have an equivalent single sign (e.g. the BSL translation of 'furniture' is TABLE-CHAIR). Moreover, where vocabulary items in sign language are denoted by pointing (e.g. body parts) or highly iconic signs, the level of task difficulty is necessarily affected (see 3.3.2 below). Similarly with syntax, certain spoken language constructions, e.g. passive sentences, do not have direct equivalents in BSL.

Assessments developed to examine adult BSL skills (Council for the Advancement of Communication with Deaf People, CACDP 1997) are used in some settings. These assessments are graded to assess different levels of skill in BSL; however they have not been designed with a developmental sequence in mind and are therefore not appropriate to use with young children.

Respondents were asked what, specifically, was assessed and identified a range of features of BSL. Vocabulary, conversational skills with deaf and hearing partners, fluency, handshapes, fingerspelling and attention were areas also addressed. Looking across all respondents, a comprehensive range of aspects of children's sign language was listed but there was a lack of agreement between different schools on which aspects were routinely assessed and how this was done. Furthermore, it is unlikely that developmental norms for any of these features were being used; in many cases, they are simply not available.

The need for specific training in assessment was investigated and the majority view was that further training was essential. The need for recognised qualifications in BSL, training in BSL linguistics and knowledge of BSL development were cited. The latter was expanded by several respondents to include knowledge of the differences in BSL development between deaf children with deaf parents and deaf children with hearing parents. Specific training on the development of hand function and how to understand child BSL was also needed.

Further training was sought in transcription of BSL, selection of features of BSL to assess, in distinguishing immature versus deviant BSL and in how to move from assessment to planning and teaching. More basic skills in assessment were also felt to be needed by many respondents, e.g. the appropriate situations to sample, materials to use, elicitation techniques and use of video.

Finally, respondents were asked what assessment tools needed to be developed. Those most frequently mentioned were norm-referenced vocabulary assessments and tests of syntax. Other suggested assessments were: receptive and expressive tests, test of concept development, comprehension of BSL questions, stories and instructions, visual tests and tests involving explanations. Assessments that took account of communication in real-life situations were felt to be important; the need for assessment to be economical on time was repeatedly stressed.

The results of this survey indicated a clear need for carefully developed assessment tools and further training in the area of sign language assessment. Some schools and services were developing their own assessments; however there was no indication that issues of reliability or validity were being addressed, nor were attempts underway to standardise these measures or make them widely available.

Perhaps unsurprisingly, services in the UK seemed generally unaware of the sign language assessment tools used in research studies. However, consideration of these can provide useful ideas on which to base the development of methods and materials for the assessment of BSL development. Research that has included the development and use of sign language assessment tools is reviewed below.

3.3.2 Review of sign language assessment tools

As mentioned above, Kyle and his team at the University of Bristol have carried out the majority of research into assessment of BSL development. Kyle (1990a) reports in detail on a study to develop and pilot a range of assessment materials on 77 deaf school children aged 4-11 years in the Bristol and Avon area. The study documents the challenges involved in developing a vocabulary test of BSL by considering the translation of an existing reputable test. Several problems became apparent: firstly, a number of words had to be changed because of the 'guessability' of the equivalent

BSL signs. We have already mentioned above that in BSL, vocabulary relating to parts of the body often entails pointing to or touching the appropriate body part, thereby reducing the complexity of the task. Other signs are iconic, being closely related to widely recognised gestures, e.g. DRINK. Clearly inclusion of such signs conveys an advantage to signers (and even to non-signers) and is not a true measure of vocabulary knowledge in BSL. Indeed, Kyle (1990a) criticises the Carolina Picture Vocabulary Test (Layton & Holmes, 1985), which seeks to establish lexical knowledge of ASL, on the grounds that almost a third of the items could be guessed by non-signers. Secondly, some English words could not be translated by just one sign, e.g. 'furniture' in English is a two-sign compound in BSL: 'TABLE-CHAIR'. The equivalence of these translations is questionable.

Kyle (1990a) included a redeveloped vocabulary test and a range of other assessment techniques in his study. The latter included: informal communication in an interview situation; tests looking at BSL sign order and classifier use; picture description to elicit mean length of utterance and verb morphology; and a sign decomposition task.

Among the overall results, Kyle (1990a) noted the generally low level of sign language ability in the children and also the variability within the group as a whole, with the exception of children from deaf families whose language skills appeared to be amongst the most developed. The majority of the children's knowledge and use of vocabulary increased broadly with age but the same could not be said of other aspects of BSL grammar. Many aspects of grammar were greatly delayed and showed unexpected trends in that some of the younger children were more proficient than the older ones. The results contained such a high degree of variability that no consistent order of difficulty for items could be isolated. The research team concluded that no standardisation was therefore possible.

These findings raise questions about the children used in the study. The variability of performance is perhaps not surprising when we think of the diverse circumstances of the majority of deaf children (as discussed in Chapter 1), e.g. the age at which deafness is identified, when sign language is introduced, the signing skills of the adults to whom deaf children are exposed (teaching staff, parents) etc. One must then address the question: who should constitute the reference population when sign language assessments are developed and standardised? Such assessments will be used in the main for the majority of deaf children who come from hearing families. However, standardising an assessment on such a heterogeneous group presents problems such as those illustrated by Kyle's (1990a) work. Taken as a group, deaf children from hearing families cannot be said to be acquiring sign language in a 'normal' way. Conversely, children from deaf signing families are in a natural language learning environment since they are exposed to BSL language models more consistently and from a young age. In order to develop norm-referenced tests, we would argue that norms of development should be taken from this group. Similarly, use of this group for the standardisation of sign language assessments will provide a benchmark to which the achievements of deaf children from hearing families can be compared.

Kyle (1990a) also reports on difficulties that arose when looking at expressive language samples. In looking at MLU in sign, their findings indicated a rough trend towards longer utterances with increased age; however figures were "well behind what would be the comparable figures for length in words for hearing children". In addition there was wide variation in performance among the 77 children studied. Children from deaf families were in the minority but their performance was noted to be generally superior in all tasks. It may be that with a more homogeneous sample of children, more comparable findings would have been obtained. However, without further research into the calculation and value of MLU in sign, it may be premature to draw further conclusions at this stage.

On the expressive vocabulary task, some children seemed to respond to the testing situation rather unpredictably by describing parts of the picture rather than providing a single sign answer. This resulted in a greater variety of responses than had been expected. In addition, children misarticulated signs, i.e. produced errors in handshape, location or movement, which presented difficulties in scoring. These findings suggest difficulties in interpreting child BSL in comparison to adult BSL. These could arise because of tester inexperience or weaknesses in the test materials. In either case, they reinforce the need for assessment procedures to be carefully piloted.

A problem not referred to by Kyle (1990a) is one that may arise when attempting to use a vocabulary test on a national basis. A feature of BSL is the wide regional variation in sign vocabulary (Sutton-Spence & Woll 1999). In addition, some families generate their own home signs, for example, families with different cultural backgrounds where English signs do not satisfactorily cover the range of terms required (Holmes, personal communication 1997). This can present considerable difficulties when trying to standardise assessment materials on large numbers.

A useful and up-to-date overview of sign language assessment materials (including those under development in the present study) is provided by Haug (2002). Haug makes several relevant observations: as we have already mentioned, most of the research is based on ASL. Although broad principles of assessment can be shared, specific assessments must be adapted and redeveloped for use with other sign languages because of cross-linguistic and consequent developmental differences. When comparing ASL with BSL, despite considerable lexical differences there are sufficient similarities in grammar to allow us to consider some ASL assessment research when developing an assessment of BSL. Nevertheless, it must still be remembered that the way each language assigns meaning to particular grammatical categories may well be different.

Haug notes that many sign language assessments are only to be found in research publications (if published at all) because they have been designed for research purposes rather than for practitioner use. As a result, they often focus in great detail on highly specific features of sign language or require enormous amounts of time for analysis of individual cases. Haug notes that few researchers report the psychometric properties of the tests they use; in some cases this is because the tests are in development and have been used on small numbers of subjects; however this is a clear obstacle to their more widespread use. He notes further the age range covered by most existing tests to be 6 years and above. This is unacceptably high for practitioners who wish to monitor deaf children's language development from a much earlier age. Finally, Haug criticises the failure of many tests to address 'communicative competence'. This is clearly an important aspect to remember when assessing any child's language development; however it may be an issue particularly close to the heart of practitioners as opposed to researchers. Nevertheless, many tests of spoken language development may be criticised on the same grounds and, as a result (see Chapter 2), no test should be used as an isolated measure. Testers must always consider test results in the light of their knowledge about individual children and ideally supplement test scores with a variety of additional sources of information.

In conclusion, Haug states that there are few assessments of sign language which have been designed for practitioners, or which can be readily adapted for practitioner use in their current form, and about which we have sufficient psychometric and normative information.

We continue now with a more detailed look at several of the existing measures, beginning with test batteries which include specifically designed tasks and materials and ending with checklist approaches based on more spontaneous samples of communication.

The most extensive test battery of sign language reported in the research literature is *The Test Battery for American Sign Language Morphology & Syntax* (Supalla *et al.* in press). Designed to compare native adult signers with late learners of ASL on a variety of aspects of ASL morphology and syntax, the test has also been used with a small number of deaf children. Unfortunately, no normative data is available and the battery is lengthy, taking two hours to administer to an adult. In addition, many sub-tests are not appropriate for use with very young children because of their abstract nature, e.g. using invented signs. Areas of ASL included in the test are reported as successful in distinguishing between early vs. late learners of ASL. As many children learning BSL come to it later than is optimal, these should form part of the content of the BSL assessment in the current study.

The ASL Assessment Instrument (ASLAI, Hoffmeister *et al.* 1990) comprises expressive and receptive tasks using pictorial and video materials. Expressive tasks assess classifiers (spatial arrangement, verbs of motion, plurals), complex sentences (co-ordination, subordination, relative clauses, embedded structures and topicalisation) and narrative production. Unfortunately, these tasks are highly time-consuming to analyse and as a result, psychometric analysis has only been carried out on the narrative tasks to date. Receptive tasks look at semantics (synonyms and antonyms), plurals and arrangement and complex sentences (as in the expressive tasks) using a multiple-choice structure. As such, they are relatively quick to administer and score. The tests have been used with over 200 deaf children aged 4-16 years and preliminary reliability and validity analysis on some of the sub-tests is underway but not yet published.

Prinz *et al.* (1994) report the development and use of *The Test of ASL* (TASL) with 155 deaf children aged 8-15 years. In common with the above two measures, this test includes a selection of sub-tests investigating production and comprehension of grammatical structures, narratives and time and map markers. Validity was considered initially by asking a number of ASL linguists to provide feedback on early versions of the test; however further evidence of validity or reliability has not been reported.

The ASL Proficiency Assessment (ASL-PA, Maller *et al.* 1999) moves away from specific tasks to a checklist approach based on spontaneous communication. The assessment was developed initially on four native signers and is intended for use with non-native signers aged 6-12 years.

Norms are based on 80 children within this age range who have had a variety of ASL experience: from deaf parents; from hearing parents where ASL was used at school and from hearing parents where MCE was used at school. The test assesses expressive language only and comprises eight morpho-syntactic structures selected from empirical studies in the research literature and ordered in terms of acquisition. Three ten-minute language samples are video-recorded: an adult-child interview (adults must be native signers), peer interaction, and storytelling, thus sampling a range of highly valid communication settings. Analysis identifies the presence of the target feature in the sample, but not its accuracy or frequency of occurrence. Coding takes between one and two hours to complete.

Children with different linguistic experience were found to perform significantly differently, which is taken to be a measure of the construct validity of the test. Evidence of concurrent validity has been collected but not published to date. The reliability (internal consistency and decision consistency) of the procedure is reported to be high. This test appears to be relevant to the needs of practitioners; although it was not developed with them in mind, its validity appears high in that it samples a range of representative communication contexts. Disadvantages include the skill and training required by testers in its use and the time needed for analysis. From the UK survey described above (Herman 1998a), it is likely that considerable training would be needed for testers to become proficient in using such a measure.

The *Signed Language Development Checklist* (Mounty 1994) is designed to assess a broad range of aspects of communication ability in ASL and is intended for an age group ranging from 2;05-14 years. Use of the checklist is based on unstructured observation; however only pilot studies have been carried out to date and evidence of reliability and validity has not yet been reported.

The *Sign Communication Proficiency Interview* (SCPI, Caccamise & Newell 1995, 1999), as its name suggests, assesses sign language skills in ASL in an interview situation and appears to be most appropriate to older deaf children and adults. The interview is video-recorded and evaluated by trained raters who assign the subject to a level using a rating scale based on highly skilled native or native-like signers. Evidence of validity has been collected based on comparisons of SCPI performance of signing college instructors and student evaluations of communication ease (Long *et al.* 1998). Rater reliability data collection is currently underway.

The MacArthur Communicative Development Inventory (Fenson *et al.* 1994) looks at lexical development using a checklist of early vocabulary completed through parental interview. The original checklist has been adapted to measure development in ASL (Spitler *et al.* 1992) and a BSL version is currently under development (Harris, personal communication 2001). Advantages of this format are its applicability to very young children, its validity and its ability to overcome problems of regional variation in lexical items. However the reliability of this measure in ASL has not to date been ascertained.

3.4 Summary

Much research into sign language acquisition is based on single case studies or small groups of children acquiring ASL. Considering the variability present among young children developing language, further research is needed which looks at larger numbers and at sign languages other than ASL. It is also important to take account of the diversity of input provided by parents and others in the child's language environment.

Practitioners require assessments to be norm-referenced. Kyle (1990a) attempted to derive norms of BSL development on a variety of language measures in a large UK study. However, he found unpredictable patterns of sign language development in the majority of deaf children in his sample. An exception was the small number of children from deaf families who displayed higher levels of BSL skill on all measures and more uniform progression. This has implications for the selection of subjects when developing sign language assessments. Although assessments are required for all deaf children, i.e. those from both deaf and hearing families, the population as a whole is highly heterogeneous. Developing and standardising a language measure on a sample taken from this population is likely to produce 'norms' which demonstrate no natural progression with age and which contain unacceptably high degrees of error. A solution is to select a more homogeneous sub-group, children exposed to BSL from birth by deaf parents. Norms derived from this group who are acquiring BSL in the most natural way can provide the benchmark against which other deaf children's BSL development can be compared.

From the research literature, we now have a broad timetable of stages of development among native signers; however, this needs to be validated by empirical research that additionally investigates the development of specific features in BSL. Nevertheless, the range of research to date provides a sufficient basis for the initial development of BSL assessment materials. Some sign language assessment measures are available, albeit largely unpublished. However, most materials have been developed for the microanalysis of isolated aspects of sign language and are based on detailed analyses of large corpora of data. As such, they are of limited value to practitioners who are more interested in broad measures of BSL attainment.

Finally, practitioners require assessments to be economical on time and easy to use. This presents difficulties as soon as an assessment is based on children's productive signing. This form of assessment requires the highest level of tester skill - familiarity with patterns of normal language acquisition, knowledge of sign linguistics and training in transcription or coding – and is also the most time consuming. The alternative is to focus on a test of comprehension that includes a range of BSL morpho-syntactic structures, is quick to administer and is norm-referenced. In Chapter 5, we consider the methodology involved in pursuing this objective.

4

Research Aims

4.1 Aims

The two broad aims of this study are:

- to develop a test of BSL grammar comprehension;
- through use of the test, to explore the BSL development of different subgroups of children who are BSL users.

Each of these aims is described more fully in sections 4.2 and 4.3. Reference is made to the chapters in which the research related to these aims is discussed.

4.2 Research aims relating to test development

In the early stages of developing the BSL measure (Chapter 5), we consider a series of questions, the answers to which determine the type of test and its purpose:

- what is the test for?
- what aspects of BSL require assessment?
- who will use the test?
- which sample of children should be included in developing and standardising the test?
- what subject variables must be considered?
- what is the intended age range?
- what materials and methods are appropriate?

We also consider the criteria that the test must satisfy, as discussed in Chapter 2 (these are revisited following the pilot work outlined in Chapter 5, and further explored in Chapters 6, 7 & 8). The test is required to:

- fulfil psychometric requirements of validity and reliability;
- provide useful quantitative and qualitative information about deaf children's BSL development against the benchmark of 'normal BSL development';
- provide assessors with clear information about the level of skill required to use the test and interpret test results;
- place demands on assessors which are reasonable in terms of the time needed to complete the test and the skills required to administer the test.

From this, we can summarise the research aims relating to test development as follows:

- to develop a valid and reliable test of BSL development;
- to develop a norm-referenced test;
- to develop a test which will be usable by practitioners.

4.2.1 Addressing test validity and reliability

Face validity is addressed through a broad consideration of the content of the test and the approach taken to test development (Chapter 5). Initial test development is based on native signers, with consideration of the language needs of the wider population of deaf children who use BSL (Chapters 5 & 6). Test results obtained from different samples of deaf children are compared (Chapters 6, 7 & 8) and in-depth case studies used (Chapter 9) to revisit the issue of face validity.

Content validity is addressed through careful selection of test items (Chapter 5). Items are developed from a broad range of morpho-syntactic features, based on the evidence available in the research literature (see Chapter 3.2.4).

Concurrent validity is considered by comparing the results of the BSL assessment with other measures. For data collected following release of the test, tester ratings of children's language abilities are related to BSL test scores and, for a small number of subjects, reading scores are correlated with BSL test scores (Chapter 8.3.5).

Construct validity is a particularly difficult area to address as no other measures of BSL have been developed (see Chapter 3.3). During the pilot phase of testing, the results of a questionnaire developed to gauge parents' and teachers' views on children's language development are compared with BSL test scores (Chapter 6). The main alternative to investigating construct validity, in the absence of other measures, is to explore group differences on the test. To this end, the scores of children with different experiences of BSL are compared (Chapters 7 & 8).

In order to address test reliability, *inter-scorer reliability* and the *internal consistency of the test* are analysed. Scores of different testers are compared to investigate inter-scorer reliability; test items are analysed using a split-half analysis (Chapter 6). *Test-retest reliability* is investigated at both the pilot and standardisation phases by re-testing a proportion of children and comparing the results obtained (Chapters 6 & 7).

4.2.2 Development of norms

In order to develop a norm-referenced test, sampling of subjects must be carefully considered. Subjects' ages (3-11 years) and exposure to BSL (native/non-native and type of educational programme) are the key selection criteria.

During the pre-pilot phase of test development (Chapter 5), children from deaf and hearing families are included. As the test is intended for use with deaf children from hearing families, it is important to include them at this stage.

In the pilot phase (Chapter 6), exposure to BSL is restricted to subjects acquiring BSL in deaf families. This is to reduce the variability of results and ensure patterns of normal development are obtained.

For the purposes of test standardisation, larger numbers of children are required. Therefore, the selection criteria are expanded (Chapter 7) to include children from hearing families who have been exposed to BSL early (below the age of 5 years) through either an established bilingual (BSL/English) educational programme or a Total Communication (TC) school programme (see Chapter 1.4 for definitions of these terms).

In order to develop norms, large numbers are needed to reduce variability; in addition, the numbers should represent a high proportion of the target population (see Chapter 2). At the time of test development, the population of children acquiring BSL under optimal conditions was small. Although the number of children used to standardise the test is small, it represents a high proportion of this total population.

4.2.3 Development of a user-friendly approach to assessment

In order to develop a user-friendly assessment tool, methodological decisions concerning test administration, materials and methods, length of test and scoring procedure are made (see Chapters 5 & 6).

4.3 Research aim relating to the test performance of different subgroups of children who are BSL users

If the research aim of achieving a valid test of BSL is achieved, u of the test provides an opportunity to explore the BSL development of different subgroups of children who are BSL users. The different subgroups and the research questions they raise are presented below.

4.3.1 Comparing deaf and hearing children in deaf families

Research on children in deaf families where a sign language is the home language has not to date differentiated between language acquisition patterns of deaf and hearing children (Chapter 3). However, these children do have different experiences of language acquisition: hearing children are generally in an accessible bilingual environment from the outset, whereas deaf children are likely to be able to access BSL more easily than spoken English input, therefore a difference in BSL acquisition may be anticipated. This forms the basis for research question 1 below (addressed in Chapters 6 & 7):

Question 1

To what extent does BSL acquisition among children in deaf families vary dependent on child hearing status?

4.3.2 Comparing deaf children according to their experience of BSL

In Chapter 1 we considered the variables affecting spoken language development in deaf children that have prompted differing approaches to their education. The most recent of these, bilingualism, raises new issues relating to language development in a sign language, particularly when BSL is not the home language. The question arises whether or not such a method is as effective for deaf children of hearing parents in the acquisition of a sign language, compared to the more normal process of language acquisition from deaf parents (addressed in Chapter 7).

Question 2

How does BSL acquisition compare between children in hearing families on established bilingual educational programmes and children in deaf families?

A further question is whether or not bilingual education leads to better achievements in BSL development compared to the more traditional TC approach. This issue is encapsulated by research question 3 (addressed in Chapter 7):

Question 3

How does BSL acquisition compare among deaf children in hearing families according to their experience of BSL via bilingual or total communication educational programmes?

4.3.3 Comparing hearing children in deaf families in both of their languages

Use of the BSL comprehension assessment alongside measures of spoken English with hearing children in deaf families provides an opportunity to explore the language development of these children in both of their languages. This leads to the following research question (addressed in Chapter 7):

Question 4

How does the development of understanding in BSL and spoken English compare among hearing children in deaf families?

4.3.4 Comparing the standardisation sample with an unselected sample of deaf children

Finally, use of the test on an unselected sample of children from the deaf population (Chapter 8) allows us to revisit the issue of test validity by making comparisons with the standardisation sample. A significant difference between sample scores, with depressed scores occurring among the unselected sample, will validate subject selection for the standardisation sample.

Question 5

How do the BSL scores of a sample of children from the wider deaf population compare with those of the standardisation sample?

In summary, the current study seeks firstly to develop a measure of BSL acquisition and secondly to use this instrument to chart the development of BSL acquisition in relation to various factors such as hearing status, educational background through an exploration of the test performance of subgroups of children who are BSL users.

5
Methodological Issues in Test Design

In this chapter we present the rationale for decisions made in the early stages in the study regarding the type of test required. Conflicting issues surrounding the skills of those involved in carrying out the research and future users of a test of BSL development are discussed. In addition, we outline the decision-making process regarding materials and methods to be employed, the rationale for selecting subjects at different stages of test development and the procedures and results of pre-pilot trials that served to define the shape of the final assessment tool. We conclude this chapter with the implications drawn from the pre-pilot trials for the next stage in test development: the pilot study.

5.1 Test design

Several factors were influential in making decisions about the design of test required to assess BSL development. Questions to be addressed before commencing pre-pilot trials included the following and each is discussed more fully below:

- what is the test for?
- what aspects of BSL require assessment?
- who will the test be used by?
- which sample of children should be included in developing and standardising the test?
- what subject variables must be considered?
- what is the intended age range?
- what materials and methods are appropriate?

5.1.1 Purpose of the proposed test

The extent to which the test achieves its purpose can be considered by evaluating its content and relevance to the target population, which is also a measure of the face validity of the test (see Chapter 2.4). The test to be developed is intended for use with children acquiring BSL. This includes both deaf and hearing children in deaf families and deaf children in hearing families. Deaf children in hearing families who use BSL should be considered as being in at least two main sub-groups:

(i) children exposed to BSL on bilingual educational programmes;
(ii) children on other types of educational programmes who use BSL, developed either through peer-group contact or other external input.

With reference to group (i) above, all these children require regular monitoring to ensure that the bilingual programme is achieving its aim and to identify individuals who are failing to develop BSL adequately. For children in group (ii), the assessment can be used to answer questions concerning children's preferred communication mode, with implications for their educational needs.

5.1.2 Users of the test

In a survey of current approaches to BSL assessment (Herman 1998a), it was noted that few professionals involved in assessing BSL development felt sufficiently qualified to fulfil their role adequately. Many assessors are hearing with variable levels of BSL fluency and little background in sign linguistics or sign language development. This factor highlighted an urgent need for training in assessment; however it also meant that, at least in the short term, a test that placed high demands on the skills of assessors in these areas would be inappropriate and might lead to unreliable results being obtained. However, developing a test that placed less emphasis on users might convey the impression that skills and knowledge related to BSL assessment are not essential. Furthermore there was an urgent need for a standardised test that would yield information about deaf children's BSL development. Test design proceeded with the underlying premise that a standardised test of BSL development should fulfil several criteria. Crucially, the test should not be viewed in isolation, but be part of an assessment process. The test itself should:

(i) fulfill the psychometric requirements discussed in 2.4;

(ii) provide useful quantitative and qualitative information about deaf children's BSL development against the benchmark of 'normal BSL development';

(iii) provide assessors with clear information about the level of skill required to use the test and interpret test results;

(iv) place demands on assessors which are reasonable in terms of the time needed to complete the test and the skills required to administer the test;

(v) incorporate training in use of the measure through a test manual and training workshops; at workshops, collaboration between key professionals with mutually beneficial skills to be encouraged and the need for further training in areas related to BSL assessment to be raised.

5.1.3 Which aspects of BSL to assess

The test is intended to measure language development in BSL. However, which aspects of BSL should be considered indicators of language development in BSL? Respondents in the UK survey (Herman 1998a) suggested that many different aspects of BSL require assessment and that assessment should ideally be norm-referenced and easy to administer. In the context of the present study, it was considered impossible to design a single test to cover all areas of linguistic competence. Therefore the decision was taken to focus the assessment on morphology and syntax.

The development of morpho-syntax is a predominant feature of the language acquisition process in the early preschool and school years and mastery is essential if native fluency in BSL is to be achieved. Furthermore, decisions regarding test content (which features of syntax and morphology to include) can be guided by the available research into sign language acquisition in this area. However, the findings from such a test can only represent one dimension of a child's language abilities. Test results should therefore be viewed as providing a contribution towards the wider process of assessment of a deaf child's sign language development.

From the literature on sign language acquisition, a profile of expressive language development would be relatively easy to compile. However, in practice, the difficulties of collecting a representative sample (see Chapter 2, section 2.5) and the availability of time and skills required for transcription are prohibitive. Furthermore, such a detailed analysis is inappropriate as a screening measure.

The assessment of vocabulary acquisition in BSL has also been problematic (see Chapter 3, section 3.2); however, receptive language skills are frequently neglected in the literature on sign language development, despite their importance in indicating language potential. A test of comprehension of morpho-syntax was therefore selected for development. Norms of development of a range of syntactic and morphological structures are available in the research literature to assist with test development and measurement of validity. Furthermore, a comprehension measure may be relatively straightforward to administer, e.g. children's comprehension of signed instructions may be analyzed by non-verbal responses such as the manipulation of toys or identification of pictures.

In developing test items, it was important for content validity that as broad a range of morpho-syntactic features as possible should be included. However, some features of BSL lend themselves more easily to testing than others. For example, assessment of interrogatives can generally only be measured when either the child asks a question or else provides the correct answer to a question. In practice, it is difficult to engineer a formal test situation where the child must produce a target question; if comprehension is being assessed, any expressive difficulty or reluctance to provide an answer on the part of the child can compromise assessment findings. Certain features such as interrogatives, although important, were therefore excluded from the test.

Some features of sign language were felt to merit greater weighting in the test because of their importance in discriminating between children with different levels of language competence. Research has indicated that spatial verb morphology (see Chapter 3, section 3.1.3).) presents problems to late learners. Since the test will be used with many such children, a decision was made to devote a significant proportion of the test content to spatial verb morphology.

5.1.4 Materials and methods

Of particular relevance when testing young children is the overall appeal of a test; that is, materials should be appropriate to the ages, backgrounds and interests of the children for whom it is intended. Use of toys has advantages in that toys appeal to young children and can make the test situation less formal. A potential disadvantage is that the child may become too engaged with the toys. Problems may also arise in the need to continually re-arrange the toys appropriately and the child in relation to them; this may be particularly crucial in certain areas of assessment, e.g. spatial location. A disadvantage is that it may extend the time needed for testing. Furthermore, use of toys with older children may not be age-appropriate, necessitating development of a different test format for different age groups.

Use of pictorial stimuli avoids the above pitfalls; however care must be taken that pictures are easily recognisable and appealing to the age range of subjects. Line drawings are more abstract than 3D stimuli and may therefore be less appropriate for use with very young children. Alternatives include use of good quality colour pictures or photographs. Whichever approach is chosen, a range of effective distracter items must be available to reduce guesswork. When using pictures, the location of the target picture on the page should also be randomised.

Regardless of test format, where grammatical competence is being investigated, failure on the test due to other factors must be minimised, e.g. unfamiliarity with vocabulary, excessive memory load, fatigue effects due to the length of the test procedure, etc. The test should take account of the attention span of children of different ages in that testing time should ideally be brief. This may be achieved in two ways: firstly, the total number of items must be limited; secondly, where items are ordered developmentally, older and more able children may enter the test at a higher level, and younger children can stop before reaching the end once they have failed a predetermined number of items, thereby shortening the time needed for the test for different age groups. Certain tests order items according to grammatical category, e.g. Test for the Reception of Grammar (TROG, Bishop 1989), making it easy to link assessment with intervention. However, there is no evidence that children acquire grammatical categories sequentially but rather that there is a developmental sequence within each grammatical category.

During the early stages of the study, ordering of items was estimated and testing time was carefully controlled. Different sub-tests were administered on different occasions if this was felt to be in the best interest of the children. We return to considerations of ordering of test items and discontinuity rules later in the study.

5.1.5 Which children should be included in test development and standardisation?

Although a test of BSL development is needed for deaf children from hearing families, there are difficulties in developing and standardising an assessment on this group because of their known variability of performance on language measures (see Chapters 1 and 3). Ideally, a more homogeneous population should be used, that of children from native signing backgrounds. These children receive consistent input in BSL from birth and are thus in a position to acquire BSL naturally. The sign language achievements of these children can provide the benchmark for comparison of deaf children from hearing families. However only 5% of deaf children are born into deaf families; therefore numbers are small. The reasons for selecting children at each phase in test development and standardisation were therefore carefully considered.

In the *pre-pilot phase* of test development, deaf and hearing children from deaf and hearing families were included. This was important, as future use of the test would include all of these children. Materials and methods would need to be appropriate for the full range of children. During the *pilot phase*, because of the need to establish differences between age groups and look at individual test items, only children from deaf families were included. To increase numbers from what is a highly limited population, hearing children from deaf families were also tested; however their scores were analysed separately to investigate whether their BSL skills were comparable to those of the deaf children.

The purpose of standardising a test is to set up norms whereby an individual subject's score can be compared with that of the appropriate standardisation population (Kline 2000). In *test standardisation*, consideration of the size and representativeness of the sample is crucial. Although ideally (e.g. in psychological testing) a sample size of several hundred is required, when testing special populations this is rarely achievable. However, what is important is that the size of the sample represents a significant proportion of the total population. Problems with small sample sizes do however include increased likelihood of error.

To achieve the required numbers, selected deaf children from hearing families were added to the sample. These children were identified by teachers using the following criteria:

i) children for whom BSL was a preferred first language *and*
ii) where BSL was introduced from an early age by consistent exposure to fluent language models through an established bilingual educational programme *or*
iii) where BSL was introduced from an early age, but exposure was less consistent through a TC educational programme.

Current research indicates that, where consistent exposure to sign language is provided via fluent language models before the age of 5 years, native-like acquisition of signing skills may be achieved (Mayberry 1993). Analyzing scores separately according to the selection criteria allowed for a comparison between these children and children in deaf families.

5.1.6 Age range

Tests of sign language development reviewed in 3.3.2 have been developed for a variety of purposes and for children within a range of ages. The purpose of developing an assessment in the present context has been described above. Because of the importance of the early years to language acquisition, it was felt that a test that started at as young an age as possible was preferable. The age of 3 years was selected as being a stage in development when a child can normally be expected to comply with the requirements of a formal test procedure. It is also from around this age that children's syntactic and morphological development progresses (see Chapter 3.2.4). Although the rate of language is fastest in the earliest years, syntax and morphology continues to develop during the primary school years. The age range of the test was therefore set between 3 – 11 years.

5.1.7 Cognitive abilities

There has been debate in the research literature concerning the cognitive abilities of deaf children. There has been some suggestion that children in deaf families achieve higher performance test scores than children in hearing families (Marschark 1993). This may be related to the original cause of deafness, e.g. deafness following meningitis may be accompanied by other neurological damage. It was therefore considered important to collect information on children's cognitive abilities, particularly when comparing sub-groups of deaf children. During the standardisation phase, non-verbal performance was assessed formally using sub-tests from the SON (Snijders *et al.* 1989). In addition, parents and teachers were specifically asked whether children had any known additional difficulties that might affect their performance. Such children were excluded from testing.

5.1.8 Section summary

A sign language proficiency test was considered appropriate to achieve the intended purpose and to meet requirements of time economy. Such a test allows routine assessment of large numbers of children by testers. Standard scores should identify children falling significantly below the norm for their age, indicating the need for more in-depth assessment.

Organisation of test items developmentally in order of difficulty allows for the identification of patterns of errors, which can be pursued in later investigations of children experiencing difficulties as measured by the test. In addition, careful consideration must be given to the selection of children on whom the test is developed and standardised.

5.2 Pre-pilot trial 1

5.2.1 Aims

The aims of the first pre-pilot trial were:

- to investigate the most appropriate methods for measuring comprehension of syntactic and morphological aspects of BSL;
- to consider the selection of vocabulary to be used in the test.

To achieve these aims, a number of test items were developed to assess different aspects of BSL grammar.

5.2.2 Subjects

Fourteen deaf and hearing children from deaf and hearing families were involved. Ten of the deaf children all attended the same school for the deaf in the south west of England that was moving towards a bilingual policy and so employed trained deaf support staff with fluent BSL skills. The children were selected by these staff as 'good BSL users', i.e. children with no identified difficulties in their language development. The remainder of the sample lived in the London area: 2 deaf children were in hearing or oral deaf schools and 2 hearing children attended a hearing nursery. There were 8 girls and 6 boys, ranging in age from 2 years 9 months (2;09) to 11;00, mean age 7;04 (see Appendix 5.1 for subject details).

5.2.2 Materials

Toy tests used large doll sized and real sized equipment or miniature (dolls house) sized equipment. Picture tests used unambiguous colour line drawings comparable with those found in books for children from 3 years of age. Pictures were sized to fit 3 or 4 alternatives on an A4 page (landscape orientation). Drawings were kept in plastic files in a ring folder for ease of presentation.

Alternatives were provided in all tests to ensure that correct responses were not due to chance. For example, in toy tests, alternative spatial locations were indicated as part of a warm-up activity and a choice of toys was provided. For the picture tests, distracter pictures depicted syntactic, lexical or phonological alternatives. An example of each is presented below:

BSL Target	**Distracter**	**Rationale**
ONE TEDDY	GROUP-OF-THREE TEDDIES	Syntactic alternative
BABY SLEEP	BABY SIT	Lexical alternative
CAR-ROW ROW ROW	BOOK-BOOK-BOOK	Phonological alternative (same handshape, different orientation)

5.2.4 Procedure

A number of test items were drawn up based on the timetable of normal sign language development. Test items that were expected to appear earliest were developed to be most appropriate for the youngest children. Depending on the age of child and construction to be tested, either toy or picture tests were devised. In addition, to compare testing with toys and pictures, some aspects of the test were presented using both methods. Familiarity with the vocabulary used was also assessed. Forty-two items of vocabulary familiar to young children were randomly allocated to either a receptive or expressive mode of assessment.

All testers were themselves deaf and children were tested in their schools or nurseries. On some occasions, teaching staff observed the test sessions, however it was ensured that the tester established a rapport using BSL with each child before commencing testing in order to ensure children were aware of the linguistic focus of the session. Testers were carefully briefed regarding the need for a standard presentation of test items. A written English gloss of each target word or sentence was provided. Testers began with a short warm-up session that included an explanation of the tasks; this was followed by the presentation of test items. Testers were trained to give feedback which motivated children to comply but which did not reveal information about the child's success or failure on individual test items. All sessions were video-recorded for subsequent analysis. Sessions took place either in school or in the children's homes.

Testing vocabulary: A core vocabulary was selected which was considered to be familiar to children within the age range of the test. In view of future users of the test learning BSL largely outside the home, consideration was also given to potential vocabulary limitations and regional variation in BSL vocabulary.

Vocabulary was assessed by picture naming or asking children to identify the tester's sign from a choice of 4 pictures. Knowledge of verbs was assessed similarly in subject-verb or verb-object constructions. Knowledge of the 33 nouns and 9 verbs included in subsequent testing was assessed in this way, 21 tested receptively and 21 tested expressively (see Appendix 5.2 for vocabulary list and method of testing).

Knowledge of modal verbs was not assessed in vocabulary testing as the deaf researchers involved at this stage did not consider them to be subject to regional variation. Noun-verb pairs (see below) were only checked in the noun form.

Recording responses: Responses to the vocabulary assessment and in all subsequent testing were initially recorded as a straightforward pass or fail. Fails were further analyzed as 'no response' or 'alternative response', in which case they were transcribed by use of an English gloss or an adapted notation. Fail responses were also noted because of the implications for performance on test items including these signs.

Testing spatial location: To assess spatial location, a hide-and-seek test was developed using a teddy and appropriately sized bed, cupboard, table, chair and blanket. The child was required to hide one object in/on/under/ beside/between the other objects. A similar test was administered using pictures to compare methods of testing. Concepts of spatial location known to be acquired earlier and those that develop later were included (see Table 5.1 below).

Table 5.1: Spatial location items included in pre-pilot trial 1

Spatial location (toys)	Spatial location (pictures)
TEDDY CUPBOARD IN	SHOE BED UNDER
TEDDY BED UNDER	TABLE CUP UNDER
TEDDY CUPBOARD ON-TOP	TABLE BALL ON
TEDDY TABLE UNDER	BOX TEDDY IN
TEDDY CUPBOARD BESIDE	CUPBOARD CAT ON
TEDDY BED BEHIND	BOX GIRL IN
BLANKET-ON-FLOOR TEDDY UNDER	CHAIR DOG IN-FRONT
CHAIR TABLE TEDDY BETWEEN	WALL MAN BEHIND

Testing agreement verbs and spatial verbs including handling classifiers: These were assessed using a tea set, involving large doll sized objects and real sized plastic food items (cup, plate, spoon, tea, milk, apple, egg, cake, bread), a doll, monkey and teddy. The child was required to hand the appropriate object or food item to the toy (see Table 5.2).

Table 5.2: Agreement and spatial verb items included in phase 1 of pre-pilot testing (toys)

APPLE TEDDY GIVE	MILK POUR-TO DOLLY
TEA POUR-TO TEDDY	EGG MONKEY FEED-TO
SPOON TEDDY GIVE	DOLLY PLATE TAKE-FROM
CAKE TEDDY FEED-TO	BREAD MONKEY GIVE

Testing indexing: This was assessed starting with 2 and increasing to 4 pictures on a page. For each test item, the tester presented the signs depicted on the page and set up a spatial locus for each before asking the child to identify the picture corresponding to the spatial locus specified by an index point (see Table 5.3).

Table 5.3: Indexing items included in pre-pilot trial 1 (pictures)

TABLE STAND-ON
WASH-CAR
MAN DRIVE
DOG SLEEP

Testing negation, noun-verb agreement, number/distribution, size and shape specifiers: These were assessed using a picture pointing response to select which of 3 or 4 pictures most accurately represented the signed instruction (see Table 5.4).

Table 5.4: Other items included in pre-pilot trial 1 (pictures)

Negation	Number/distribution
NO HAT	APPLES LOTS
NOT-SLEEP	PEOPLE QUEUE
CAN'T-REACH	CUPS ROWS
NOT-LIKE-EAT	SHOES ROWS
Size and shape specifiers	**Noun-verb agreement**
SMALL	BOOK/READ
TALL	FOOD/EAT
THIN	CUP/DRINK
LONG	SCISSORS/CUT
LONG-THIN	PEN/WRITE
SMALL-BALL	BAT/HIT
BIG-TABLE	CAR/DRIVE
THIN-PERSON	BIKE/RIDE

Scoring: Scoring was on a pass/fail basis. Where errors occurred, the tester noted on the score-sheet the nature of the error for later analysis.

5.2.5 Results and discussion

Vocabulary test: Nine subjects completed the vocabulary test. Group results are presented in Table 5.5 below. Overall, children demonstrated good knowledge of the test vocabulary. There was no advantage for older children over the younger members of the group, suggesting that the selected vocabulary was appropriate to the age of the children. It should be noted that no children below the age of 5 were included, so familiarity of vocabulary for younger children cannot be confirmed.

Table 5.5: Group results of vocabulary test in pre-pilot trial 1

Vocabulary item tested receptively	Passes (n=9)	Vocabulary item tested expressively	Passes (n=9)
APPLE	9	BAT*	9
BALL	9	BLANKET*	5
BED	8	BREAD	9
BIKE	9	BOY	7
BOX	9	CAT*	9
CAR	9	CHAIR	9
CAKE	9	DOG	9
CUP	9	DOLL*	9
CUPBOARD	9	EGG	9
HAT	9	GIRL	7
HOUSE	9	MILK	8
MAN	9	MONKEY	9
PEN	9	PLATE	9
SCISSORS	9	SHOE	9
SPOON	9	TEA	9
TABLE	9	TEDDY	9
PERSON-STANDING	9	WALL	4
PERSON-HIDE	7	PERSON-SLEEPING	9
PERSON-WALKING	9	PERSON-SITTING	7
PERSON-EATING	9	PERSON-FEEDING-BABY	3
PERSON-WASHING-CAR	9	PERSON-POURING-TEA	6
TOTALS	186/189		164/189

** indicates three or more regional variants and/or incorrect responses produced*

A noticeable difference emerged depending on whether vocabulary was tested expressively or receptively. Vocabulary items tested receptively were all correctly identified, except for three (186/189). Where children were required to name pictures to demonstrate knowledge of the sign, 8 nil responses, 17 incorrect responses and 164 correct responses out of 189 were obtained. Incorrect responses resulted when children failed to correctly produce the target and instead described some other aspect of the picture. When subsequently tested on those items receptively, almost all children identified the correct picture from the tester's sign. This suggests a difficulty with identification of the feature of the picture to be named, rather than a difference between the words selected for the expressive and receptive test format, and is particularly evident on pictures used to elicit verbs. Of the 164 correct responses to items assessed expressively, a number of items were produced with regional variants. Items that produced three or more variants and/or incorrect responses (indicated in the table by an asterisk) were deemed to be too variable to include in the test and excluded in the next stage of test development. The variability of production for the items tested receptively was not explored at this stage, but is examined during the pilot phase of test development (Chapter 6).

Comprehension tests: The results of the comprehension items organized by linguistic feature are presented in Table 5.6 below. All 14 children co-operated with all aspects of testing; however some of the younger children were unable to complete all of the items because their attention was limited. Certain test items achieved a ceiling pass rate, indicating that they were too easy for those children in the sample who did attempt them. Items testing agreement and spatial verbs were only attempted by the three oldest children and therefore cannot be commented upon at this stage.

Items assessing indexing presented particular problems. Firstly, the nature of the task was different for these items compared to the others. As a result, children needed additional explanations to facilitate their understanding of the task. In addition, the memory load was heavy for these items and some of the younger children were clearly guessing rather than trying to follow the test instructions. A format with reduced memory load and practice items for this section would be required for future testing. Other problems arose with the type of test, toy versus picture, and the presentation of test items. These are discussed further below.

Table 5.6: Group results of comprehension items using toys and pictures included in pre-pilot trial 1

Spatial location (toys)	**Passes/ subjects**	**Spatial location (pictures)**	**Passes/ subjects**
TEDDY CUPBOARD IN	5/6	SHOE BED UNDER	9/11
TEDDY BED UNDER	2/6	TABLE CUP UNDER	10/11
TEDDY CUPBOARD ON-TOP	6/6	TABLE BALL ON	8/11
TEDDY TABLE UNDER	2/6	BOX TEDDY IN	5/11
TEDDY CUPBOARD BESIDE	2/6	CUPBOARD CAT ON	6/11
TEDDY BED BEHIND	2/6	BOX GIRL IN	7/11
BLANKET-ON-FLOOR TEDDY UNDER	0/6	CHAIR DOG IN-FRONT	6/11
CHAIR TABLE TEDDY BETWEEN	1/6	WALL MAN BEHIND	5/11
Agreement verbs (toys)		**Indexing (pictures)**	
APPLE TEDDY GIVE	3/3	TABLE STAND-ON	7/9
BREAD MONKEY GIVE	3/3	WASH-CAR	7/9
SPOON TEDDY GIVE	2/3	MAN DRIVE	5/9
		DOG SLEEP	5/9
Spatial verbs (toys)		**Number/distribution (pictures)**	
MILK POUR-TO DOLLY	1/3	APPLES LOTS	5/9
EGG MONKEY FEED-TO	1/3	PEOPLE QUEUE	7/9
DOLLY PLATE TAKE-FROM	1/3	CUPS ROWS	5/9
TEA POUR-TO TEDDY	2/3	SHOES ROWS	7/9
Size and shape specifiers (pictures)		**Noun-verb agreement (pictures)**	
SMALL	9/9	BOOK/READ	10/10
TALL	8/9	FOOD/EAT	7/10
THIN	6/9	CUP/DRINK	6/10
LONG	9/9	SCISSORS/CUT	7/10
LONG-THIN	9/9	PEN/WRITE	5/10
SMALL-BALL	9/9	BAT/HIT	4/10
BIG-TABLE	9/9	CAR/DRIVE	4/9
THIN-PERSON	6/9	BIKE/RIDE	6/9
Negation (pictures)			
NO HAT	5/10		
NOT-SLEEP	7/10		
CAN'T-REACH	8/10		
NOT-LIKE-EAT	10/10		

Toy tests: Only the six youngest children completed the toy tests. A problem that arose with 3 of the children was the time needed to complete all items. This was partly because the children wanted to explore the toys and were reluctant to follow an external agenda. It was also necessary for the tester to set up specific arrangements of the toys in between items for presentation to be standardised. This was a particular issue with items assessing spatial location as the prior arrangement of toys could have conveyed an advantage. Care in rearranging toys added to the time needed and, with even younger children, would present a considerable disadvantage to this method of testing.

Picture tests: Eleven children completed the picture tests. In the picture tests, a choice of three or four drawings was provided. On pages containing only three pictures, these were arranged such that a space was left for the missing fourth picture. Where this occurred, children became confused, thinking that a picture had fallen off the page. They also occasionally pointed to the empty space by way of response. This may have been because they did not understand the test item and could not identify what they perceived to be a correct response from among the existing pictures. This is clearly an undesirable outcome and subsequently all pictures were equally spaced to prevent this from occurring.

Presentation: In reviewing the videos of the test sessions it became apparent that, despite careful practice, error had been introduced by testers varying the test instructions between test sessions. This was a major factor in the toy tests, yet it also occurred with the picture tests. To avoid such variation, one identified solution was to present all test items on video. This has a disadvantage in that the format of the test becomes restricted. It was felt that such a style of presentation would be more suited to a picture test than a toy test. In addition, very young children may not respond to a tester who is on video. This was a focus of the next stage of pre-pilot testing.

5.3 Pre-pilot trial 2

5.3.1 Aims

The aims of the second pre-pilot trial were:

- to trial a video version of selected test items with children as young as 3 years of age;
- to try out an improved layout of pictures.

5.3.2 Subjects

Four deaf children with hearing parents attending a school for the deaf in the London area were included in the second pre-pilot trial. There were 2 girls and 2 boys, aged from 3;06 – 5;10, mean age 4;03 (see Appendix 5.3).

5.3.3 Procedure

A selection of test items used previously and some that were newly developed were pre-recorded onto a Superior Quality VHS videotape by a native signer. The videotape was shown to the children individually by a deaf researcher.

On the video, the test presenter faces the camera with a test booklet on her lap that is similar to that which the child is using. Pauses (approx. 10 seconds) were inserted between test items in the form of fade-outs to allow subjects time to look away from the video in order to respond. The response format was a picture-pointing task using the accompanying test booklet. The subject was presented with each receptive item once only and was required to select the appropriate colour drawing from a choice of 3 or 4 spaced equally on an A4 page. Responses were recorded live by the assessor, as in pre-pilot 1. Each assessment was also video-recorded.

5.3.4 Results and discussion

The results are presented in Table 5.7 below. All children were able to complete the video task. It was necessary to repeat many of the test items for the youngest two children initially in order to convey the nature of the task. Two other children required repetition of the first few items by the tester in order to understand what was required of them, but thereafter were able to complete the task. This suggests that younger children take longer to understand the nature of the video task. This would be helped by including practice items either on the video or presented by the tester before starting the test proper for all children to ensure that they know what is expected of them.

Some of the children looked away from the video before the presenter had finished signing the target instruction. In these circumstances, the deaf researcher rewound the video and showed it a second time. This highlighted the need for the tester to ensure that the child watched the entire test item before looking at the picture booklet.

Table 5.7: Results of video receptive test used in pre-pilot trial 2 (picture tasks)

Linguistic feature	Passes/ subjects	Linguistic feature	Passes/ subjects
Indexing		**Size and shape specifiers**	
WASH-CAR	2/4	SMALL-BALL	3/4
MAN DRIVE	2/4	BIG-TABLE	3/4
DOG SLEEP	2/4	THIN-PERSON	2/4
Number/distribution		**Negation**	
APPLES LOTS	1/4	NO HAT	1/4
PEOPLE QUEUE	2/4	NOT-SLEEP	1/4
CUPS ROWS	3/4	CAN'T-REACH	1/4
SHOES ROWS	1/4	NOT-LIKE-EAT	3/4
Spatial location		**Noun-verb agreement**	
SHOE BED UNDER	2/4	CUP/DRINK	1/4
TABLE CUP UNDER	3/4	SCISSORS/CUT	2/4
TABLE BALL ON	2/4	PEN/WRITE	1/4
BOX TEDDY IN	2/4	CAR/DRIVE	3/4
CUPBOARD CAT ON	1/4	BIKE/RIDE	2/4
BOX GIRL IN	2/4		
CHAIR DOG IN-FRONT	0/4		

With more regular spacing of pictures on the page in the answer booklet, there were no difficulties making a response by selecting one of the pictures.

5.4 Pre-pilot trial 3

Before proceeding with the pilot study proper, one further area was investigated: the response of children with no experience of sign language to the receptive video test. This was to ensure that the measure was assessing BSL and that high scores could not be achieved purely by understanding iconic signs or lip-reading.

5.4.1 Aim

The aim of the third pre-pilot trial was to trial a video version of the test with hearing children who had no prior experience of sign language.

5.4.2 Subjects

Four hearing children ranging in age from 4;05 – 9;05 years (mean age 7;05) were involved. There were 2 girls and 2 boys.

5.4.3 Procedure

Children were shown the video test individually by a hearing tester. They were told to guess which picture the person on the video was talking about. The procedure followed that of pre-pilot trial 2.

5.3.4 Results and discussion

All children attempted all items. Group results are shown in Table 5.8 below. Items where there was 75% accuracy or above were discarded because they seemed to be too easy. This was either because of the iconicity of the signs or because of the lipreadability of the presenter.

5.5 Summary of pre-pilot trials

Test items assessing a variety of linguistic structures in BSL were developed and methods of presenting a receptive language task in BSL using toys and pictures

Table 5.8: Results of video receptive test used in pre-pilot trial 3

Linguistic feature	Passes/ subjects	Linguistic feature	Passes/ subjects
Spatial location		**Noun-verb agreement**	
SHOE BED UNDER	1/ 4	CUP/DRINK	2/ 4
TABLE CUP UNDER	1/ 4	SCISSORS/CUT	4/ 4
TABLE BALL ON	1/ 4	PEN/WRITE	2/ 4
BOX TEDDY IN	2/ 4	CAR/DRIVE	1/ 4
CHAIR DOG IN-FRONT	0/ 4	BIKE/RIDE	3/ 4
Number/distribution		**Negation**	
APPLES LOTS	1/ 4	NO HAT	0/ 4
PEOPLE QUEUE	2/ 4	NOT-SLEEP	1/ 4
CUPS ROWS	3/ 4	CAN'T-REACH	2/ 4
SHOES ROWS	0/ 4	NOT-LIKE-EAT	2/ 4

were trialed with children from deaf and hearing families. The suitability of test vocabulary was also evaluated.

Problems arose in testing children's knowledge of the test vocabulary. Asking children to name pictures resulted in a number of alternative responses in that children either named different aspects of the pictures to those required or else produced regional variants. Although testing comprehension was generally most satisfactory, the extent of regional variation in vocabulary tested in this way could not be determined. Pictures used to assess vocabulary need to be carefully drawn to be as clear and unambiguous as possible. Regional variation in vocabulary needed to be reviewed in the next stage of test development.

The lack of a written form of BSL led to problems in the accuracy of presenting test items. This was most evident in the toy tests where the task of the tester was more onerous. To overcome this, the test was video-recorded and test materials limited to pictures only. The ability of children to respond to an assessment on video was piloted with a different group of younger deaf children. It was found that children as young as three could co-operate with this form of assessment. The need for practice items to be included on the video was noted. In addition, the youngest children took longer to understand the demands of the task and therefore repetition of test items should be built in to the task for this age group if needed. The time taken to complete the test was an important factor, especially for the youngest children. Further testing should either allow for breaks or reduce the number of test items. It was also noted that the tester needed to monitor the child's attention to the video carefully to ensure that the child watches the entire test item before making a response.

Finally, the performance of a small number of hearing children with no prior knowledge of sign language was assessed using the pre-pilot video of the receptive test. Several items were discarded because of the high scores achieved by these subjects. The results of the pre-pilot phase were built into the development of the pilot assessment tool, which is presented in the next chapter.

6

Pilot Study

6.1 Aims

The aims of the pilot study were:

- to evaluate the administration directions and the video format of the test for children from 3 to 11 years
- to confirm the suitability of the test vocabulary
- to confirm the suitability of the test items for the age range of children involved
- to establish an ordering of test items in terms of difficulty; this would allow for discontinuation of testing with younger children during the standardisation phase
- to evaluate the effectiveness of the distracter pictures
- to conduct a test item analysis
- to establish scoring criteria and determine inter-scorer reliability
- to investigate test-retest reliability on a proportion of subjects by repeating the test within a limited time-scale
- to investigate the internal consistency of the test by carrying out a split-half analysis
- to investigate construct validity by comparing test scores with results obtained from parent and teacher questionnaires
- to conduct a preliminary analysis looking for broad age effects
- to conduct a preliminary investigation of the effect of gender differences (see Chapter 2.8.1); this was to identify the existence of gender effects among the pilot sample and to identify whether or not any effects were in keeping with expectations from the literature
- to compare the performance of hearing and deaf children in deaf families
- (see research question 1, Chapter 4.3.1)

6.2 Subjects

The two criteria for inclusion were native signing background (i.e. deaf families) and age. Families were recruited voluntarily by publication of the study in deaf media (Ceefax and deaf magazines), deaf clubs, deaf conferences, schools for the deaf and through personal contacts. 'Deaf families' were defined as families in which at least one parent was a deaf BSL user and BSL was the main language used in the home. This was confirmed by questionnaires completed by families prior to being accepted on the study. Sample letters to families and consent forms are to be found in Appendix 6.1. Questionnaires about family language usage are in Appendix 6.2.

Subjects were 41 children aged between 3;02 and 11;06 years (mean age 7.1 years) from native signing families. There were 28 deaf and 13 hearing children, of whom 20 were girls and 21 were boys. All children were reported by parents and/or teachers as developing normally. Details are provided in Appendix 6.3.

6.3 Procedure

Subjects were assessed on a vocabulary checklist and on a pilot version of the receptive test of morpho-syntax in BSL containing 68 items (see Appendix 6.4). A deaf fluent BSL user explained to the children in BSL what they would be required to do before administering the two tests. All subjects were tested individually and all completed the vocabulary checklist before the receptive test. This was important to confirm the suitability of the test vocabulary in general (e.g. familiarity; regional variation), but also to eliminate individual children from further testing if found to have difficulties at this early stage.

6.3.1 BSL vocabulary checklist

The vocabulary checklist required each child to name 25 individual pictures of objects or people included in the receptive test, producing a total of 28 signs (3 pictures were each used to elicit 2 signs). Scoring involved the tester coding the child's responses according to the regional variant used. It was anticipated that three main variants would be used, coded as:

1 = London variant

2 = Leeds variant

3 = Scottish variant

Where children failed to produce any sign, produced the wrong sign or produced a homesign, this was coded as:

4 = no response, wrong response, homesign

Where a score of 4 was given for a picture, the picture was put aside. At the end of the vocabulary check, the tester presented each of these pictures again, demonstrating the sign that would be used on the video. The pictures were then mixed up with some others and presented in groups of four. The child was then required to identify the picture from the tester's sign to demonstrate recognition of the test sign.

6.3.2 BSL receptive test

The pilot receptive test was presented entirely on video (see Appendix 6.5). On the video, a female test presenter was filmed facing the camera with a test booklet (a colourful A4 ring file) visible on her lap, similar to that which the child used, against a plain colour background. The presenter wore plain clothing and simple jewellery to minimise distractions.

At the start of the video, the presenter introduces herself and explains the test procedure in a child-adjusted register of BSL, i.e. simple language, short phrases with pauses, an animated facial expression. A translation of the BSL text is as follows:

"Hello, my name is Sallie, sign name Sallie. What are we here for? I have a nice book here with pictures, the same as you have, and we are going to look at it together. I'm going to ask you some questions and you have to point to the right picture, OK? But remember, don't look away too quickly, wait until I finish signing, then the picture will fade and you can look at the pictures. Point clearly, then turn over the page and look at the video again. If you get confused, don't worry, just ask for help."

The test then starts with 3 practice items before going on to the main test. The presenter signs each of the test sentences to the camera, taking care not to eye-point to the target picture in the test booklet open in front of her, and pauses as the picture fades to allow the subject time to look away from the video in order to respond before the next sentence is presented. The picture then returns and the next test sentence is presented.

For convenience, test sentences were organised in sections according to the linguistic feature being assessed, e.g. all items testing spatial verbs were grouped together, although it was not expected that they were of equal difficulty. Order of sections was determined by approximatecorrespondence to the timetable of acquisition outlined by Woll (1998). This was to ensure that very young children would not be deterred by encountering too many difficult items early on in testing.

The pilot receptive test contained 68 items investigating comprehension of the following morphological and syntactic features of BSL (see Appendix 6.4):

- two-sign combinations (n=4)
- negation (n=8)
- number/distribution (n=6)
- spatial verb morphology including handling classifiers, body-part classifiers and movement classifiers (n=24)
- size and shape specifiers (n=6)
- noun-verb distinction (n=5)
- verb agreement morphology (n=5)
- indexing (n= 6)
- embedded clauses (n=4)

New test items were added to those developed in the pre-pilot phase of testing (see 5.2 and 5.3) to increase the range of linguistic structures assessed by the test. A further practice item was introduced for the section on indexing as the different nature of this task had presented difficulties in the pre-pilot trials. In addition, using single objects/people rather than people/objects plus actions in this section reduced the memory load.

The response format was a picture-pointing task using the accompanying test booklet. The subject was presented with each receptive item once only and required to select the appropriate colour drawing from a choice of 3 or 4 positioned randomly on an A4 page. Children aged 3;00-3;11 were allowed a single repetition of each test item if the tester felt that this was necessary. In unavoidable circumstances, e.g. when there was an interruption or other distraction during testing, a repetition of the test sentence was allowed. If the child requested a repetition and subsequently changed their response, this was scored as a fail response, whether or not it was correct.

All pictures on each page were numbered 1 to 3 or 1 to 4. The score-sheet contained list of test items and a series of numbers corresponding to the picture arrangement on the page of the test booklet. To record the responses made by an individual child, the scorer circled the number on the score-sheet corresponding to the picture selected by the subject. The correct response was emboldened on the score-sheet, enabling a pass/fail decision to be made and an analysis of fail responses to be carried out at a later date to investigate the value of the distracter pictures.

Practice items were not scored; however performance on the practice items was used to determine whether or not the child had understood what was required to complete the rest of the test. Any errors made on the practice items were fed back to the child and repetitions of the practice item were presented, either live by the tester or by rewinding the video, until the child achieved the correct response.

6.3.3 Reliability

All subjects were video-recorded completing the vocabulary checklist to assist with coding responses and checking reliability of coding. In addition, 12 (29%) children's receptive tests were each scored by 2 independent testers. To investigate test-retest reliability, 8 (20%) of the children were re-tested one month later.

Group test results were analysed to establish the internal consistency of the test using a split-half analysis. For this analysis, items were paired alongside items that tested similar areas of BSL grammar. These test items were numbered *a* or *b* and separate raw scores calculated for the *a* (n=32 items) and *b* (n=32 items) halves of the test. Four test items were excluded from this analysis because they could not be paired with like items (nos. 17, 30, 32 and 36).

6.3.4 Validity

The test sets out to measure knowledge of morphological and syntactic features of BSL. Test items comprise a variety of BSL utterances that include these features. This is taken as an indication that the face validity of the test is upheld. The range of features of BSL included in the test, although not exhaustive, satisfies the requirement of content validity.

Construct validity was investigated by comparing test scores with results obtained from parent and teacher questionnaires (see Appendix 6.6). Questionnaires were developed to informally assess children's understanding of BSL as demonstrated in home and school situations. Parents or teachers were asked to indicate whether the child could understand a range of exemplified linguistic structures which corresponded to the areas being explored in the video based test. Questionnaires were completed either in writing or in an interview with the tester before the video test was performed.

6.4 Results and discussion

6.4.1 Test administration

Overall, subjects were able to comply with the test procedure and appeared to enjoy both the pictures and the video format. However, at the start of the pilot, some subjects did not go through the test in a systematic way because of an inconsistent approach adopted by the tester, e.g. items were omitted, repeated inappropriately or not recorded. This was resolved by further training and testing in pairs. Responses obtained on the incomplete score-sheets were used in some of the item analyses described below.

For some children there were too many items in the pilot test to attempt in one sitting. Where time allowed, testing was completed over several shorter sessions. Occasionally, this meant that testing took place over two days; however testing was always completed within the time-scale of a week. In some situations, it was not possible to find additional times to complete testing, e.g. due to child illness, travel time to test venue, constraints of school timetables. Where this could be anticipated, children were encouraged to attempt as many items as possible in one sitting; however in some cases, tests could not be completed. As above, their total raw scores could not be used in analyses that looked at group differences; however, scores obtained from the items attempted were included in the item analyses.

6.4.2 Vocabulary

Children were more consistent in correctly identifying the target lexical item from the vocabulary pictures than in the pre-pilot phase. Children were able to produce one of the anticipated regional signs in response to the vocabulary pictures, although in fact only two distinct regional variants emerged: one for the south of the UK and one for the north. Where children did not produce the target sign, they were able to correctly identify it once the tester had shown it to them. This confirms that the pictures and the vocabulary selected were appropriate for the children in the sample.

An exception was in children's responses to the picture representing the sign BED, to which many children produced the sign SLEEP. This was considered by the deaf researchers to be an acceptable and common substitution for the adult sign BED. Therefore a decision was made that in the next phase of testing, receptive test items which included the sign BED would be signed SLEEP.

6.4.3 Effectiveness of distracters

All fail responses were analysed in order to ascertain whether full use was made of the distracter pictures. With certain test items, children who failed consistently identified only one of the distracter pictures (other than the target) as a response. This suggests that they only considered 2 pictures (the target and one other) as potential responses. Selection from a choice of 2 increases the likelihood of getting a correct response due to chance, therefore items where only one alternative picture was identified as a fail response were deemed to be ineffective. Six such items were excluded from further analysis (nos. 10a, 10b, 14a, 15b, 16a and 32).

6.4.4 Item facility

The difficulty of individual test items was investigated using an item facility analysis. Items that were either too easy (passed by all children) or too difficult (failed by all children) were excluded. Five items were found to be too easy (nos. 1a, 1b, 2a, 2b and 18b) and 4 items were too difficult (nos. 21a, 23a, 23b and 30). The latter all involved a left-right perspective that was confusing when presented on video. This was apparent from the children's behaviour when attempting those items and the responses of deaf adults (parents or teaching staff) who occasionally sat in on testing.

6.4.5 Item discrimination

The discrimination value of the remaining 53 items was examined by looking at subjects' total raw scores in comparison to their performance on individual items. For each test item, the total raw scores of children who passed or failed the item were tabled as Passes or Fails. The figures for the raw scores in the Passes column were then correlated with those in the Fails column. Items which achieved a significant correlation coefficient ($p<0.05$) of between 0.2 and 0.8 were initially retained (n=36); the results are provided in Table 6.1 below). A number of items failing to achieve this criterion were automatically discarded (n=8). However, for several items there was insufficient data to allow firm conclusions to be drawn about their discrimination value (n=9). This was because of incomplete score-sheets, for reasons explained above, rather than because of any other failing. Therefore, a decision was made to obtain further data on these items rather than automatically discarding them (see Table 6.1 below).

6.4.6 Analysis by grammatical feature

Analysis of items grouped by the grammatical feature they were assessing revealed a problem with items testing indexing. All but one item (no. 26b) produced non-significant or low significant correlations. As with some of the harder test items that had previously been excluded, it was felt that this was due to a problem with left-right perspective because of the video presentation. Whereas some children consistently achieved the correct responses, others had been observed to produce a pattern of error that was a direct result of left-right confusion. The decision was taken that these items were unreliable and they were therefore removed from the final test battery. Other items grouped by grammatical feature revealed a satisfactory profile and were therefore retained (n=33).

6.4.7 Order of items

All retained items were ordered from easy to difficult by calculating percentages from the total number of passes for each item by all children who attempted them. Items achieving higher percentage scores were deemed to be easier than those obtaining lower percentage scores.

Table 6.1: Item analysis correlations for pilot test items

Item no.	Correlation (r)	1= retained 2= discarded 3= more data needed	Item no.	Correlation (r)	1= retained 2= discarded 3= more data needed
3a	.5911**	1.	**21b**	.3280*	1.
3b	.5958**	1.	**22a**	.4900**	1.
4a	.7391**	1.	**22b**	.3398*	1.
4b	.2937*	1.	**24a**	.0049	3.
5a	.4632**	1.	**24b**	.3732*	1.
5b	.2830*	1.	**25a**	.1182	2.
6a	.2955*	1.	**25b**	.2780*	1.
6b	.4959**	1.	**26a**	.1911	2.
7a	.4790**	1.	**26b**	.5916**	1.
7b	.5024**	1.	**27a**	.2887*	1.
8a	.4034**	1.	**27b**	.1410	2.
8b	.8447**	3.	**28a**	.2502*	3.
9a	.4036	3.	**28b**	.3410*	1.
9b	.7588	3.	**29a**	.6029**	1.
11a	-.3780**	2.	**29b**	.5770**	1.
11b	.0690	2.	**31a**	.2849*	3.
12a	.3451*	1.	**31b**	.5458**	1.
12b	.2753*	1.	**33a**	.4919**	1.
13a	.6792**	1.	**33b**	.7028**	1.
13b	.0559	2.	**34a**	.4725**	1.
14b	.4001**	1.	**34b**	.4763**	3.
15a	.3610**	1.	**35a**	-.0361	2.
16b	.4723**	1.	**35b**	-.2099	3.
17	.4304**	1.	**36**	.6658	3.
18a	.3804**	1.			
19a	.5216**	1.			
19b	.5350**	1.			
20a	.0336	2.			
20b	.4920**	1.			

items initially retained =36
items automatically discarded = 8
items with insufficient data = 9
TOTAL: n=53

* = 1- tailed significance at 0.05 level, ** = 1 - tailed significance at 0.01 level

Following this, 10 score-sheets were selected at random from children who had attempted all test items. The score-sheets were then reorganised according to the new order of difficulty to confirm that children would pass early items and fail later items. Although individual children occasionally failed some of the early items, the general pattern of an increased fail rate with progression through the test was confirmed. Once children failed four or more items consecutively, they did not then revert to a pattern of passing later items. Four consecutive fails was therefore deemed to be the point at which testing could be discontinued in future use of the test.

In the re-ordering process, linguistic items testing the same linguistic domain that had initially been presented together, were reorganized to occur at different stages in the test. As explained above, the initial ordering was approximate; it was not expected that items within a linguistic domain were of equal difficulty. For example, different linguistic mechanisms are available in BSL to express the semantic concept of negation: NOTHING as denoted by the 'O' handshape (see item 3a on scoresheet in Appendix 6.4 and on video tape in Appendix 6.5) is understood relatively early, whereas NOTHING expressed by the 5 handshape plus the mouth pattern 'poo' is familiar only to older children. In the subsequent re-ordering, test items involving negative constructions were therefore more widely dispersed throughout the test.

6.4.8 Reliability

Inter-scorer reliability was investigated by double marking 12 children's tests where subjects had attempted the total number of items in the test. The difference in total raw scores obtained by different scorers was found to be extremely low, ranging from 0-3, (mean variance = 0.54). Using a Pearson Correlation, a highly significant positive correlation was obtained ($r=0.998$, $p<0.01$). The correlation is displayed graphically in Figure 6.1 below. From this we can conclude that inter-scorer reliability was very high (see Appendix 6.7 for details of analysis).

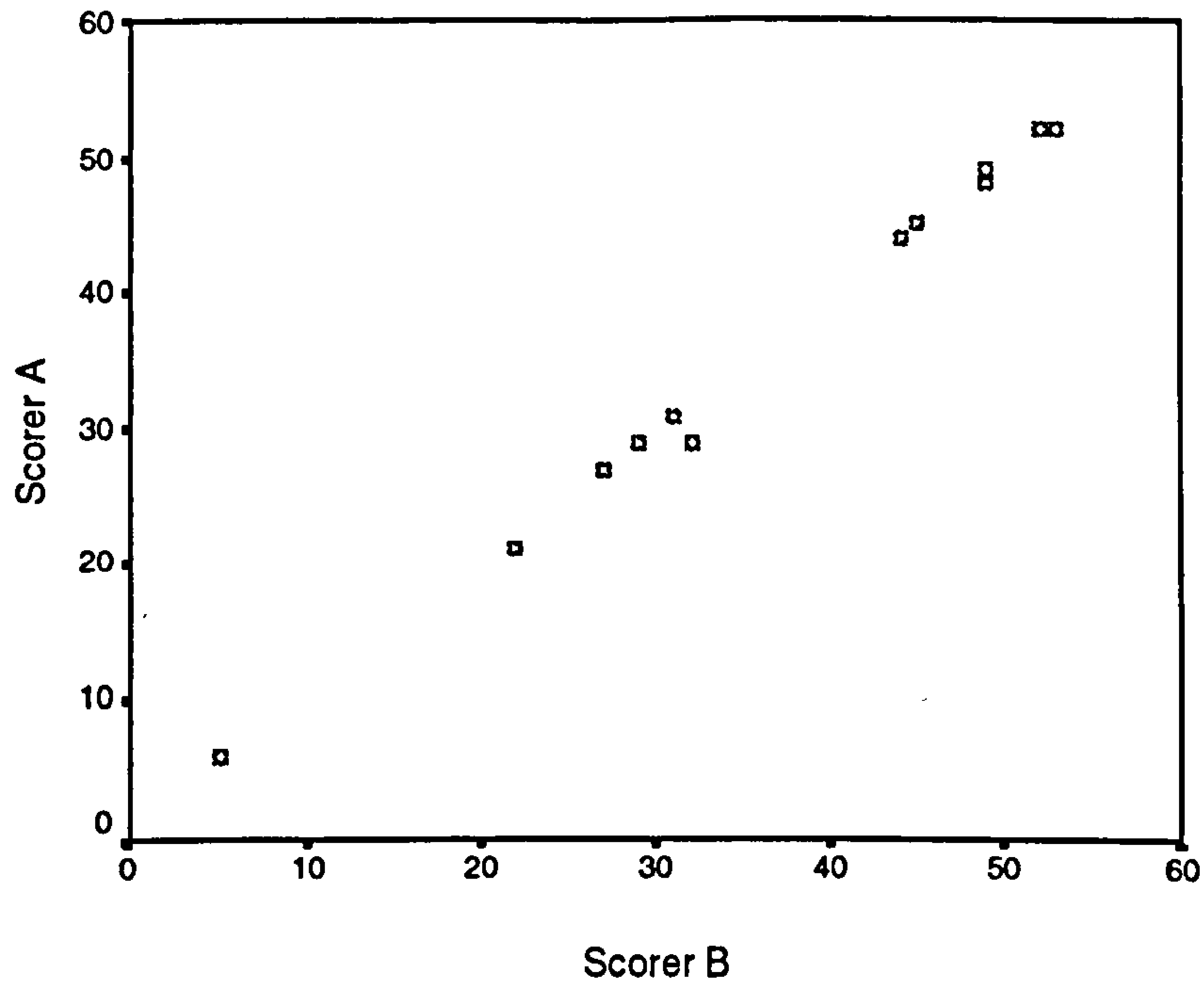


Figure 6.1: Correlation of pilot scores obtained by different scorers (n=2) as a measure of interscorer reliability (n=12)

In order to investigate the internal consistency of the receptive test, a split-half reliability analysis was carried out on the *a* and *b* raw scores. A significant high correlation (r=0.9, p=0.05) was observed, indicating high internal consistency of the test.

Test reliability was investigated by re-testing 8 subjects approximately one month later. Using a Pearson Correlation, a highly significant positive correlation (r=0.907, p<0.01) was found, indicating test-retest reliability to be high. These results are presented in a scattergram in Figure 6.2 below; full details of the analysis may be found in Appendix 6.8.

6.4.9 Validity

Problems emerged with the use of the parent and teacher questionnaires developed to look at construct validity. Respondents tended to credit children with an ability to comprehend the majority of utterances on the questionnaire, even when developmentally they would not be expected to do so. This may have been a reflection of the reliability of respondents used, or because in live situations, children's use of contextual and paralinguistic cues

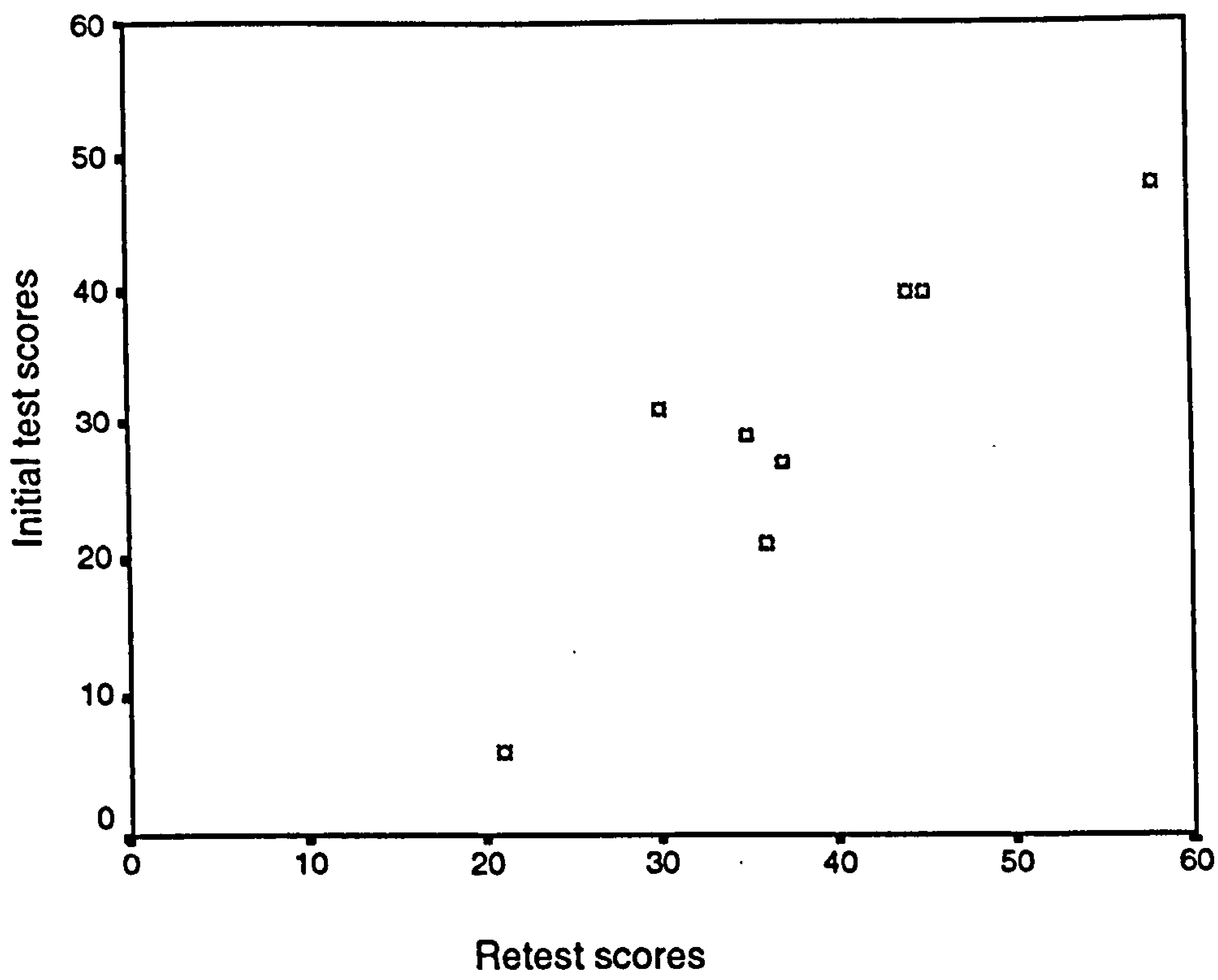


Figure 6.2: Correlation of initial and retest pilot scores

to facilitate comprehension may give the impression that they have understood the linguistic message alone.

The early results obtained from the questionnaires showed a pronounced ceiling effect in scores which it was felt would clearly compromise any attempt to correlate questionnaire scores with receptive test scores. Therefore, use of the questionnaires was discontinued. We return to the issue of validity in Chapters 7 and 8.

6.4.10 Age effects

A preliminary analysis was conducted to look for age effects by grouping subjects into three broad age bands. Children who failed to complete the test were excluded from this analysis. This left 31 children, grouped into three broad age bands as follows (see Table 6.2 below).

A one-way ANOVA was used to investigate the relationship between raw score and age. The results indicated a highly significant relationship between age and raw score ($p<0.001$). A Tukey range test was used to look at differences

Table 6.2: Mean scores of children in pilot study by age group

Age group	Age range	Number of children	Mean scores
1	3;00-5;11	10	32
2	6;00-9;05	12	44
3	9;06-11;06	9	48
	TOTALS	n=31	41.45

between groups. Significant differences were found between groups 1 and 3 ($p<0.001$) and between groups 1 and 2 ($p<0.001$), but not between groups 2 and 3 ($p=0.06$). This latter finding was to be expected since most grammatical development is completed by the age of 8 years of age, therefore differences are less marked. It may also have been because of the small numbers of subjects tested.

In order to look for an overall trend in size of raw score in relation to age, a Jonckheere Trend Test was used. For this test there need to be equal numbers of subjects in each group, hence three subjects were eliminated from group 2 (the three children with the top, middle and bottom scores) and one child was eliminated from group 1 (the child whose score replicated that of another subject in that group). A highly significant trend emerged ($p<0.01$, S value=269), indicating a definite trend for raw scores to increase with age.

See Appendix 6.9 for details of these analyses.

6.4.11 Gender effects

A preliminary analysis was conducted to look for gender effects, comparing scores obtained by boys and girls using an independent t-test. A non-significant result ($p=0.29$) was obtained, indicating that there was no difference between girls and boys in the sample on the receptive test (see Appendix 6.10 for analysis).

6.4.12 Comparing the performance of deaf and hearing children in deaf families

The pilot study was able to address the first of the research questions posed in Chapter 4.3.1 in investigating BSL acquisition among deaf and hearing children in deaf families:

Scores of 10 age-matched pairs of subjects (matched within 4 months of age but not matched for gender), one of whom was deaf, the other hearing, were examined to see if there was a difference in score related to hearing status using an independent t-test. The results of deaf and hearing children on the receptive test were not found to be significantly different ($p=0.52$). This finding lends support to the viability of including hearing subjects alongside deaf subjects in standardising the test (see Appendix 6.11 for analysis).

6.5 Summary

A pilot version of the receptive BSL test containing 68 items was administered to a sample of 41 children from deaf families who were acquiring BSL naturally from their parents. The format of the test was found to be appropriate for children within the age range 3 to 11 years. Inter-scorer reliability and test-retest reliability proved to be high. A split half analysis indicated the internal consistency of the test to be good.

Test validity other than face and content validity could not be satisfactorily evaluated due to difficulties with the measure of construct validity. This requires careful consideration in the next stage of test development.

Test items were subjected to several levels of analysis to determine their contribution to the effective measurement of children's comprehension of BSL morpho-syntax. In total, 26 items were discarded either because of the level of difficulty, because the distracter pictures proved ineffective or because watching the tester signing on video resulted in right-left confusion. A reduced set of 33 effective test items was produced for use in the next stage in test development. In addition, 9 items needing further data to confirm their value were retained.

After the pilot study, the 42 items were re-organised according to level of difficulty and the re-ordering shown to be effective (based on 10 children's score-sheets) in predicting the point at which testing could be discontinued during the next phase of testing.

A preliminary analysis using three age bands established broad age effects on the test. A preliminary investigation of gender effects was non-significant. In addition, no significant differences emerged between hearing and deaf subjects. This finding lends support to the viability of including hearing subjects in the standardisation of the test.

7

Standardisation Phase

7.1 Aims

The aims of the standardisation phase were:

- to carry out the test on large numbers of children aged 3-11 years to derive age norms
- to analyse any advantage conveyed by prior exposure to the test materials for children involved in the pilot study
- to confirm the preliminary analysis carried out during the pilot phase looking at the effects of gender (Chapter 6.4.11)
- to explore the effects of exposure to languages other than English and BSL on BSL test scores
- to repeat the preliminary analysis (Chapter 6.4.12) addressing research question one (Chapter 4.3.1) comparing the language performance of children in deaf families according to child hearing status
- to compare test scores of children according to parental hearing status and (within children from hearing families) type of exposure to BSL (see research questions two and three, Chapter 4.3.2 & 4.3.3)
- to further investigate the reliability of the test through test-retest analysis
- to explore the development of understanding in BSL and spoken English among hearing children in deaf families (see research question 4, Chapter 4.3.4) by comparing BSL test scores and scores obtained on the Clinical Evaluation of Language Fundamentals (CELF) Preschool (Wiig *et al.* 1992) and school-aged version (Wiig & Semel 1988).

In addition, several test items were re-analysed to investigate their discrimination value as this had not been completed satisfactorily during the pilot study.

7.2 Subjects

A total of 138 children located throughout England, Scotland and Northern Ireland were tested during the standardisation phase. Subjects were assigned a numerical ID and information was gathered as follows:

- age in months at time of testing
- gender
- child hearing status
- parental hearing status
- education programme: bilingual/TC (deaf children only)
- type of school attended: day/residential, hearing impaired unit, mainstream provision
- age in months when BSL signs first used (parental report)
- presence of deaf relatives
- family geographical location
- family socio-economic status (from postal code information)
- parental education
- parental occupation
- use of other spoken languages at home

Information on parental education and occupation was incomplete (20%) and therefore excluded from any analysis. Full details of subjects included in the standardisation sample are to be found in Appendix 7.1a (for key to table, see Appendix 7.1b).

The age range of the sample was from 36-156 months (mean age 90.34 months). There were 118 deaf children and 20 hearing children; 75 were girls and 63 were boys. Children were grouped according to age to form 6 age groupings. Despite small numbers, it was considered important to maintain yearly age intervals for the younger children (3;00-5;11 years) as progress in language development in this period is particularly marked. For the older children (6;00-13;00 years), two-yearly intervals were selected (see Table 7.5)

Seventy-eight children were from deaf families; 58 were deaf and 20 hearing. Sixty children were from hearing families, of whom 23 children were from established bilingual programmes and 37 were from schools and hearing impaired units with Total Communication (TC) programmes (see Figure 7.1 below). The children from bilingual programmes were unselected in that any children from such programmes who could be accessed were included. The children from Total Communication programmes were selected by teachers and deaf instructors as those for whom BSL was a preferred language and who were good signers. In some circumstances, this was reported to be because there were other deaf relatives, e.g. a deaf sibling or deaf grandparent. Information on deaf relatives was therefore collected. Of children in deaf families, 48 had deaf relatives (other than their parents) and 26 had none. Of children in hearing families, 23 had deaf relatives whereas 26 did not and data was missing on the remaining 11 children.

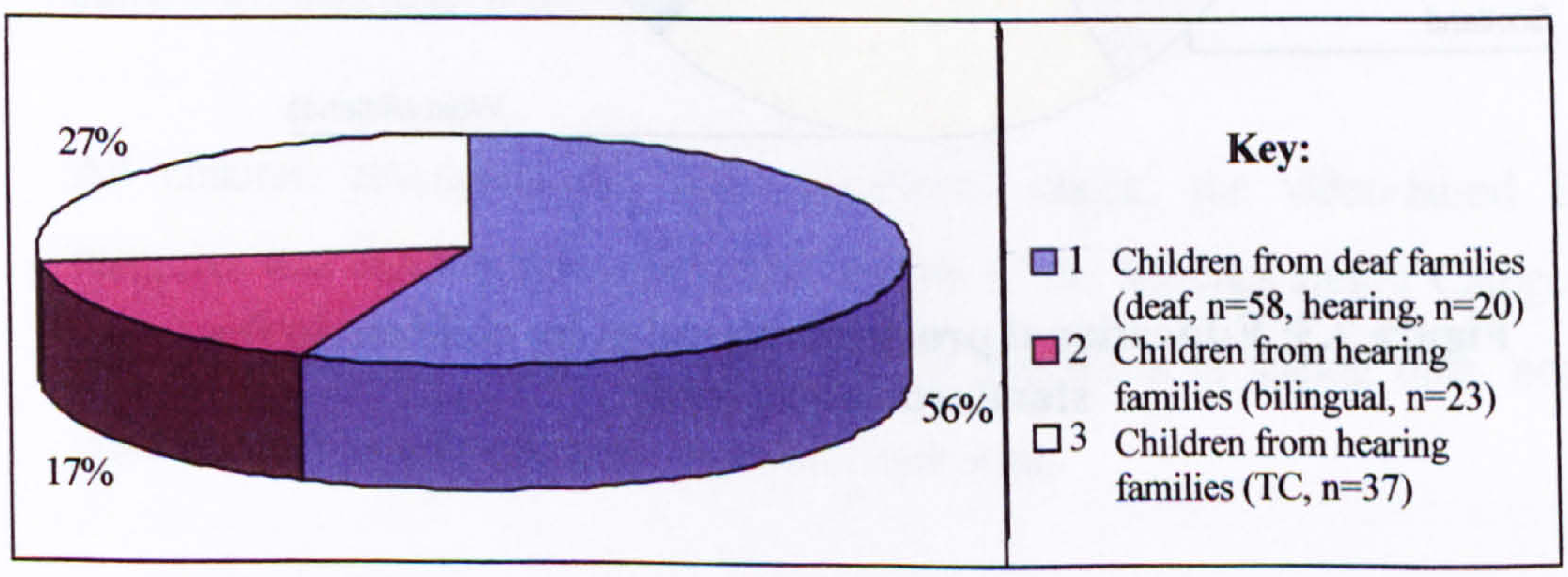


Figure 7.1: Type of exposure to BSL of subjects (n=138) in standardisation phase

All children were reported by their teachers or parents to be developing normally in all aspects. Where possible, parents provided information on the age in months when BSL signs were first used. Although this data set is incomplete, it does provide some measure of the child's age at exposure to and subsequent development of BSL, which is useful when comparing groups according to their experience of BSL (see 7.4.1).

The geographical locations of families and types of school attended by children are presented graphically in Figures 7.2 and 7.3 below. This information was collected largely to define the sample rather than to use in analysis.

Figure 7.2: Geographical location of families included in standardisation study

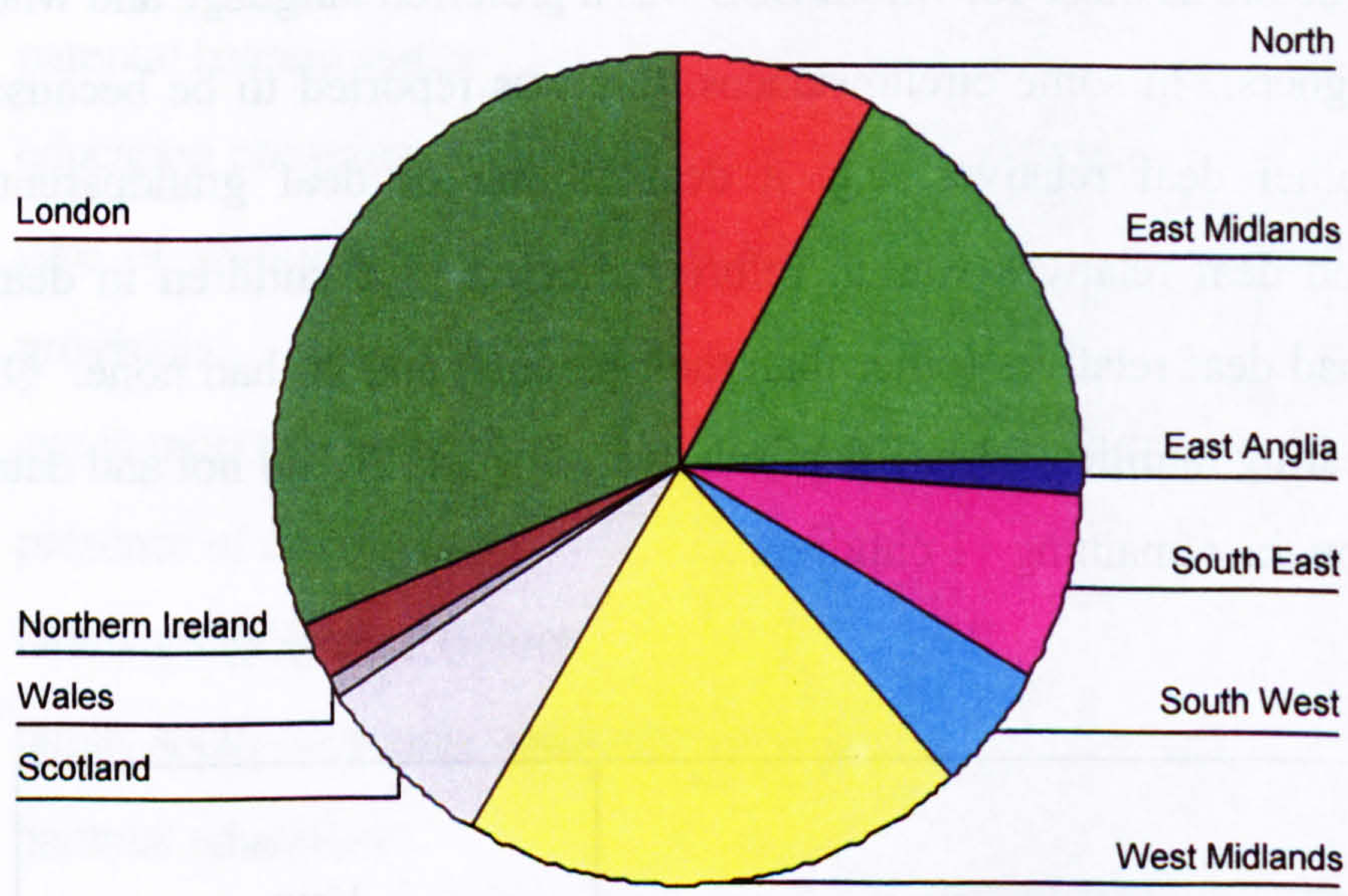
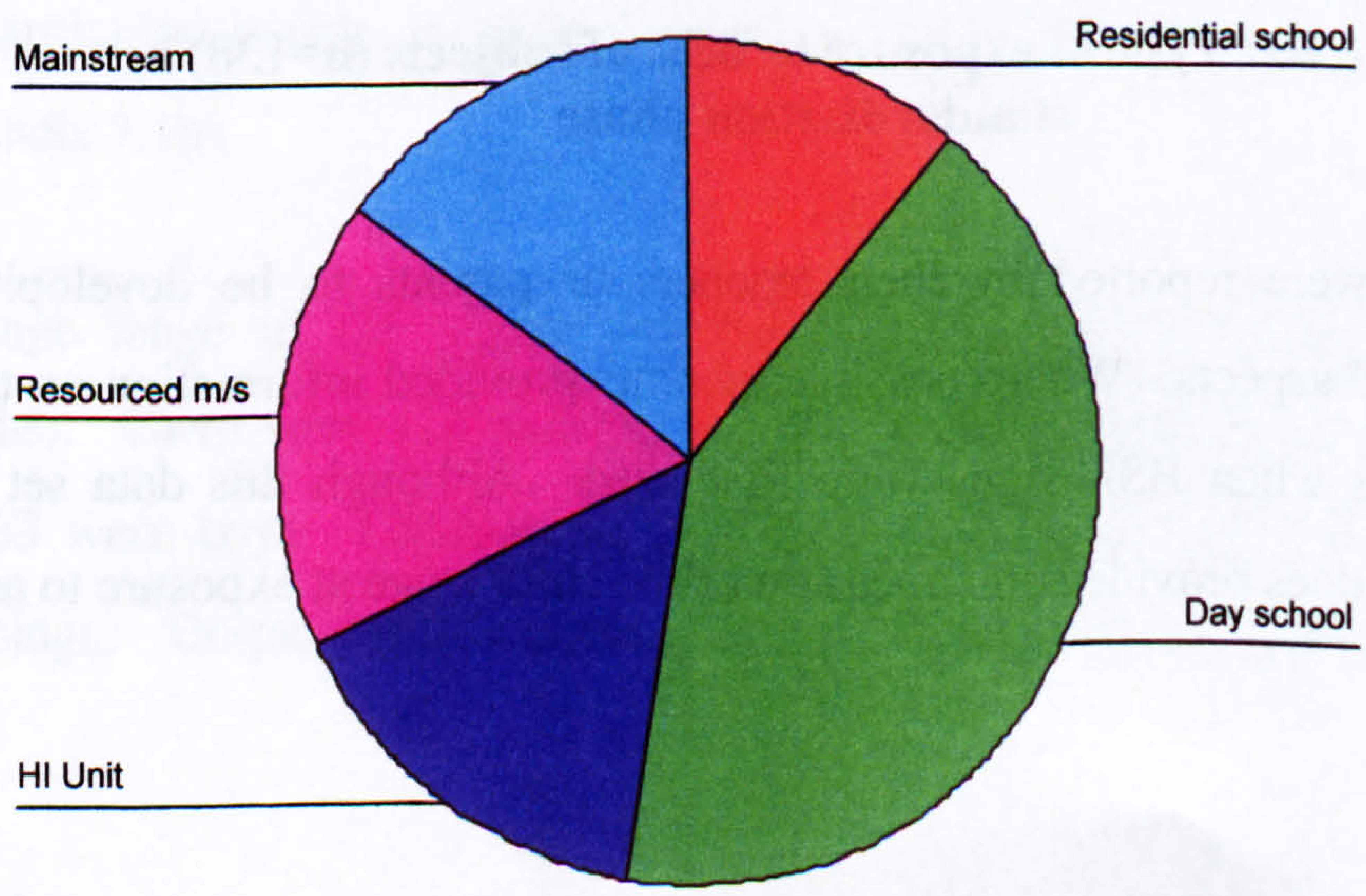


Figure 7.3: Educational provision attended by children in the standardisation study



Twenty-six of the children (19%) had been involved in the pilot study one year previously. Their results were compared to the rest of the sample to investigate the effect of prior exposure to the test materials.

Finally, data was collected on whether children had exposure to languages other than English or BSL at home (see Appendix 7.1a). Two of the 78 children from deaf families and 18 out of 60 children from hearing families were exposed to another language at home, although details were not collected of the range of languages included.

7.3 Procedure

All children were tested individually in a distraction-free room in their school, home or local deaf club. The test environment was chosen wherever possible as one in which individual children would feel it was appropriate to use BSL. A deaf researcher who was a fluent BSL user and a hearing researcher with good BSL skills were involved in data collection. The deaf researcher started each session with a conversation in BSL to establish the language to be used during testing and to establish a rapport with each child. The deaf researcher administered all BSL tests.

All children attempted the BSL vocabulary check, the video-based BSL receptive test and the age-appropriate version of the Mosaics and/or Categories sub-tests from the SON. However, due to limitations in testing time, not all children were able to complete both SON sub-tests.

The SON subtests (Snijders *et al.* 1989) were used to assess the children's general developmental level as a basis for inclusion in the study. The SON test battery is widely used with deaf children (deaf children were included in its standardisation) and sub-tests may be presented with no accompanying language. Only two sub-tests were administered due to limitations in testing time and not all children were able to complete both of these. The two sub-tests were selected because they investigate different aspects of non-verbal intelligence: the Mosaics sub-test looks at purely visual abilities and the

Categories sub-test involves more language-like non-verbal abilities. Children attempted either the Junior (age range 2.5-7 years) or Senior (5-17 years) versions of the sub-tests (see sample score-sheets in Appendices 7.6 and 7.7).

Fifteen of the 20 hearing children also completed age-appropriate sub-tests from the CELF-Preschool (Wiig *et al.* 1992) and school-aged CELF (Wiig & Semel 1988) as a measure of their English skills. Two receptive sub-tests were selected from each of the pre-school and school-aged versions of the CELF (see sample score-sheets in Appendices 7.8 and 7.9) because they were similar in content to the BSL test and/or because pre-school and school-aged versions contained comparable sub-tests. The sub-tests used were: Oral Directions, Linguistic Concepts, Recalling Sentences, and Semantic Relationships. Both CELF assessments are used widely in the UK and the school-aged version has recently been standardised in the UK. Only 15 children attempted these additional sub-tests as they could only be carried out by a hearing tester who was not always available.

7.3.1 BSL vocabulary check

The revised vocabulary check took approximately 5-10 minutes to administer. Each child was presented with 20 individual colour drawings approximately 8cm x 12cm in size (see sample picture in Appendix 7.2) representing familiar objects and people and asked to name them. The 20 pictures were used to elicit 22 signs. This was because for certain pictures, two signs were checked using the same picture: these were 'boy/child' and 'dog/collar'.

For some pictures, the tester provided prompts to elicit the target sign, e.g. for MOTHER, some children might produce the sign LADY. The tester was able to encourage the child to produce the target by signing AT-HOME WHO? YOU AND ...?

Responses were recorded using a score sheet containing 3 columns (see sample vocabulary score sheet in Appendix 7.3). The first column contained the vocabulary listed in alphabetical order. The tester was instructed to record the signs the child produced in the second column as follows:

- to code as 1 if the child used the same sign as the UK/South test version (MOTHER is located on the head and BOY is produced using the index finger only).
- to code 2 if the child used the same sign as the UK/North test version (MOTHER is located on the left upwards facing palm and BOY is produced using the index and middle finger).
- to code O for 'other' if the child used a sign which differed from both test versions but was nonetheless correct (e.g. a local sign or home sign).
- to code X if the child used a wrong sign (e.g. TAIL for DOG)
- to leave blank if the child did not produce a sign.

Pictures marked either 'X' or 'O', or which the child did not name at all, were placed to one side. After the child had gone through all the pictures, the tester returned to this pile to see if the child could recognise any signs s/he had failed to name correctly or for which a different sign was used. The tester was instructed as follows:

- to place pictures which had been put to one side in front of the child, four at a time (adding others if necessary to make up four)
- to explain that s/he, the tester, used some different signs and now wanted to show them to the child
- to demonstrate the test version of the sign for each picture
- to tell the child to remember these signs and point to the picture when it was signed by the tester
- to present each sign one at a time and record the child's responses as correct/incorrect
- if the child made a mistake, failed to respond or signed 'don't know', to repeat the process once more
- if the child was unable to select the right picture for 5 or more test signs, not to continue with testing
- if testing proceeded, to check any unfamiliar signs against failed test sentences when testing was completed

- in certain circumstances, e.g. with young or distractible children, to administer test sentences live using the child's own version of the sign but otherwise following the exact format as on the video (in practice, this was not necessary).

7.3.2 BSL receptive test

The revised video-based receptive test contained 45 test items. Of these, there were 3 practice items which were not scored and 9 items included for the purpose of collecting further data before making a final decision on whether or not to retain them (see sample score sheet in Appendix 7.3 and copy of the video in Appendix 7.4).

As in the pilot version of the test, a female test presenter was filmed facing the camera with a test booklet (a colourful A4 ring file) visible on her lap, similar to that which the child used. The presenter wore plain clothing and simple jewellery to minimise distractions.

The video commenced with an introduction in which the presenter introduced herself and explained the test procedure in a child-adjusted register of BSL (see 6.3.2). The test then started with 3 practice items before going on to the main test. The purpose of the introduction and practice items was to acclimatise children to the presenter's style of signing and to the demands of the test. Feedback was allowed during the practice items. Practice items were not scored.

The test was presented on video individually to each child and took between 20-40 minutes to administer, depending on whether pauses were inserted in addition to the 10 second fade-out provided on the video in between items. Children responded by selecting a colour drawing from a choice of 3 or 4 arranged randomly on a laminated A4 page (landscape orientation) in a ring binder (see sample test plate in Appendix 7.5).

As far as possible, testing was conducted in an area where there were no distractions. Children were seated at an appropriately sized table placed opposite a TV with the screen at the child's eye level. The tester sat adjacent to the child and observed carefully to ensure the child was attending to the video at the right times. The child was encouraged to make a response even if s/he was unsure which was the correct picture. Test sentences were shown once only unless the child was below 4 years of age, in which case a single repetition was allowed. Children were praised for co-operating with the test; however care was taken not to provide any feedback which might indicate how the child was performing. It was often helpful for the tester to point at the television screen in order to direct and maintain the child's attention to it until the picture faded between items, at which point the tester looked at the child to encourage him/her to make a response.

Where testing could not be completed in a single session, e.g. if a child lost concentration or testing was interrupted, testing was resumed as soon as possible and was always completed within a week of starting the test. Where testing was interrupted, testers were instructed to indicate where this happened on the score sheet so as to be able to pick up from where the child left off.

The child's responses were recorded on the score-sheet. The tester was required to circle the number corresponding to the picture the child selected for each test sentence. Testing was discontinued after four consecutive fail responses. After the test was completed, the number of passes was calculated to provide a raw score for each child.

7.3.3 Reliability

Approximately 10% of children were re-tested one month later to investigate test-retest reliability.

7.4 Data analysis and results

7.4.1 Initial explorations of the data set (1): IQ scores

Results obtained from 3 children scoring greater than 2 standard deviations below the mean on non-verbal performance measures (subjects 023, 127 and

138) were excluded from all subsequent analyses, leaving a total of 135 subjects.

A series of one-way ANOVAs were performed using scores obtained on individual SON sub-tests to investigate differences according to child gender, age group (see Table 7.5 below), child and parental hearing status and type of exposure to BSL. Raw data and analyses are presented in Appendices 7.10-7.13. A summary of findings is presented in Table 7.1 below.

Table 7.1: Summary of SON sub-test analyses on standardisation sample

SON sub-test	Nos	Significance of differences according to:				
		Child gender	Type of exposure to BSL	Child hearing status	Parental hearing status	Age group
Junior Categories	44	p=0.97	p=0.59	p=0.61	p=0.81	p=0.45
Junior Mosaics	50	p=0.87	p=0.13	p=0.14	p=0.04*	p=0.54
Senior Categories	49	p=0.34	p=0.07	p=0.91	p=0.20	p<0.001**
Senior Mosaics	54	p=0.64	p=0.18	p=0.61	p=0.09	p=0.59

Results indicate no statistically significant differences between groups varying in child gender, child hearing status or type of exposure to BSL. No differences were observed for parental hearing status with the exception of Junior Mosaics, where a significant difference emerged in favour of children from deaf families over children from hearing families. No differences were observed for age group with the exception of Senior Categories, where group 4 scores were significantly lower than those of groups 5 and 6 (note: for description of age groups, see Table 7.5 below).

7.4.2 Initial explorations of the data set (2): Age when BSL signs first produced

Data on parental report of children's BSL development was collected. Although the reliability of this type of data is questionable, it was felt that it may provide some insight into the early development of BSL among the sample and would provide a further means of comparing children across a range of key variables. If expected patterns are found to occur, e.g. children in deaf families showing an advantage in comparison to children from hearing families, this will suggest the data to be reliable.

The available data was incomplete with only 77 entries and 58 sets of missing data, therefore a series of chi-square analyses was performed to investigate any systematic bias before proceeding with further analyses using this data. (Note: in cases where analyses included cells with an expected count of less than 5, Fischer's Exact Test was used; this was only necessary for the analysis by age group).

Subjects were initially grouped according to whether or not data was available. The two groups were analysed for differences according to child gender, type of exposure to BSL, child hearing status, parental hearing status and age group (see Table 7.2 below).

Table 7.2: Summary of X^2 analyses investigating systematic bias in distribution of data on BSL development (standardisation sample)

	Child gender	Type of exposure to BSL	Child hearing status	Parental hearing status	Age group
Info on BSL development available/not available	p=0.53	p=0.02*	p=0.44	p=0.01**	p=0.03*

** significant at 0.05; ** significant at 0.01*

No significant differences were found between groups according to child gender or hearing status. Statistically significant differences emerged for type of exposure to BSL, parental hearing status and age group (using the age groups presented in Table 7.5). More deaf families contributed data than did hearing families; proportionately more parents of children on bilingual programmes contributed data than did parents of children on TC programmes. The analysis by age group was skewed by all but one of the 10 children in the youngest age group providing data, with a trend for less data to be provided with increasing age. Full details of these analyses are provided in Appendix 7.14.

Having identified the existence of bias in provision of information on children's BSL development, the data available from 77 subjects was then analysed cautiously for differences according to child gender, type of exposure to BSL, child hearing status, parental hearing status, and age group using a series of one-way ANOVAs. Raw data and analyses are presented in Appendix 7.15. A summary of the findings is presented in Table 7.3 below.

Table 7. 3: Summary of analyses of children's BSL development (based on parental report) according to key variables

	Significance of differences according to:				
	Child gender	**Type of exposure to BSL**	**Child hearing status**	**Parental hearing status**	**Age group**
Age (mths) when BSL signs first produced	p=0.06	p=0.01**	p=0.05* (whole group) p=0.12 (deaf families)	p=0.03*	p=0.15

** significant at 0.05; ** significant at 0.01*

No significant differences in BSL acquisition were reported according to child gender (p=0.06), although a trend approaching significance was observed for girls to be in advance of boys in producing their first signs (as may be expected from the research literature – see Chapter 2.8.1). Hearing children were reported as being in advance of deaf children in BSL development (p=0.05) when the whole sample of deaf children was included. This is not surprising when we consider that all of the hearing children were from deaf families and would therefore be exposed to BSL from birth. When hearing children were compared with only those deaf children from deaf families, the difference was non-significant (p=0.12). This result concurs with our finding in relation to the first research question (Chapter 4.3.1) reported in Chapter 6.4.11 that there are no differences in BSL development among children in deaf families, regardless of child hearing status.

Deaf and hearing children from deaf families were then compared with children from hearing families and the former were reported to produce their first signs significantly earlier (p=0.03), as may be expected. When children from hearing families were subdivided, an overall highly significant difference in BSL development emerged according to type of exposure to BSL (p=0.01). A post-hoc analysis using a Tukey test revealed this effect to arise from the large difference between children from deaf families and children from hearing families on TC programmes (p<0.001). The difference between children from deaf families and children from hearing families on bilingual programmes was non-significant (p=0.80). The difference between children from hearing families on bilingual versus TC programmes, although in favour of those on bilingual programmes, was also non-significant (p=0.09) – see Figure 7.4 below.

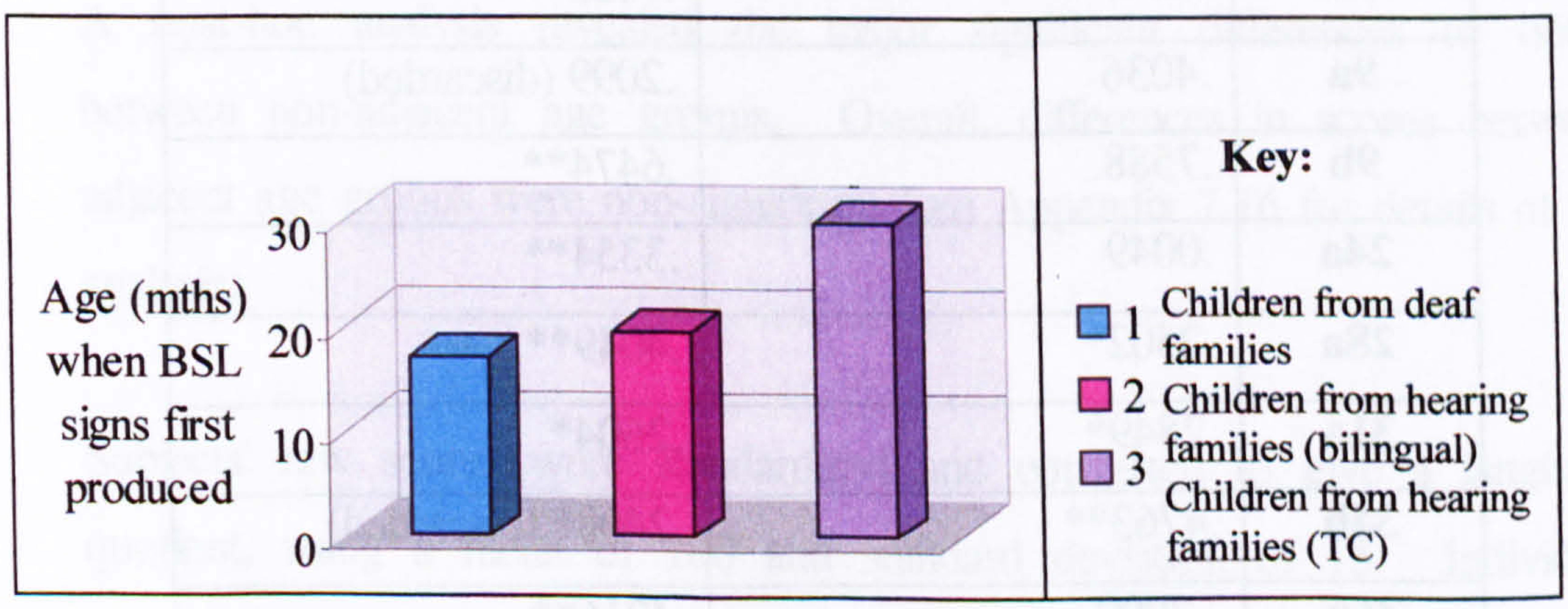


Figure 7.4: Mean age when BSL signs first produced according to type of exposure to BSL

Finally, age when BSL signs were reported to be first used was compared across the age groups for the available data set. No significant differences emerged (p=0.15), indicating that age group was not a significant variable when taken across the entire sample.

Overall, the findings from the analysis of data on BSL development are in line with expectations, suggesting it to be reasonably reliable.

7.4.3 Item analysis

Nine items for which insufficient data had been available during the pilot study were analysed for their discrimination value. The correlation coefficients are displayed along with the subsequent decision whether or not to retain the item in Table 7.4 below. As a result of this analysis, 1 item was discarded outright because of a non-significant correlation (9a). The item with the lowest significant correlation was also rejected (34b). The remaining 7 items were retained. All subsequent analyses were therefore based on a possible maximum raw score of 40 (i.e. excluding scores for the 2 discarded items and the 3 practice items).

Table 7.4: Correlation coefficients for test items with previously insufficient data

Item no.	Original correlation	New correlation
8b	.8447**	.7123**
9a	.4036	.2099 (discarded)
9b	.7588	.6474**
24a	.0049	.3354**
28a	.2502*	.4049**
31a	.2849*	.2604*
34b	.4763**	.2408* (discarded)
35b	-.2099	.4216**
36	.6658	.6082**

** = significant at 0.05, **= significant at 0.01*

7.4.4 *Standardisation and age norms for the BSL receptive test*

From the age range 3-13 years, 6 age groups were selected for the standardisation of the receptive test (see Table 7.5 for raw data and Figure 7.5 for a graphical presentation of mean raw scores by age group). Raw scores achieved by subjects ranged from 4 to 36 with a mean of 25.30 and a standard deviation of 7.74. Mean raw scores by age group suggest a trend for older children to achieve higher scores. A one-way ANOVA was used to investigate whether group differences were statistically significant. The results indicated an overall highly significant difference between groups ($p<0.001$).

Table 7.5: Age groups used in test standardisation and mean raw scores

Group	Age range	Number of subjects	Mean raw scores (max = 40)	Standard deviation
1	3;00-3;11	10	10.88	5.96
2	4;00-4;11	15	16.20	5.48
3	5;00-5;11	17	23.00	5.51
4	6;00-7;11	32	25.06	4.88
5	8;00-9;11	32	29.47	4.29
6	10;00+	29	32.00	2.65
		Total =135	**Sample mean =25.30**	**Sample mean =7.74**

A post-hoc analysis revealed the major significant differences to occur between non-adjacent age groups. Overall, differences in scores between adjacent age groups were non-significant (see Appendix 7.16 for details of the analysis).

Subjects' raw scores were standardised and converted to give a language quotient, using a mean of 100 and standard deviation of 15. Individual standard scores are presented in Appendix 7.17.

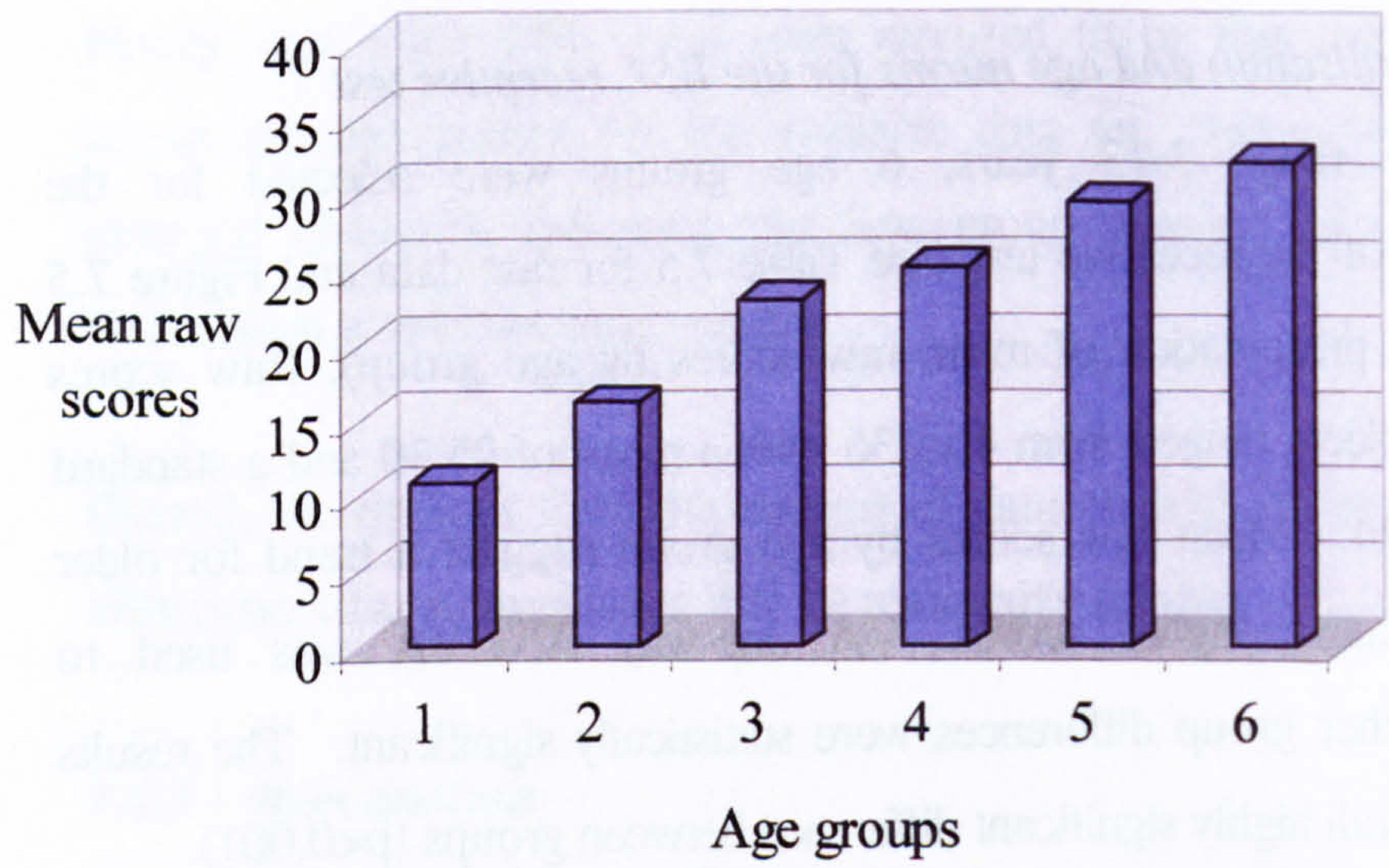


Figure 7.5: Mean BSL raw scores by age group (n=135)

7.4.5 BSL test scores according to child hearing status

The pilot analysis on differences between deaf and hearing children in deaf families (Hypothesis 1) was repeated on the standardisation sample using standard scores, thereby controlling for age differences (see Table 7.6 below for group means). As previously, no difference was found between groups (p=0.43).

Table 7.6: Mean BSL standard scores of deaf and hearing children from deaf families

Child hearing status	N	Mean standard BSL score	Standard deviation
Deaf	58	99.41	17.04
Hearing	19	102.79	12.29
Totals	77	100.25	15.99

Groups were then compared for non-verbal abilities using the Junior and Senior Categories sub-tests of the SON to investigate any advantage. No significant differences emerged between groups (p=0.71 and p=0.91 respectively). Analyses are presented in Appendix 7.18.

7.4.6 BSL test scores according to gender

The pilot analysis on differences between boys and girls was repeated on the standardisation sample using standard scores, thereby controlling for age differences (see Table 7.7 below for group means). As previously, no difference was found between groups (p=0.14); see Appendix 7.19 for analysis.

Table 7.7: Mean BSL standard scores of boys and girls

Child gender	N	Mean standard BSL score	Standard deviation
Girls	74	101.95	14.94
Boys	61	98.02	15.38
Totals	135	100.17	15.21

7.4.6 BSL test scores according to according to experience of languages other than English or BSL at home

Information about whether or not children were exposed to languages other than English or BSL (where available) was used initially to divide the sample into 2 subgroups in order to investigate any effect on BSL test scores. Taken across the whole sample, no significant differences emerged (p=0.72) - see Table 7.8 for raw data.

As the majority of children for whom other languages were used at home came from hearing families, this variable was then analysed across subgroups according to their experience of BSL. Among children exposed to BSL by one or more deaf parents, a significant difference was observed in favour of families where no other languages were used at home (p=0.04). However, only two children in this group were exposed to other languages, so this result must be taken with caution.

Among children on bilingual programmes, a difference approaching significance (p=0.06) emerged in favour of children with experience of other languages at home.

Finally, among children on TC programmes, no significant difference between groups was evident (p=0.50). See Table 7.8 below for raw data and appendix 7.20 for details of these analyses.

Table 7.8: Mean BSL standard scores of children with/without experience of languages other than English or BSL at home

Experience of languages other than English or BSL at home	Mean BSL standard score for whole sample	Mean BSL standard score for children exposed to BSL from deaf parents	Mean BSL standard score for children on bilingual programmes	Mean BSL standard score for children on TC programmes
Yes	95.44 (n=18)	87.50 (n=2)	109.17 (n=6)	88.80 (n=10)
No	100.90 (n=117)	100.59 (n=75)	106.71 (n=17)	97.88 (n=25)
Totals	n=135	n=77	n=23	n=35

7.4.7 BSL test scores according to type of exposure to BSL

To address the research questions stated in Chapter 4.3.2, BSL standard scores were initially analysed according to parental hearing status using an independent t-test. Taking the sample as a whole, the results indicated no significant difference between children from deaf and hearing families (p=0.95), see Table 7.9 below.

Table 7.9: Mean BSL standard scores of children from deaf and hearing families

Parental hearing status	N	Mean standard score	Standard deviation
Deaf	77	100.25	15.99
Hearing	58	100.07	14.24

The next analysis sought to explore differences between sub-groups of children from hearing families. Scores of children from hearing families on bilingual and TC programmes were compared using an independent t-test. As may be expected, children on TC programmes scored significantly lower than those on bilingual programmes ($p < 0.001$). A one-way ANOVA was carried out on all subjects looking at the overall effect of type of exposure to BSL (deaf parents, bilingual programme, total communication programme) on subjects' standard scores. Results revealed an overall significant difference between subjects ($p=0.01$); see Figure 7.6 below.

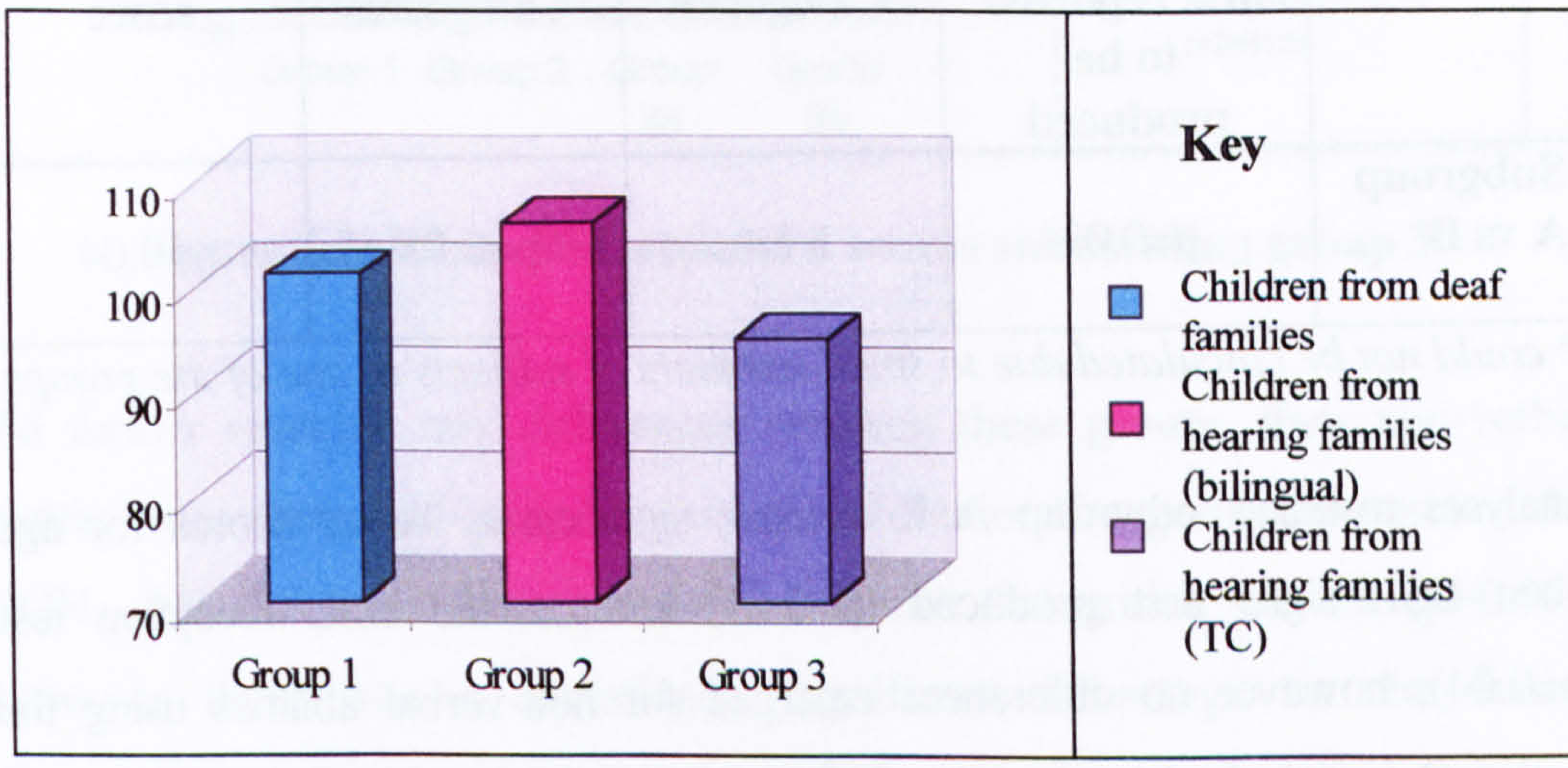


Figure 7.6: Mean BSL standard scores by type of exposure to BSL

A post-hoc analysis using a Tukey test indicated that this was due to the difference between children on TC programmes and those on bilingual programmes ($p=0.01$). Thus, the difference between children with deaf parents and those on bilingual programmes was not significant ($p=0.10$), nor was the difference between children with deaf parents and those on TC programmes ($p=0.23$). These findings are discussed more fully in the discussion (section 7.5). Full details of all the above analyses are provided in Appendix 7.21.

Scores of children in the TC group were noted to be highly variable. An analysis was therefore carried out to explore possible reasons for this variability. Children in the TC group with deaf relatives (subgroup A, n=11) were separated out from those with no known deaf relatives (subgroup B, n=15). Subjects with missing data (n=9) were excluded from this analysis. Subgroups A and B were compared using a series of independent t-tests to investigate possible differences in age when BSL signs were first produced, SON sub-test scores (Categories only) and BSL standard scores (see Table 7.10 below).

Table 7.10: Summary of analyses of TC subgroups A (children with deaf relatives) and B (children with no deaf relatives)

	Age when BSL signs first reported to be produced	SON: Junior Categories	SON: Senior Categories	BSL standard score
Subgroup A vs B	p=0.03	*	p=0.78	p=0.04

* *could not be calculated due to small numbers of subjects in one of the groups*

Analyses revealed subgroup A to achieve significantly better scores for age when BSL signs first produced (p=0.03) and on the BSL receptive test (p=0.04); however no differences emerged for non-verbal abilities using the Senior Categories sub-test of the SON, therefore results cannot be explained by group differences in non-verbal performance alone (see Appendix 7.22 for analyses).

Standard scores obtained from TC Groups A and B were then compared to those from the bilingual and deaf families groups using a one-way ANOVA. The result was an overall highly significant effect ($p<0.001$), with the principal differences occurring between children on bilingual programmes and TC subgroup B ($p<0.001$) and children in TC subgroups A and B (p=0.04); see Figure 7.7 below.

7.4.9 Effect of prior exposure to the test materials

BSL test standard scores of 26 children involved in the pilot study were compared to scores of 26 children who had not previously been exposed to the test materials, matched by age and parental hearing status. Using an independent t-test, the difference between groups did not achieve statistical significance (p=0.75).

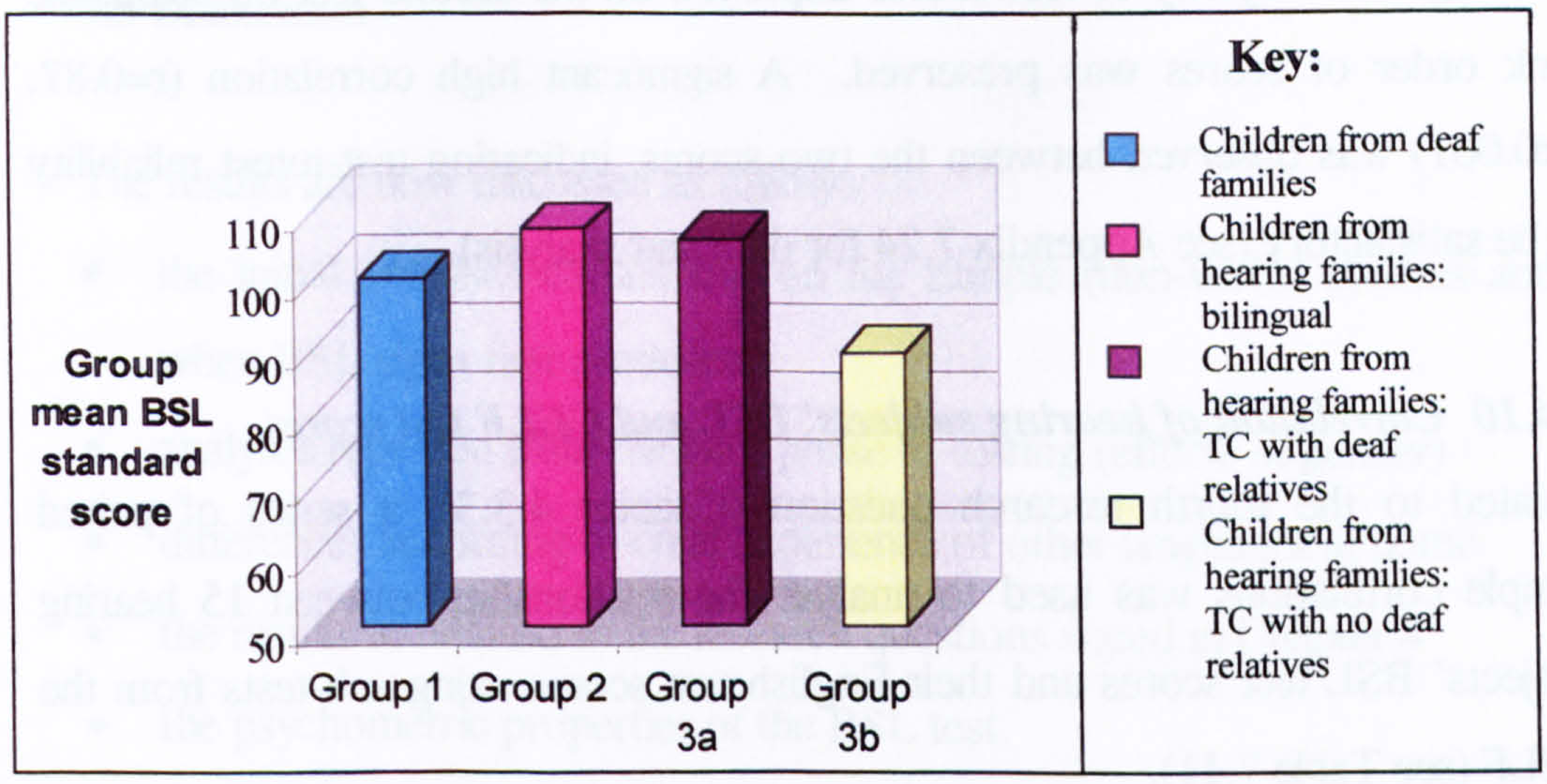


Figure 7.7: Mean BSL standard scores subdividing group 3

To further examine any differences between these groups, their non-verbal scores were compared using the Junior and Senior Categories sub-tests of the SON. No difference emerged for the Senior Categories sub-test (p=0.99); however there was a statistically significant advantage on the Junior Categories sub-test for children who had been involved in the pilot compared to the remainder of the sample (p=0.03, df=17). Full details of these analyses may be found in Appendix 7.23.

7.4.10 Test reliability

The initial and retest raw scores of 22 subjects (16%) were compared statistically using a Pearson correlation (see Figure 7.8 below).

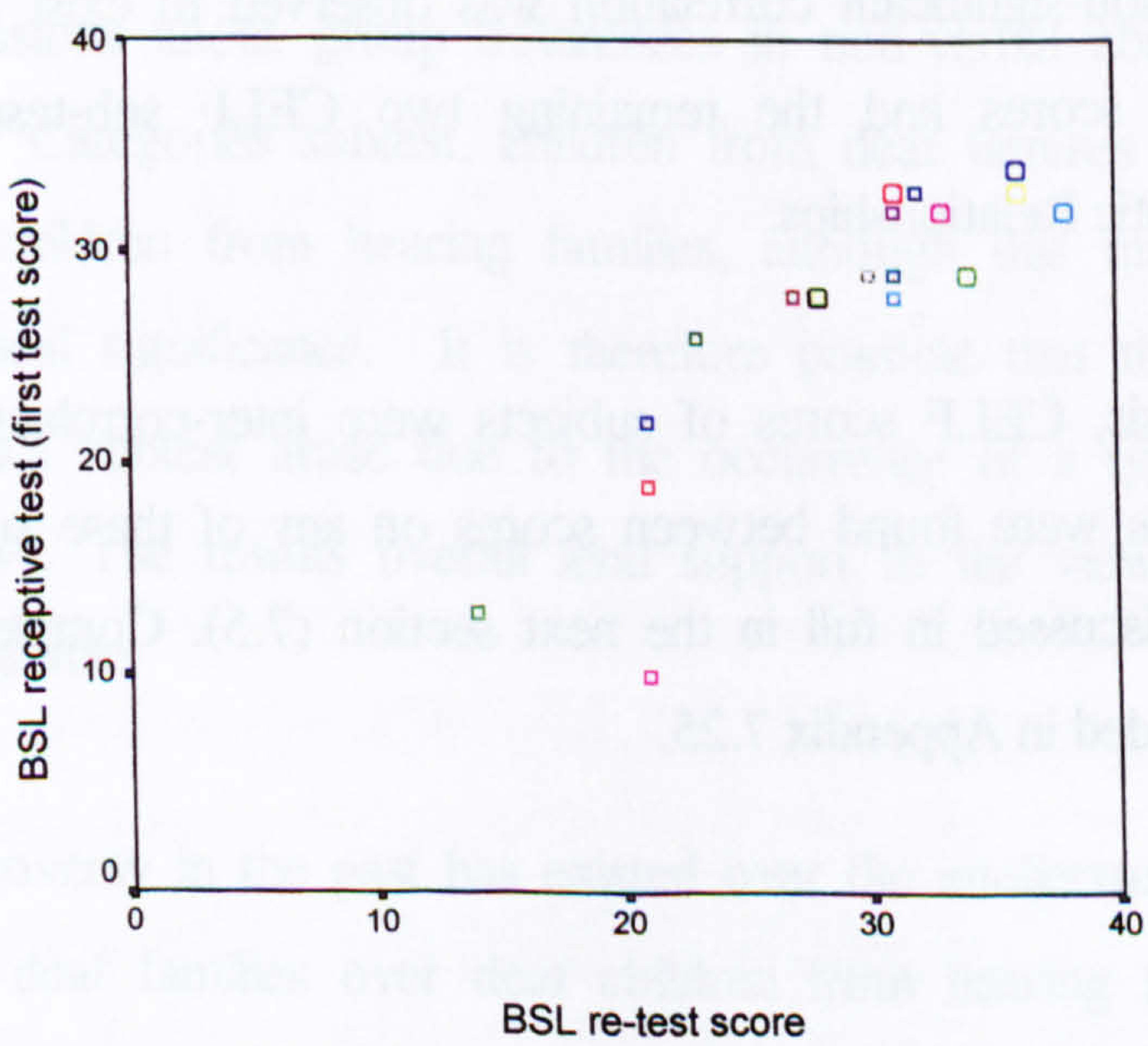


Figure 7.8: Correlation between BSL test and retest scores

Although the majority of test scores improved on the second test occasion, the rank order of scores was preserved. A significant high correlation ($r=0.87$, $p<0.001$) was observed between the two scores, indicating test-retest reliability to be satisfactory (see Appendix 7.24 for data and analysis).

7.4.10 Correlation of hearing subjects' BSL and CELF test scores

Related to the fourth research question (Chapter 4.3.3), a series of paired sample correlations was used to analyse the relationship between 15 hearing subjects' BSL test scores and their English test scores using sub-tests from the CELF (see Table 7.11).

Table 7.11: Correlation coefficients for hearing children's CELF and BSL test scores

CELF sub-test	Numbers of children	Correlation coefficient (r)	Significance level
Linguistic Concepts	8	-0.29	p=0.49
Recalling Sentences	6	-0.09	p=0.89
Oral Directions	8	0.16	p=0.71
Semantic Relationships	4	0.53	p=0.46

A non-significant negative correlation was observed between children's BSL test scores and two of the CELF sub-tests, Linguistic Concepts and Recalling Sentences. A low non-significant correlation was observed to exist between children's BSL test scores and the remaining two CELF sub-tests, Oral Directions and Semantic Relationships.

Following this analysis, CELF scores of subjects were inter-correlated. No significant correlations were found between scores on any of these sub-tests. These findings are discussed in full in the next section (7.5). Complete data and analyses are provided in Appendix 7.25.

7.5 Discussion

The results are now discussed as follows:

- the initial analyses carried out on the sample (non-verbal abilities and age when BSL signs first produced)
- analyses repeated from the pilot phase of testing (effects of gender)
- differences according to child experience of other languages at home
- the results in relation to the research questions stated in Chapter 4
- the psychometric properties of the BSL test.

7.5.1 Initial analyses (1): Non-verbal abilities

The initial analyses sought to explore the nature of the standardisation sample. The SON sub-tests provided information on the non-verbal abilities of children and were also used as part of the entry criteria to the main study. Overall, group means for all children revealed subtest results to lie within one standard deviation of the mean. This indicates a normal range of scores, compared with hearing children in hearing families.

Overall, no significant differences emerged for child gender, child hearing status or parental hearing status, with the exception of Junior Mosaics where a statistically significant difference (0.04) was observed in favour of children in deaf families. Although this finding is of interest, the fact that no differences were found in the three other tests used does not allow us to draw any firm conclusions about group differences in non-verbal abilities. Indeed, on the Junior Categories subtest, children from deaf families achieved lower scores than children from hearing families, although this finding failed to achieve statistical significance. It is therefore possible that the result on the Junior Mosaics subtest arose due to the occurrence of a type 1 error, i.e. a false positive. The results overall lend support to the view that sub-groups were comparable.

Controversy in the past has existed over the intellectual advantage of children from deaf families over deaf children from hearing families (Braden 1994).

When children from hearing families are selected for good language development in BSL and are in all other ways developing along normal lines, the present results support the view that there is no difference in their non-verbal abilities when compared with children from deaf families.

7.5.2 Initial analyses (2): Age when BSL signs first used

Data on children's reported early BSL development was analysed. This data was incomplete and highly skewed with only 77 entries overall, 51 of which came from deaf families. In addition, younger children were better represented than older children. It should also be noted that only limited credence can be assigned to this data due to its highly retrospective nature. Parents were asked to report on the emergence of their children's first BSL signs; for younger children this may have been relatively recent and therefore reasonably reliable; however for older subjects, parents were recalling events that occurred up to 11 or 12 years previously. When we consider the data collected from deaf families, the variability is high, with signs reported as emerging between 6-54 months (mean 16.92 months, standard deviation 10.26). Nevertheless, this data does provide some background on the children's BSL development.

When this data was used to explore differences in the sample, significant differences were found relating to parental hearing status and type of exposure to BSL, but not to child gender, child hearing status or age group. Children from deaf families as a group produced their first BSL signs earlier than children from hearing families. This is to be expected as children in deaf families are exposed to BSL from birth, whether or not they are deaf, whereas children in hearing families are only exposed to BSL once deafness is diagnosed.

Further differences emerged relating to children's experience of BSL. The greatest difference in reported age of first BSL signs was between children from deaf families (mean 16.92 months) and children from hearing families on TC programmes (mean 29.32 months). Children on bilingual programmes (mean 19.38 months) did not differ significantly from either of the other groups, their first BSL signs reported to emerge only shortly after children in deaf families. This suggests that bilingual programmes are more successful in encouraging early BSL development than TC programmes because of the emphasis placed on developing BSL as a first language. TC programmes, on the other hand, generally aim to establish English through sign support. Although many children on TC programmes go on to develop BSL subsequently, BSL is not the primary aim of such programmes and this is reflected in the present data.

7.5.3 Effects of gender

As with the pilot study, no differences were found to occur between girls and boys on the BSL test. This suggests that the test is effective on children regardless of gender.

7.5.4 Effects of experience of other languages at home

The data collected during the standardisation phase provided an opportunity to explore the BSL performance of a small number of children exposed to languages other than English at home (n=18). Overall, no statistically significant differences emerged separating these children from the others in the sample, suggesting that exposure to other languages neither helps nor hinders deaf children's BSL performance. Interestingly, when this analysis was repeated on subgroups according to their exposure to BSL, the results for children educated on bilingual programmes approached significance in favour of children with experience of other languages. This area would merit further exploration with larger numbers of subjects.

7.5.5 Comparing deaf and hearing children in deaf families

The analysis carried out in the pilot study was replicated on the corresponding group of children in the standardisation sample. As before, results indicate no differences in BSL development, as measured by the video-based BSL receptive test, between deaf and hearing children from deaf families.

Despite differences in language exposure among deaf and hearing children in deaf families (Singleton & Tittle 2000), these differences do not appear to affect BSL receptive skills. This question has not been experimentally addressed in the research literature to date. The present findings lend support to the views of Kessler (1984) that grammatical development in each of the languages to which bilinguals are exposed follows the same pattern as that of monolinguals. This does not, of course, mean that differences are not present when other measures are used, e.g. measures which look at BSL production. Further research is required to investigate differences in other areas of sign language development between deaf and hearing children in deaf families. However, for the purposes of the present study, these findings confirm the validity of the decision to include hearing children in the sample used to standardise the BSL receptive test.

7.5.6 Comparing deaf children according to their experience of BSL

In this section we address research questions 2 and 3 as stated in Chapter 4.3.2. The results of the analysis on the standardisation sample indicated no overall difference between children from deaf families and children from hearing families. This finding lends support to the criteria used to select children for the study. The sample of children from hearing families used in the present study is not representative of the wider population of deaf children. Children were specifically selected because they were developing BSL as a first language. This was either because they benefited from optimal educational settings in which to develop BSL, i.e. established bilingual programmes, or because their teachers identified them as proficient BSL users even though they were on TC programmes which seek to develop English as a primary goal. As will be discussed later, many of those from TC programmes possessed an additional advantage in having access to deaf relatives. Thus, the above finding can only be upheld for the present sample and not generalised to children from deaf and hearing families as a whole. Indeed, this question is re-visited when we look at test results from the wider population of deaf children from hearing families in Chapter 8.

Looking in greater detail at test performance according to children's experience of BSL, children on bilingual programmes were found to achieve significantly higher scores than those on TC programmes, as anticipated, but were not significantly different to children from deaf families. Indeed, the raw data suggested a surprising trend in favour of children on bilingual programmes. This may be explained by the delivery, in bilingual programmes, of an educational curriculum through the medium of a sign language possibly enhancing metalinguistic awareness. The issues may be similar to those for children of immigrants. The children may have native fluency in the parental language, but have restricted contexts for its usage, compared with English.

The difference between the bilingual and TC group was as anticipated because of the difference in emphasis between these educational programmes. Bilingual programmes seek to develop BSL as a first language from as early an age as possible. To this end, relatively large numbers of native signers are employed who provide a high level of quality BSL input. A high deaf profile serves to raise the status of BSL among staff, children and families. In addition, bilingual programmes are increasingly teaching BSL grammar as part of the curriculum; this also raises children's awareness of differences between BSL and English.

In contrast, total communication programmes prioritise English first and foremost, albeit with sign support. TC programmes generally employ fewer deaf staff (indeed, some deaf staff may be oral role models) and little emphasis may be placed on distinguishing BSL from SSE. As a result, both the input in and status of BSL is inferior to English. Furthermore, as signing generally accompanies spoken English, children may not be fully aware of differences between BSL and English grammar. Guy (1998) looked at older deaf children educated in TC programmes to investigate their competency in BSL and (written) English. Her results suggest that the net result of TC programmes can be confusion, with some children failing to master the grammar of either language adequately.

The high variability in test scores among children on TC programmes was noted and further explored by considering the influence of access to deaf relatives other than deaf parents (siblings, cousins, grandparents etc.) When the TC group was sub-divided into those with (TCA) and without (TCB) deaf relatives, an interesting pattern emerged. Analysis of the BSL scores of TCA children revealed them to approximate more closely the scores of children in deaf families and those on bilingual programmes, such that no significant differences were observed between any of these groups. However, the difference between these scores and those of the TCB children was statistically significant. A series of further analyses was performed to exclude other sources of bias distinguishing these groups. No significant differences emerged for non-verbal abilities; however groups did differ in reported age of BSL development.

7.5.7 Comparing hearing children in deaf families in both of their languages

In this section we address research question four (Chapter 4.3.3). The results indicated no correlation between any of the CELF sub-tests and subjects' BSL scores. However, there was very little data on individual CELF sub-tests because of the size of the data set. The 15 subjects spanned a wide age range; as a result, younger subjects completed different sub-tests to older children and very few children completed more than one sub-test. As a result the maximum group size was 8 (Linguistic Concepts and Oral Directions) and the minimum 4 (Semantic Relationships). With such small numbers, just one or two outliers can skew the result of any analysis.

Because of the lack of relationship between CELF and BSL test scores, subjects' CELF sub-test scores were then inter-correlated. These results also showed no significant correlations, suggesting the problem may not lie with the BSL test alone. Research looking at hearing children's performance on a range of language tests has produced confusing results (McCauley & Swisher 1984a, Millen & Prutting 1979, Howlin & Cross 1994). This may be because different tests are not looking at the same areas of language or because a single measure used with young children is often unreliable. Further testing is required with larger numbers of subjects to satisfactorily address this question. However, a further explanation may be related to the complex pattern of language development in bilingual children. We have assumed hearing children's performance in English and BSL will be comparable; however it is possible that performance in either language can vary both across and within individuals. Further research into bilingual patterns of language development in each language is required.

7.5.8 Psychometric properties of the BSL test

In the final part of the discussion of the standardisation phase, we consider the psychometric properties of the BSL test based on the remaining analyses reported in the results.

Item analysis: The standardisation phase allowed for collection of further data and analysis on 9 test items. As a result, the 2 items with the lowest and non-significant correlation coefficients were discarded. This left a test with a total of 40 test items and 3 practice items, upon which all subsequent analyses were based.

Age groupings and standardisation: Subjects were grouped according to age to form 6 age groupings (see Table 7.5). The rationale for using yearly age intervals for the younger children (3;00-5;11 years) was because progress in language development in this period (and especially morphosyntax) is particularly marked. For the older children (6;00-13;00 years), two yearly intervals were selected to allow for larger subject numbers in each group, producing a more reliable basis for the standardisation. In addition, as language development as measured by the test was starting to plateau among the older children, two-yearly groupings were more effective at emphasising differences between groups.

This was borne out by an analysis of group differences, the result of which indicated an overall highly significant difference between groups, although differences in scores between adjacent age groups were non-significant. This latter finding may be due to the fact that the range of raw scores across the sample did not include the full range of possible scores, with the overall mean score being rather high at 25.30 (standard deviation 7.74). This suggests that the test contains too many easy items and too few difficult items, thereby preventing more sensitive discrimination between age groups. Any future development of the test should seek to address this limitation.

Subjects' raw scores were standardised and converted to give a language quotient, using a mean of 100 and standard deviation of 15. Standard scores were used in all subsequent analyses as they build in an age control. Percentile scores were not calculated because of the small numbers of subjects.

Effect of prior exposure to test materials: BSL standard scores of 26 children involved in the pilot study one year previously were compared to children who had not previously been exposed to the test materials, matched by age and family hearing status. No significant differences were observed between mean scores indicating no advantage conveyed by prior exposure to the test materials.

Test reliability: Twenty-two subjects (16%) were re-tested one month later; initial and re-test scores were compared. Although the majority of re-test scores showed improvement, the rank order of scores was preserved and a significant high correlation ($r=0.87$, $p<0.001$) was observed, indicating test-retest reliability to be good.

7.6 Summary

A second version of the BSL receptive test was administered to 138 children. Testing allowed for further analysis of test items and resulted in a final set of 40 test items and 3 practice items. Standard scores derived from 6 age groupings were used to address the research questions stated in Chapter 4, and to investigate the reliability of the test.

Findings regarding the non-significant effects of child gender reported in the pilot study were replicated during the standardisation phase, although a trend for girls to achieve higher scores than boys was observed. Comparison of a small subgroup of children with experience of languages other than English or BSL at home with the rest of the sample revealed no significant differences.

With regard to the research question concerning deaf and hearing children from deaf families, the present result replicates the finding of the pilot study in suggesting that these groups perform similarly in terms of BSL development, as measured by the receptive test. This is the first set of experimental data to investigate differences between these groups and the results lend support to the view that deaf and hearing children can be considered equivalent when standardising a developmental test of BSL receptive grammar.

The research question regarding test performance of children according to their experience of BSL was also addressed. No overall significant differences were found between children from deaf and hearing families. Although initially surprising, this finding can be explained by the stringent selection criteria adopted for children from hearing families.

Deaf children from hearing families on bilingual programmes, achieved significantly higher scores than deaf children from hearing families on TC programmes. However, when children on TC programmes were subdivided according to whether or not there were additional deaf relatives, children with deaf relatives outperformed children with no deaf relatives. The implications of these findings for educational programmes for deaf children have been discussed.

Access to hearing children from deaf families provided an opportunity to compare their test performance on BSL and English (using the CELF test) measures. CELF sub-test scores did not correlate with BSL test scores, however neither did they correlate with each other. This may be partly due to the small numbers of subjects attempting each of the CELF sub-tests. The findings relating to this research question therefore remain inconclusive.

Finally, the reliability of the test was investigated using test-retest analysis and found to be high. No measures were taken to investigate the validity of the test during the standardisation phase, however the findings on the BSL test so far have indicated it to be a psychometrically robust tool for the measurement of BSL receptive grammar. We return to the issue of validity in Chapter 8.

8

Extended Use of the Test: Group Data

Following the standardisation phase, the test was made available to professionals working with deaf children. Training courses were provided in its use and feedback was sought on the format of the test, the adequacy of the training provided and the overall contribution of the test to assessing deaf children's BSL development.

Test users were asked to return completed score-sheets (sample score-sheet in Appendix 8.1) and questionnaires (sample in Appendix 8.2) in order to gather specific information on individual children tested. This provided a supplementary data set. The aims of analysing the supplementary data set were as follows:

- to explore defined variables within the supplementary data set (e.g. age, gender, parental hearing status, etc.) in comparison with the standardisation sample
- to compare BSL test scores in the supplementary data set with those obtained during test standardisation
- to investigate the validity of the BSL test by repeating analyses carried out previously (comparing test performance by age group; comparing children from deaf and hearing families)
- to investigate test validity by conducting novel analyses (correlating tester ratings; correlating reading scores with BSL test scores)

8.1 Subjects

A total of 196 score-sheets (representing 187 subjects) were returned by 18 different testers based in England and Wales over a two-year period. It emerged that three children had previously been tested in the standardisation phase; their data were therefore considered to be re-test data based on the original sample rather than supplementary data and consequently excluded from the main analyses below. Data from nine new subjects also included a set of re-test data. The re-test data were also excluded from the main analyses below, to avoid introducing a bias in the sample.

There was only one hearing child in the sample and he had been placed in a school for the deaf because of an auditory processing disorder affecting spoken language development. Because this child did not fit into any of the previously established groups for analysis, his data were excluded from subsequent analysis. Finally, two of the subjects could not co-operate with the video presentation and so all test sentences were presented live. As this violated the recommended standardised mode of presentation, data from these subjects were excluded from further analysis.

As a result of these decisions, the sample size was reduced to 181 children, of whom 89 were girls and 92 were boys. The age ranged from 40 to 177 months (mean age 102.97). The majority of children were between the ages of 5 and 12 years. Children at the younger end of the age range were under-represented, only 9 (5%) being under 5 years of age. Data were also sent in on 5 children (3%) over the age of 12 years, which is beyond the recommended age range of the test.

Of the total sample, 35 children came from deaf families, 113 came from hearing families and information was unavailable about family hearing status on the remaining 33 children.

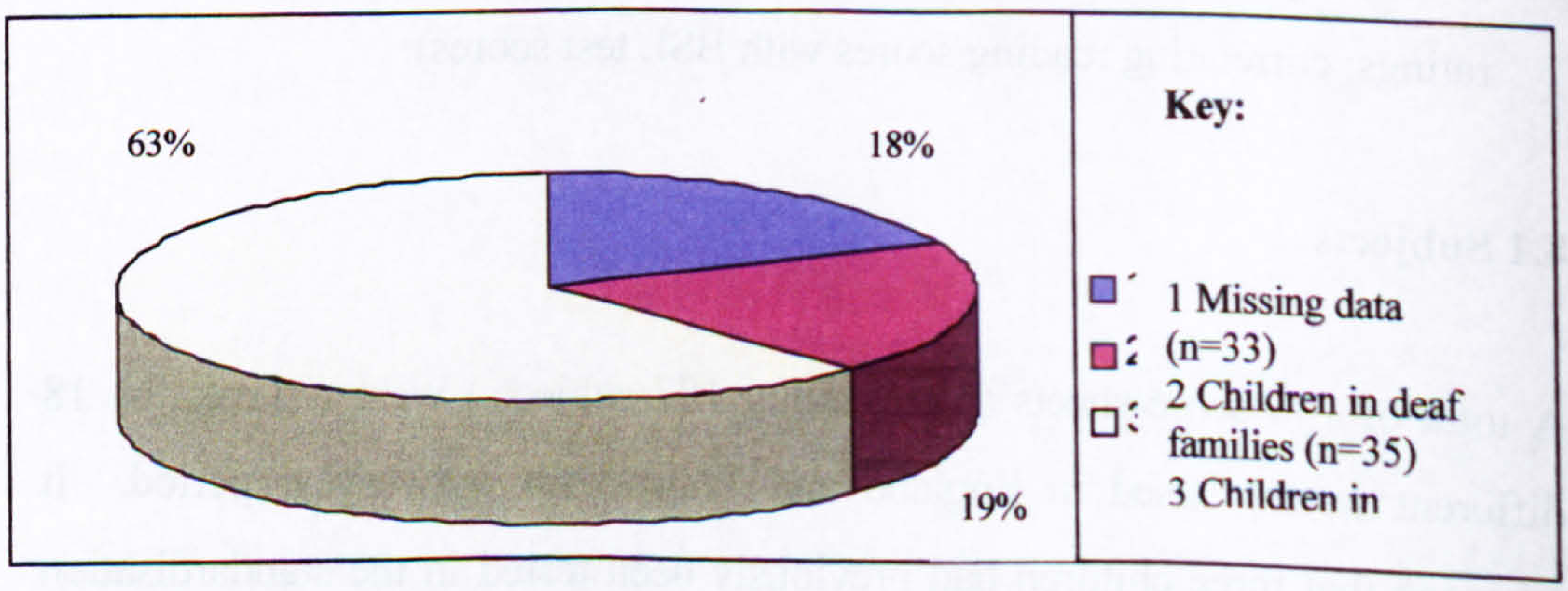


Figure 8.1: Parental hearing status of children in new sample

Unfortunately it became apparent once the questionnaires were returned that it would not be possible to consistently allocate children to the same categories of educational programme as had been used during the standardisation phase. This was because respondents sometimes described their school's communication policy idiosyncratically as 'child-centred communication', and at other times, schools were described as bilingual when the policy had only been operational for a short period of time. For these reasons, data on educational programme could not be used in further analyses.

Data were provided on deaf relatives for 142 subjects 23 children from deaf families had additional deaf relatives, whereas 10 did not. Among children from hearing families, 18 had one or more deaf relatives; 91 had none.

Data were provided on age in months when BSL signs were first produced for only 34 subjects (19%). Of these, information was available from 5 deaf families and 29 hearing families (including one child rated as having below-average non-verbal abilities).

Testers were asked to provide information on children's overall levels of development (excluding language), in the form of psychological assessment results or subjective opinions. Such information was returned on 119 (66%) of the sample. Of this number, 63 (53%) were rated as having non-verbal abilities within the normal range, 31 (26%) were rated as below average and 25 (21%) were reported to be performing at an above average level.

Of interest, ratings of 'below average' children were frequently accompanied by objective psychological test results which corroborated the subjective views of testers. This suggests the rating for the below average group to be reasonably accurate in separating low achievers from the remainder of the sample. The number of children rated as performing above average non-verbally seems unusually high. No data from these children or from those rated as average included objective test data to support testers' ratings. This suggests that these ratings may not be particularly reliable in discriminating between average and above average subjects.

Additional information was provided on some of the children. Eight children had received cochlear implants. Twenty two (7.5%) children in the sample were described as having additional special needs which were listed as significant behavioural and/or attention problems (n=8), cerebral palsy (n=5), Ushers (n=2), Charge syndrome (n=1), dyslexia (n=1) and mild microcephaly with subsequent physical difficulties (n=1). One tester provided information on 11 children's reading ages in months; three testers also sent in their own subjective views on 19 children's BSL skills (see 8.3.5 below).

The geographical locations of families and types of school attended by children are presented graphically in Figures 8.2 and 8.3 (see Chapter 7.2 for equivalent information on standardisation sample). Full details on all subjects are provided in Appendix 8.3.

Unfortunately no data were collected on children's experience of other languages at home, so this area identified during the standardisation phase could not be pursued using the supplementary data set.

8.2 Procedure

Testers were deaf and hearing professionals: deaf instructors, speech and language therapists, teachers of the deaf, psychologists and researchers. Tester skill and knowledge of BSL are unknown. Children were tested individually in schools, nurseries or at home. All children completed the BSL vocabulary check and the BSL video-based receptive test, as described in 7.3.

8.3 Data analysis and results

We begin this section by exploring the new sample according to the available data on age when BSL signs were first produced before considering children's BSL test scores by age group. Thereafter, we make comparisons between the supplementary data and the standardisation sample, looking at a number of variables before combining the data sets. For some analyses, numbers of

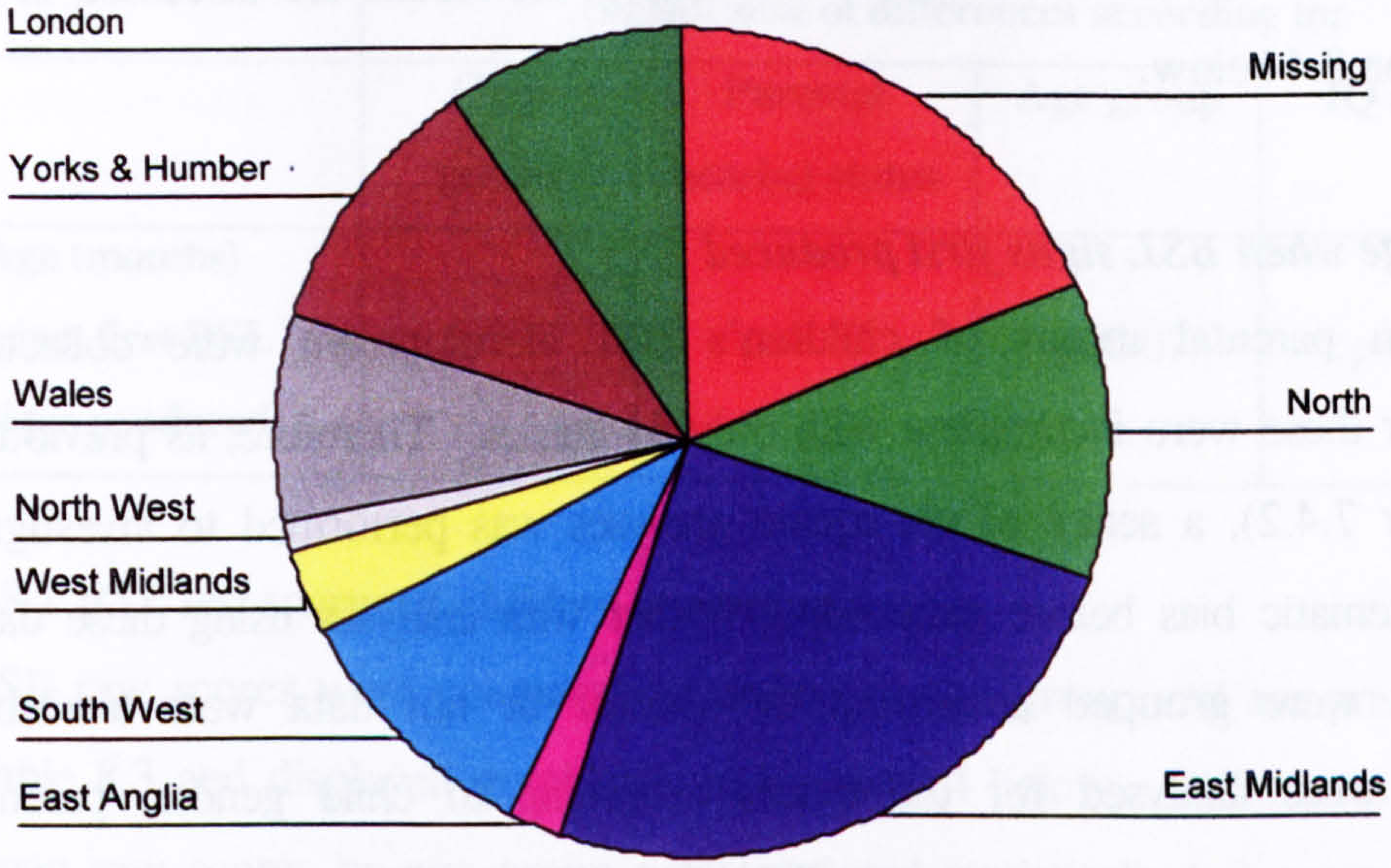


Figure 8.2: Geographical location of families in new sample

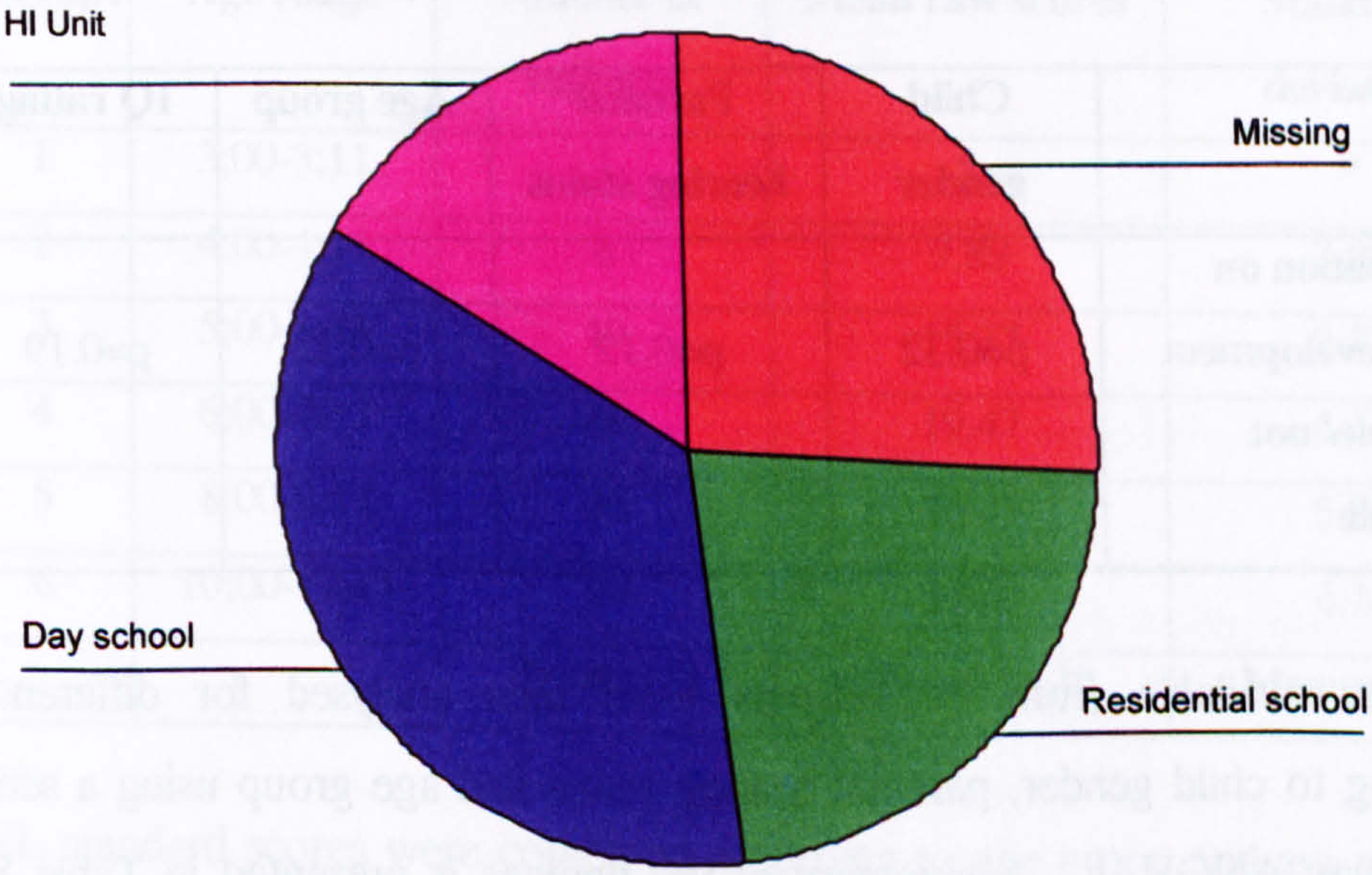


Figure 8.3: Educational provision attended by children in new sample

subjects vary according to whether or not information was provided, e.g. onset of BSL, ratings of non-verbal abilities); other subjects are excluded because BSL standard scores could not be calculated. All results are discussed in full in section 8.4 below.

8.3.1 Age when BSL signs first produced

Data on parental report of children's BSL development were collected, however these were incomplete with only 34 entries. Therefore, as previously (Chapter 7.4.2), a series of chi-square analyses was performed to investigate any systematic bias before proceeding further with analyses using these data. Subjects were grouped according to whether or not data were available. Groups were analysed for differences according to child gender, parental hearing status and age group (see Table 8.1 below). Because some analyses included cells with an expected count of less than 5, Fischer's Exact Test was used. No significant differences were found between groups according to any of the above variables, indicating no bias to be present in the distribution of data. Full details of these analyses are provided in Appendix 8.4.

Table 8.1: Summary of X^2 analyses investigating systematic bias among distribution of data collected on BSL development (supplementary data)

	Child gender	Parental hearing status	Age group	IQ rating
Information on BSL development available/ not available	p=0.32	p=0.12	p=0.22	p=0.19

The data available from 34 subjects were then analysed for differences according to child gender, parental hearing status and age group using a series of one-way ANOVAs. A summary of the findings is presented in Table 8.2 below. No significant differences in BSL acquisition were apparent in relation to any of the above factors, although a trend approaching significance emerged for age group, with later onset of BSL reported for older children than for younger children. Raw data and analyses are presented in Appendix 8.5.

Table 8.2: Summary of analyses of children's BSL development (supplementary data)

	Significance of differences according to:			
	Child gender	Parental hearing status	Age group	IQ rating
Age (months) when first BSL signs produced	p=0.51	p=0.12	p=0.07	p=0.81

8.3.2 BSL test scores of children according to age

BSL raw scores were compared according to age group and are presented in Table 8.3 and displayed graphically in Figure 8.4 below. Differences between mean raw scores by age group were explored statistically using an ANOVA. A highly significant overall effect of age was observed (p<0.001). A post-hoc analysis revealed the significant differences to lie between non-adjacent age groups.

Table 8.3: Mean BSL raw scores according to age group (supplementary data)

Group	Age range	Number of subjects	Mean raw scores	Standard deviation
1	3;00-3;11	1	5	*
2	4;00-4;11	8	9.89	7.95
3	5;00-5;11	19	15.37	9.32
4	6;00-7;11	49	19.47	6.46
5	8;00-9;11	44	26.43	5.86
6	10;00-11;11	60	29.02	6.16
		Total=181	Mean= 23.39	Mean= 8.76

BSL standard scores were compared according to age group and are presented in Table 8.4 below. A number of children's raw scores were too low to enable conversion to a standard score and were therefore omitted from these analyses. Despite some of the age groups' low mean standard scores, differences between age groups were not statistically significantly different (p=0.66). Full details of these analyses are provided in Appendix 8.6.

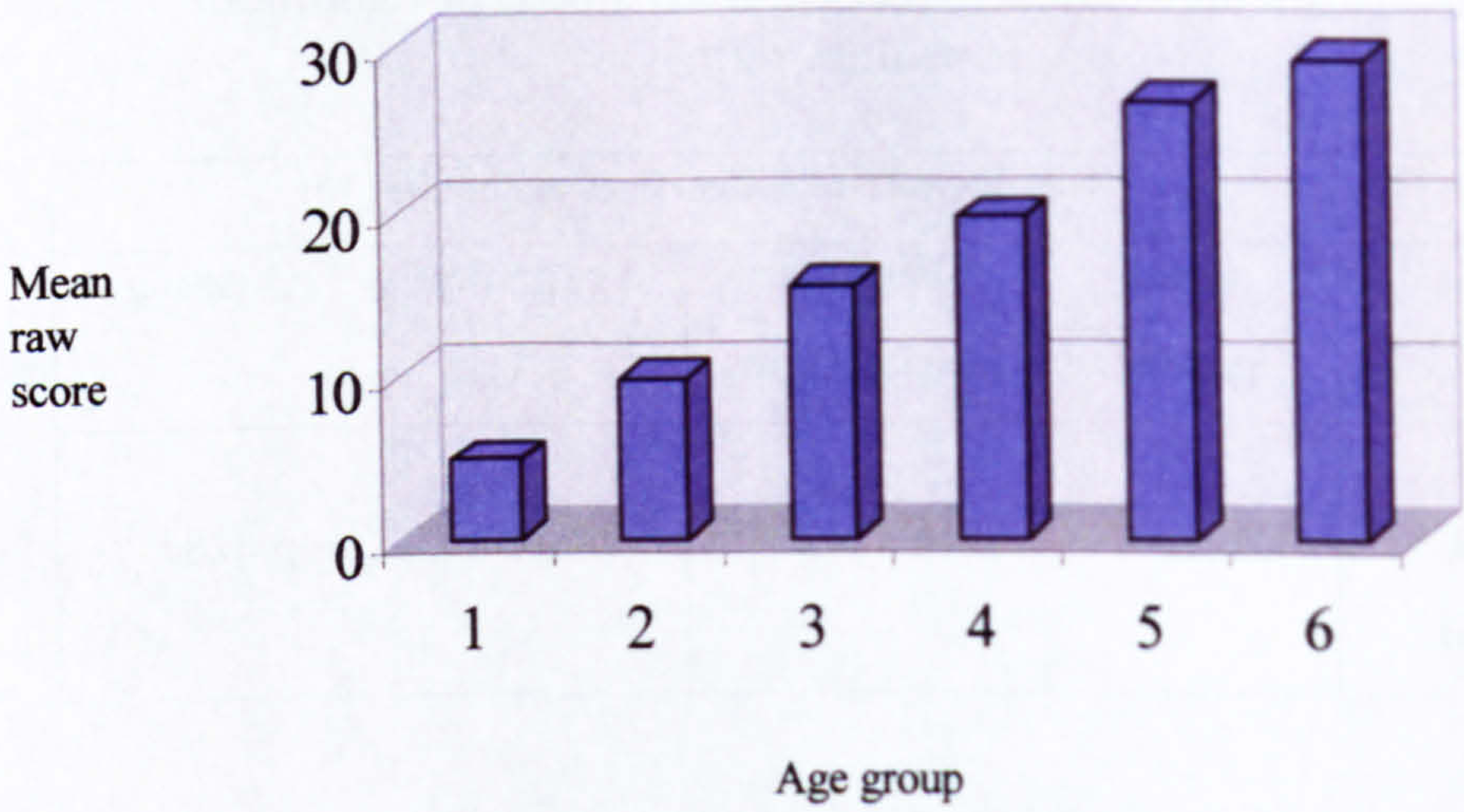


Figure 8.4: Mean BSL raw scores by age group (supplementary data)

Table 8.4: Mean BSL standard scores according to age group (supplementary data)

Group	Age range	Number of subjects	Mean standard scores	Standard deviation
1	3;00-3;11	1	84.00	*
2	4;00-4;11	6	91.83	17.68
3	5;00-5;11	15	89.13	18.53
4	6;00-7;11	44	86.52	15.64
5	8;00-9;11	43	92.49	17.51
6	10+	53	92.43	21.67
		Total = 162	**Sample mean = 90.46**	**Sample mean =18.54**

** could not be calculated (only one child in age group)*

8.3.3 BSL test scores according to gender

BSL standard scores of boys and girls were compared. The results indicated a statistically significant difference, girls outperforming boys (p=0.01). Full details are in Appendix 8.7.

8.3.4 BSL scores according to parental hearing status

A one-way ANOVA was used to investigate BSL test scores of children from deaf and hearing families in the supplementary data set. The overall effect was highly significant (p<0.001), children from deaf families achieving higher standard scores overall than children from hearing families (see Figure 8.5). The analysis was repeated without those children performing at a lower than average developmental level. The results still indicated a significant overall difference between groups (p=0.001). See Appendix 8.8 for analyses.

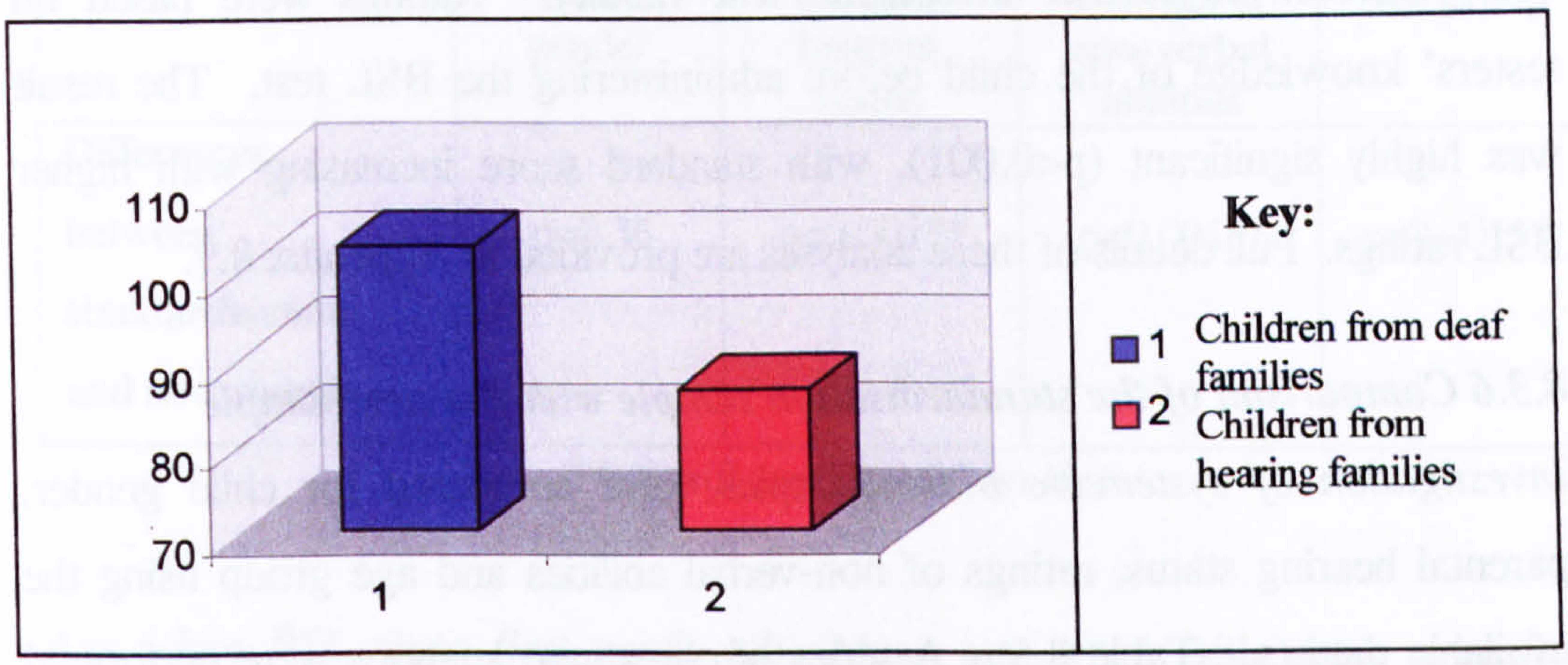


Figure 8.5: Mean BSL standard scores of children from deaf and hearing families (supplementary data)

8.3.5 Test validity

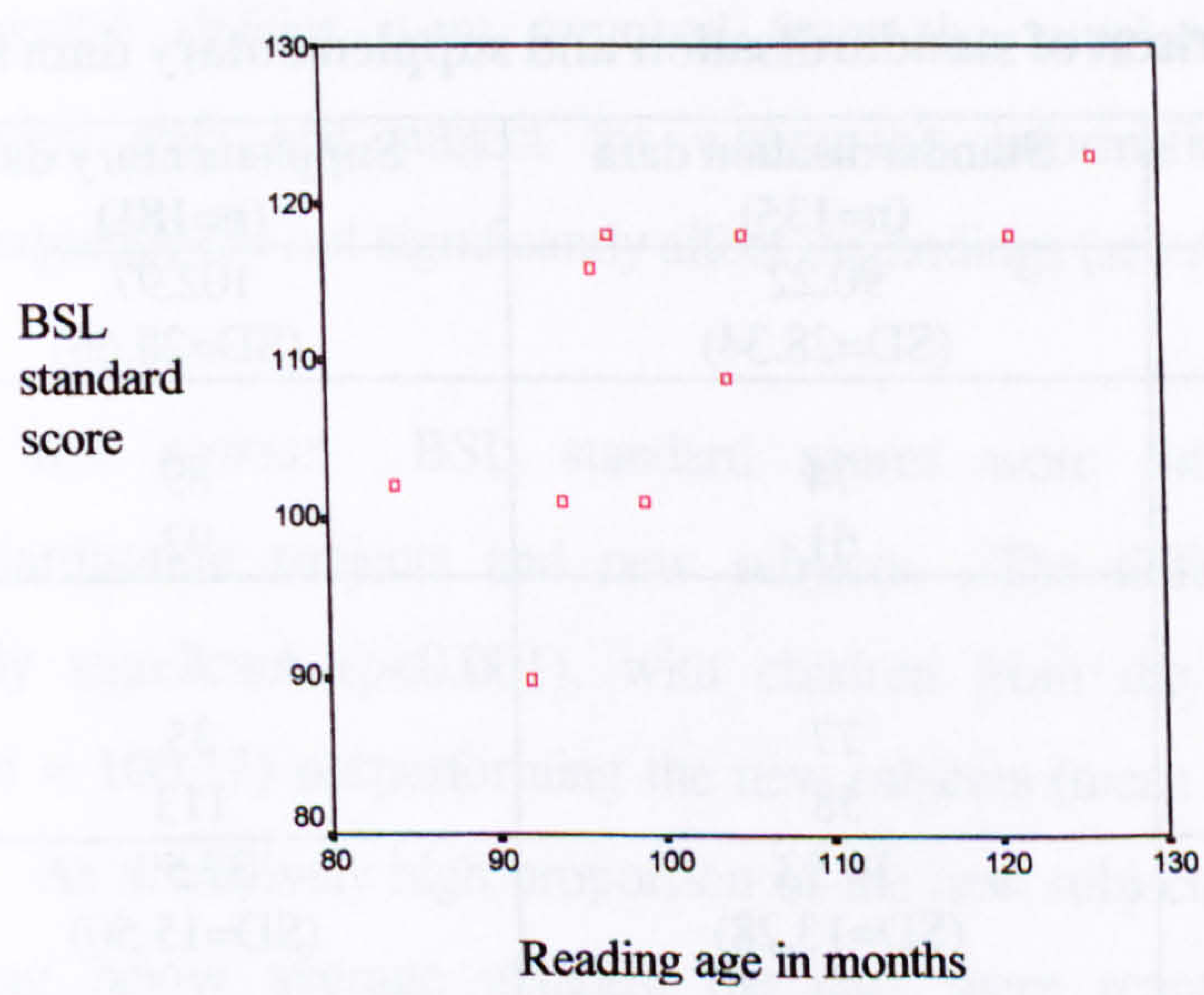


Figure 8.6: Correlation between BSL standard scores and reading age

Correlation of BSL test scores with reading scores: Information on reading age in months was available on 11 children from one school. Their BSL standard scores were therefore correlated with their reading scores as a measure of the validity of the BSL test. A significant positive correlation was observed to exist between the two scores (r=0.70, p=0.02), displayed graphically in Figure 8.6.

Comparison of BSL test scores with tester ratings of children's BSL: BSL standard scores were analysed according to tester ratings of 19 children's BSL comprehension to further investigate test validity. Ratings were based on testers' knowledge of the child before administering the BSL test. The result was highly significant (p<0.001), with standard score increasing with higher BSL ratings. Full details of these analyses are provided in Appendix 8.9.

8.3.6 Comparison of the standardisation sample with the new sample

Investigation of systematic bias: Samples were compared for child gender, parental hearing status, ratings of non-verbal abilities and age group using the available data (see Table 8.5). A series of chi-square analyses were performed using Fischer's Exact Test to investigate sample differences (see Table 8.6 below). Analysis revealed highly significant differences for all variables except for child gender. Full analyses are provided in Appendix 8.10.

Table 8.5: Comparison of standardisation and supplementary data sets

Variable	Standardisation data (n=135)	Supplementary data (n=181)
Child age (mths)	90.22 (SD=28.34)	102.97 (SD=28.66)
Child gender: female male	 74 61	 89 92
Parental hearing status: deaf hearing	 77 58	 35 113
Age (mths) when BSL signs first reported to be produced	19.53 (SD=13.28)	37.59 (SD=15.50)
Rating of non-verbal abilities, where known: 1 (low) 2 (average) 3 (high)	 0 126 0	 31 63 25

Because samples clearly differed on children's non-verbal abilities, henceforth analyses include controls for ratings of non-verbal abilities as well as looking at data on all subjects.

Table 8.6: Summary of X^2 analyses comparing standardisation and supplementary data sets

	Child gender	Parental hearing status	Ratings of non-verbal abilities	Age group
Differences between standardisation and new sample	p=0.36	p<0.001**	p<0.001**	p=0.001**

*** significant at 0.01 level*

Age when BSL signs first produced: Mean age when BSL signs were first produced was compared between samples using a one-way ANOVA. Children from the standardisation study showed a highly significant advantage ($p<0.001$), with a mean age at onset of BSL signs of 19.53 months, compared with 37.95 months for the new subjects. When children with below average non-verbal abilities were removed from the supplementary data set, this excluded only one subject for whom this information was available and consequently did not significantly affect the findings (see Appendix 8.11).

BSL test scores: BSL standard scores were then compared between standardisation subjects and new subjects. The difference was statistically highly significant ($p<0.001$), with children from the original group (mean score = 100.17) outperforming the new subjects (mean scores = 90.46) on the test. As a relatively high proportion of the new subjects had been identified as having below average abilities, the data were reanalysed excluding these children from the supplementary data set (n=31) and those for whom no information was available (n=8). Information from the standardisation sample was unavailable for 9 children. Following this analysis, the difference between groups was still found to be significant ($p=0.04$, see Figure 8.7; Appendix 8.12).

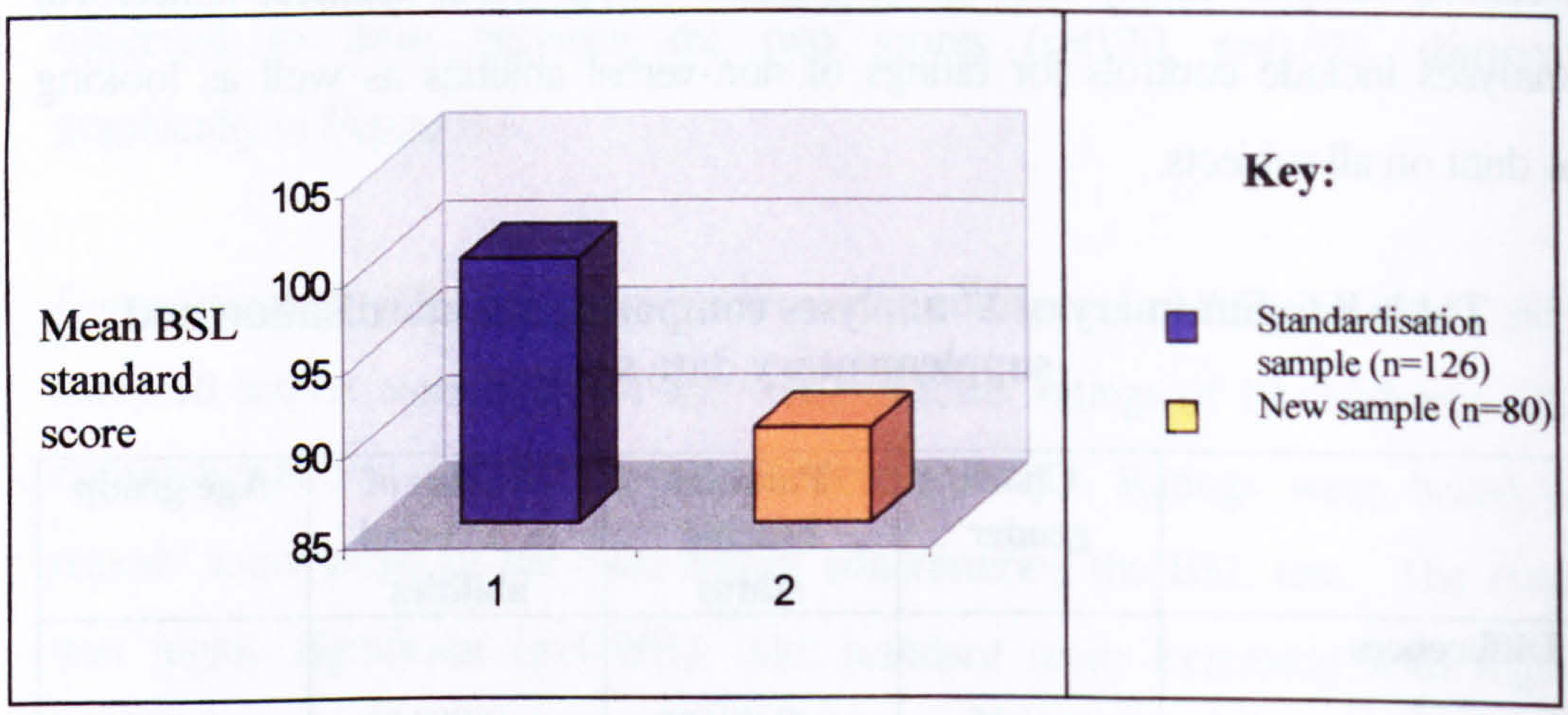


Figure 8.7: Mean BSL standard scores of standardisation and new sample (excluding children with low non-verbal abilities, or those for whom no information on non-verbal performance was available)

Effect of gender: BSL standard scores were analysed to explore the effect of gender across the samples using an ANOVA. A highly significant overall effect was observed ($p<0.001$). Child gender was found to differ significantly, girls achieving significantly higher test scores than boys in both data sets ($p=0.01$). There was also a significant effect of sample type, children in the standardisation sample achieving higher overall scores ($p<0.001$). However, there was no interaction between child gender and sample type. When children with low non-verbal ratings were excluded, the results revealed the same patterns (see Appendix 8.13 for analysis).

BSL test scores according to parental hearing status: Mean BSL standard scores of subjects were compared across samples for parental hearing status using an ANOVA. A significant overall effect was observed ($p<0.001$), with significant differences in parental hearing status and sample type. A significant interaction was also observed between parental hearing status and sample type ($p=0.01$): children from deaf families achieved higher overall scores in both samples; however, the scores of children from hearing families were significantly lower in the supplementary data set.

When children with low non-verbal ratings were excluded, the results revealed the same broad patterns; however the difference between samples was non-significant (see Appendix 8.14). This was because children from deaf families in the new sample achieved the highest overall scores and children from hearing families in the new sample achieved the lowest overall scores.

8.3.7 Combining the standardisation and supplementary data sets (1): Children from deaf and hearing families

The final analyses on the samples involved looking for patterns over the combined data set, beginning with a comparison of children according to parental hearing status. Results indicated that children in deaf families achieved significantly higher BSL standard scores ($p<0.001$) than children in hearing families. The analysis was repeated, excluding children with lower than average non-verbal abilities. Again, children from deaf families were significantly better than children from hearing families ($p=0.002$, see Appendix 8.15).

8.3.8 Combining the standardisation and supplementary data sets (2): Effect of gender

BSL standard scores were analysed to explore the effect of gender. Girls were found to achieve significantly higher test scores than boys ($p=0.003$). When children with low non-verbal ratings were excluded, the result remained statistically significant ($p=0.003$, see Appendix 8.16).

8.4 Discussion

We begin the discussion of these results by reviewing differences between the original standardisation and supplementary data sets. Thereafter, we consider the results under the research aims and questions stated in Chapter 4.

8.4.1 Comparisons of standardisation and supplementary data sets (1): Age when BSL signs first produced

The information summarised in Table 8.5 above indicates significant differences on all variables between the two samples. Where possible, subsequent analyses therefore attempted to control for key variables. Overall, the limited data on age at onset of BSL indicated a significant advantage for children in the standardisation sample. Most data in this sample came from children from deaf families, whereas most data from the new sample came from children from hearing families, so this finding was to be expected.

In addition, in a trend approaching significance, younger children in the supplementary data set were reported to produce their first BSL signs earlier than older children. This may be related to changes in communication approach of schools in the UK, alongside the more widespread recognition of BSL. In addition, it is increasingly recognised that development of a first language needs to be encouraged as early as possible. These factors may have led to children developing BSL at a younger age in recent years compared to previously. However, it must also be remembered that data based on parental recollection are likely to be unreliable, so findings must be interpreted with caution.

8.4.2 Comparisons of standardisation and supplementary data sets (2): Ratings of non-verbal abilities

One of the selection criteria for inclusion in the original sample was non-verbal performance within the normal range, within two standard deviations of the norm as measured by the SON. However, the group of children on whom the test has since been used includes significant numbers with below average non-verbal abilities (see Table 8.5). This is a significant factor as low non-verbal performance is very likely to have an impact on language ability.

For a number of children in the supplementary data set rated by testers as below average, objective test results corroborated the rating, suggesting it to be reliable. Subsequent analyses therefore controlled for non-verbal abilities by excluding subjects rated as below average. In addition, children whose standard score could not be calculated because it fell significantly below the lowest tabled value were excluded from analyses using standard scores

As none of the original sample was excluded based on above average non-verbal performance, it was decided not to exclude any such children from the supplementary data set who fell into this category. Indeed, it was felt that 'above average' ratings may be misleading as no objective data were provided to support testers' ratings for this category.

8.4.3 Comparisons of standardisation and supplementary data sets (3): Analysing BSL test scores

Children in the new sample achieved raw scores which, although lower than those of children in the original sample, still indicated a significant trend for scores to increase with age (see Table 8.3 above). However, there was also far more variability within age groups than was found in the original sample (see Table 7.5). This was as expected in view of the careful selection criteria adopted for the standardisation phase, whereby children were expected to be following a pattern of language development approximating the norm for native signers. The wider degree of variability in the new sample would suggest that some children are not following the same pattern. Indeed, a number of children in the supplementary data set were described as having additional difficulties, ranging from specific physical impairments (e.g. cerebral palsy) to attention/behavioural problems. These factors will have contributed to lower scores in the supplementary data set. To investigate individual patterns of development further, a more qualitative approach is required. We return to this when we examine individual cases in Chapter 9.

8.4.4 Comparisons of standardisation and supplementary data sets (4): Effect of gender

Girls in the supplementary data set achieved significantly higher scores overall than boys. A similar trend was noted in the standardisation sample (Chapter 7.5.4) but failed to achieve statistical significance. When the data sets were combined, the overall effect of gender was found to be significant (8.3.6). This finding is in line with previous research which has repeatedly shown girls to outperform boys on verbal measures (Bornstein *et al.* 2000).

8.4.5 Comparing children' BSL performance according to their experience of BSL

Considering the supplementary data first, the results confirm previous findings that children from deaf families achieve significantly higher BSL test scores than children from hearing families . When the two samples are combined, this effect is again highly significant and remains so even when children with below average non-verbal abilities are excluded. Deaf children in deaf families have repeatedly been shown in the literature to demonstrate advantages over deaf children from hearing families (Paul & Quigley 2000). The fact that the BSL test replicates such a robust effect provides support for its construct validity.

8.4.6 Test validity: Correlations between BSL test scores, reading test scores and tester ratings

Reading age scores were correlated with BSL test scores for a small number of subjects from the same school to provide a preliminary measure of the concurrent validity of the BSL test. The highly significant positive correlation which was observed accords with emerging research on the relationship between measures of ASL and reading (Chamberlain *et al.* 2000).

In the absence of any other objective measures of BSL, three testers experienced in working with deaf children were asked to provide their own subjective ratings of children's BSL comprehension prior to administering the test. Ratings of below average, average and above average were found to reliably distinguish between BSL test scores. This, again, is a further source of support for the validity of the BSL test.

8.4.7 Feedback on the test

Testers who returned score-sheets provided feedback on the format and value of the published version of the test. Suggested changes to the presentation of the test included the following:

- including a statement that the test video presents sentences from the presenter's perspective, otherwise interpretation of some of items testing spatial verbs could be ambiguous
- making improvements to certain illustrations, e.g. item 36 HEARING-AID NOTHING, pictures should be of head and shoulders only so that the hearing aids were easier to see
- altering characters in pictures to reflect a broader ethnic mix.

Overall, very favourable comments were made concerning the value of the test. These included:

- that it was an important step forward to have a national assessment of BSL
- that the test raised the status of BSL among parties who were sceptical of using BSL in schools
- that many children with lower cognitive abilities were able to comply with test requirements
- that parents found their children's BSL test results encouraging, especially as the majority had experienced disappointment at achievements on English language tests.

8.4.10 Training needs and tester variables

From the training days on use of the test, a number of issues have arisen. Firstly, it has become apparent that few deaf staff whose job it is to assess BSL development are provided with adequate training in language assessment. This was noted in the survey carried out at the start of the present study (Herman 1998a); several years later, little has changed. Secondly, even when written documentation and training in use of the test are provided, mistakes still occur, e.g. including practice items in the raw score; repeating items during testing; continuing testing beyond the discontinue rules. Such inconsistencies clearly affect children's scores. They also highlight the need for training in test use and the value of a careful follow-up on the test once it has been released.

Feedback from participants has also indicated that training days provide unique opportunities for professionals to share experiences related to BSL assessment and to set up support networks. A comment frequently made on the feedback forms sums up the general view: 'Can we have more, please?'

8.5 Summary

This chapter has reviewed the findings of data collected from widespread use of the published test in schools and services for deaf children following the standardisation study. Analysis of the supplementary data set has enabled us to revisit some of the research questions considered previously and has provided further information on the psychometric characteristics of the BSL test.

Overall, children in the standardisation data set achieved higher BSL test scores than children in the supplementary data set. This was as expected because the latter group sampled from the wider population of deaf children, whereas the former was a carefully selected sample of children acquiring BSL in optimal circumstances. This view was supported by (albeit incomplete) data on age of acquisition of BSL and ratings of non-verbal abilities. When the data sets were combined, children in deaf families outperformed those in hearing families and girls achieved higher BSL scores than boys. Analyses of the validity of the BSL test showed BSL development to be positively related to tester ratings of children's BSL skills. Furthermore, data on reading age, based on a small number of subjects, revealed a positive correlation between measures. This is an encouraging start to providing more objective data on the validity of the BSL measure.

Finally, feedback from test users has confirmed the value of the test in identifying children with language difficulties and in planning intervention.

9

Extended Use of the Test: Case Studies and Related Research

This chapter reports findings from two further areas in which the BSL receptive test has been used: (i) in-depth assessments of individual children performed as a result of tertiary referrals and (ii) related research projects. The case studies provide an opportunity for a more detailed look at individual children's quantitative and qualitative performance on the test. Two cases are described, a hearing child with deaf parents and a deaf child with hearing parents, to illustrate the contribution made by the test to the assessment of BSL development. The test has also been used in a number of separate research projects on deaf children and adults. We refer to these in the second part of this chapter; however the analysis of data from these studies is beyond the remit of the present study.

9.1 Clinical case studies

In this section, we contrast the analysis of group data with the presentation of two in-depth case studies to illustrate the contribution made by the BSL test to the assessment of BSL development.

9.1.1 JA (age 5;11): Hearing child of deaf parents

Reason for referral: JA was referred for assessment by the peripatetic teacher of the deaf because of language difficulties in English and behavioural problems, both of which were affecting his school work. It was unclear whether his difficulties in English were due to his having BSL as a first language and English as a (weaker) second language, or if he had a language learning disorder. He was assessed in English and in BSL on different occasions by a hearing speech and language therapist and a deaf researcher. Additional information was provided by teachers and parents.

Background: JA was the youngest of 2 hearing children of deaf parents. His mother communicated with JA using SSE. JA's father was a BSL user, although his BSL appeared to be fairly limited and his contact with JA was confined to alternate weekends. JA's parents reported that JA generally used English at home and at school, although he would use some signs when his father was present. At school, JA's listening skills in class were reported to be poor: he often failed to pay attention and could not follow classroom commands. On an individual basis, his performance was generally much better and he was responsive to praise. He was struggling with reading and mathematics but benefited from once-weekly small group work with a special needs teacher.

Assessment of English: JA's understanding and use of English were assessed using the Pre-School CELF (Wiig *et al.* 1992), on which his overall performance was low. Particular weaknesses were identified with comprehension of basic linguistic concepts (e.g. either/or, next to, before/after, first/last, some), use of pronouns (him/her/them) and tense forms. JA's expressive language skills in English were felt to be relatively strong but still immature for his age. JA's vocabulary was not assessed in detail; however there did not appear to be any particular problems. The pattern of errors, particularly highlighted through assessment of comprehension, was felt to be more indicative of a language disorder than a straightforward language delay.

Assessment of BSL: JA's comprehension of BSL was assessed using the pilot version of the BSL receptive test. He was able to correctly sign all vocabulary items, indicating use of the video-based test to be appropriate. On the BSL receptive test he attempted 23 items and passed only 10, saying several times in English 'I'm guessing'. His pattern of failure was highly erratic: he demonstrated inconsistent knowledge of basic negatives, failing the simpler items and passing more complex ones. A similar pattern was evident on items testing number and distribution, and handling classifiers, where he failed earlier items and passed items (ordered in terms of developmental difficulty) that came later in the test. Because he was assessed using the pilot version and was unable to complete the test due to poor attention, several areas of BSL grammar were not examined. Nevertheless, an overall score of 10 and the pattern of failure described together indicate a poor mastery of BSL grammar. JA was able to use and understand some basic signs; however his ability to understand syntactic and morphological contrasts was extremely limited.

Conclusion: The assessment results highlighted difficulties in both BSL and English. The assessment of JA's BSL indicated a competence with basic vocabulary, but marked comprehension difficulties with BSL grammar. Expressive language skills were not investigated, nevertheless, the findings taken together with information from the parents suggested that BSL was not at a level to be considered JA's dominant language. The errors noted could be partly explained by the limited exposure to good language models; however the presence of anomalous patterns (compared with normal development) was suggestive of a more specific problem with BSL grammar.

When asked, JA reported that he preferred using English; despite the errors observed, overall findings suggest that it was the stronger of JA's languages. This is likely to be due to more consistent exposure to English at home from his mother and hearing sister and at school. It was felt that the erratic pattern of JA's difficulties in English were not typical of E2L learners, nor could they be attributed to interference from BSL. The more severe difficulties with comprehension of grammar and the relative intactness of vocabulary and expressive language all pointed to a language disorder.

Outcome: Following a diagnosis of a specific language disorder affecting both languages, JA was referred for extra support from a Speech and Language Therapist to develop his comprehension of English (his dominant language), in addition to the help he was already receiving with reading and maths at school. Had assessment results indicated his BSL to be developing normally, this referral would have been inappropriate. Language difficulties in a second language are more easily addressed in the school setting, on the basis that normal language development in one language provides a sound basis upon which a second language can develop.

9.1.2 JJ (age 12;00): Deaf child of hearing parents

Reason for referral: JJ was referred by a paediatric neuro-psychologist for an assessment of his language development in BSL pending suspension from his new school for bad behaviour. It was felt that his behavioural difficulties might have been due to his inability to follow spoken English at his new oral school, having transferred from a school where signing was used. Previous assessment of JJ's communication had focused exclusively on his spoken language. Results from previous assessments indicated a severe delay in comprehension and extremely limited expressive spoken language, greater deficits than would be expected given his degree of hearing loss. He also had very poorly developed literacy skills with possible dyslexic difficulties. An assessment of his BSL was therefore required to establish if he had language difficulties in BSL as well as English and whether BSL was more developed than English, the result indicating the preferred language in which his education should be delivered.

Background: JJ was the only deaf child in a hearing family. Following medical mismanagement at birth, JJ had a mild dyskinetic cerebral palsy and a bilateral profound sensori-neural hearing loss, although the latter was not diagnosed until the age of 2 years.

Assessment: Assessment of JJ's signing abilities was based on his response to the standardisation version of the video-based BSL receptive test, a vocabulary test and a story recall task administered by a fluent BSL. An observation was also made of him communicating with his mother using SSE.

JJ appeared to follow conversation in SSE with his mother comfortably. He was also at ease when communicating with a fluent BSL user and able to answer questions appropriately. On the BSL receptive test, JJ achieved a standard score of 95, indicating his receptive performance to be within the normal range for his age. This was a good result in view of the relatively limited exposure to BSL (rather than SSE) that he had had. In addition, JJ passed easier items and failed more difficult items, corresponding to a normal pattern of performance. JJ was also tested using a non-standardised assessment of BSL vocabulary; his score on this test was found to be in line with the average score for deaf children of hearing parents tested on the same vocabulary test.

Conclusion: The assessment results revealed JJ to have good BSL skills, especially in view of the limited exposure to BSL he had received. There was no evidence of language impairment affecting his BSL. Therefore, it was concluded that JJ's English language difficulties were specific to the spoken/written modality.

Outcome: It was recommended that JJ undergo further assessment of his vocal production and speech perception to determine the precise cause of his difficulties. Furthermore, it was recommended that he be placed in an educational setting with good BSL provision to support academic development and access to the National Curriculum. Assessment of this child's BSL development assisted in pinpointing the source of his difficulties and determining the best educational provision for him. Had such an assessment not been performed, JJ was at risk of being branded a behaviour problem and failing at school.

9.2 Related research using the BSL receptive test

The BSL receptive test and data from its development have been used in a number of research studies exploring a range of topics. These include studies of atypical signers (Woll & Grove 1996, Sieratzki *et al.* 2001), functional magnetic resonance imaging studies of native signers (MacSweeney *et al.* 1999), empirical studies of theory of mind in deaf children (Jackson 2000, 2001) and studies of BSL development (Morgan *et al.* 2000). Two of these studies are reviewed below.

9.2.1 Research into atypical signers: hearing twins of deaf parents with Down syndrome

Woll & Grove (1996) used the BSL receptive test to explore the language deficits of hearing twins with Down syndrome who had deaf parents. Signing is often used with children with Down syndrome because it is considered easier to access, recall and produce than spoken language (*ibid*). Indeed, these children often make more progress with signs than with speech; however why this should be remains unclear. One explanation is related to modality: signs succeeding because they bypass a weak auditory-vocal processing system. An alternative explanation is that there is a deficit in the underlying linguistic system.

The study of hearing twins with deaf parents who are bilingual in English and BSL presented a unique opportunity to explore the issue. The authors argue that if the advantage conveyed by sign were related to modality, these twins would demonstrate age appropriate BSL development. If difficulties were caused by an underlying linguistic deficit, this would be evidenced by problems with BSL grammar.

The study used a qualitative analysis of the twins' performance on the BSL receptive test, compared with their performance on a range of tests of English grammar and non-verbal intelligence. Errors on the BSL test indicated specific areas of difficulty related to simultaneous marking of morphology (whereas lexical marking was unproblematic) and difficulties handling three-dimensional representations of space for linguistic (as opposed to gestural) use. Woll & Grove conclude that children with Down syndrome find BSL no easier than English, therefore providing support for the existence of an underlying linguistic difficulty common to language in general in such children.

9.2.2 *Research into BSL development*

Morgan *et al.* (2000) used data collected during the standardisation phase of the present study to investigate the development of complex verb morphology in BSL. The construction studied was that of a particular type of spatial verb, referred to as the 'AB' verb.

Group data on 30 native signing children's comprehension of these verbs were compared with elicited sentences at different age intervals between 3 and 12 years of age. Data on comprehension allowed the research team to identify stages in development corresponding to the type of errors that the children made. The comprehension data showed that the understanding of AB verbs preceded their production by several months. This indicated that the AB verb was not conceptually beyond the child, but that difficulties were related to its realisation in BSL, which requires children to produce verb predicates from two contrasting perspectives. The structure produced early errors in children's signing and exhibited a protracted pattern of development towards the correct form; mastery of the construction was mostly achieved by the age of 9 years.

Developmental data on the performance of large numbers of children acquiring BSL are generally not available. Data from the standardisation of the BSL test can thus provide a valuable basis from which to study the development of specific aspects of BSL grammar.

9.4 Summary

This chapter has reviewed the contribution made by the BSL receptive test to decisions about the educational and communication needs of individual children. Such case studies provide further evidence of the validity of the BSL assessment.

Use of the test in research studies has illustrated its contribution to unresolved issues relating to atypical signers. Data collected in developing the test has also provided a valuable resource from which to study the development of specific features of BSL.

10

Conclusion: Limitations of the Study and Directions for Further Research

The present study has been successful in achieving its primary aim of developing a psychometrically robust assessment of receptive grammatical development in BSL. Use of the test has indicated the contribution made towards the assessment of deaf children's language development. We conclude the present study by describing limitations of the research and indicating directions for future work.

10.1 Small numbers of subjects

The test has been standardised on children acquiring BSL as a first language. Although the sample size is relatively small, it represents a significant proportion of the total population of such children within the designated age limits. Nevertheless, there is a need to interpret test scores with caution, bearing in mind the small numbers in age groups and the range of variability that exists within normal development, especially among younger children. In addition, tests must be re-standardised at regular intervals because populations change: norms as well as data on reliability and validity become obsolete (Snijders *et al.* 1989). A future standardisation of the test with larger numbers of children would meet both of these needs.

10.2 Test sensitivity and specificity

Feedback suggests that the test has enabled professionals working with deaf children to more confidently assess language development in BSL, thereby being able to credit deaf children's achievements as well as identify deficits. However, we need to be sure that the test is specific in identifying only those children with difficulties in BSL development. Further research is required which follows up groups of children on whom the test has been used to confirm that those who succeed on the test are competent in BSL and that those who underachieve do indeed have problems.

The test may also provide an objective measurement of progress and be used in evaluating intervention outcomes. However, more work is needed before we know how sensitive the test is to measuring change and over what time interval. In addition, although preliminary analysis has indicated test scores to be related to children's overall competence in BSL, more work is needed on the precise relationship between test performance on individual areas of grammar, and comprehension of these in a non-test context. Research on tests of spoken language (Chapter 2) suggests this to be necessary. Until more is known about this relationship, professionals should proceed cautiously when planning intervention based on test performance alone.

10.3 Test validity

Investigating test validity in the absence of any other objective measures of BSL has been challenging. However, some measures of the validity of the test have emerged through examining the relationship between test scores and a range of other measures (tester ratings and reading age scores), exploring differences between diverse groups of children who are BSL users and looking in detail at individual cases. Overall, such relationships have proved positive; however their basis on small numbers and subjective ratings renders them open to dispute. Further research is needed to explore the validity of the BSL test with larger samples of deaf children.

10.4 Generalising test scores

The test provides useful information about one aspect of language development in BSL. As such, test performance 'within normal limits' can only be applied to the area being measured. There is a danger in overgeneralising test scores to areas of BSL development that may not be developing normally. There is an urgent need for alternative measures to be developed, both for practitioners and for research purposes, which investigate a range of other areas of BSL competence, e.g. phonology, production skills, pragmatics. BSL production data collected during the present research but not reported in this thesis will form the basis for future investigations of children's BSL development.

10.5 Performance of children in deaf families

This study has established that hearing and deaf children's BSL development is comparable, as measured by the BSL receptive test; however further research is required to investigate other areas of language development to determine whether this finding is specific to comprehension alone.

The present study has attempted to explore the relationship between hearing children's BSL and English skills, however the precise nature of this relationship remains unresolved. Further longitudinal studies are needed on the pattern of language development in each of the languages used by hearing children who are sign bilinguals.

Hearing children in deaf families have in the past been reported to experience difficulties in acquiring English. An assessment of BSL grammar will allow professionals to begin to investigate the extent to which this applies to these children's BSL development and ultimately to judge whether difficulties in English are due to acquiring it as a second language rather than due to language difficulties per se.

10.6 Children in hearing families

The study has provided support for previous research in finding that overall, children in deaf families achieve better test scores than children in hearing families.

However, the benefits of early and consistent exposure to BSL via a well-established bilingual educational programme have been demonstrated by the standardisation study: no differences were found to exist between these children and children from native signing backgrounds. Within the bilingual group, children with experience of languages other than English or BSL at home performed equally well on the BSL test. This is a positive finding and one that merits further investigation.

In Total Communication environments where, despite the emphasis on English, children do develop BSL, the lack of adequate BSL input can be supplemented by access to deaf relatives. This finding from the standardisation study could not be pursued with the additional data collected because educational programmes were not reliably categorised. Further research should investigate whether the current findings in this area are replicable.

10.7 Training needs

The postal survey carried out at the start of the study highlighted the need for staff working with deaf children to be trained in areas related to BSL assessment. A training day was provided in use of the BSL receptive test when the test was released, but this was not sufficient to meet the broad range of training needs which exist. The training day related solely to use of a video based test that places relatively limited demands on tester skill. To fully assess other areas of BSL development, staff involved in BSL assessment require far more extensive training in BSL development, BSL linguistics, data collection, transcription, analysis and interpretation.

10.8 Research into atypical signers

This study has focused on the development of a BSL assessment tool based on children acquiring BSL normally. However, many children on whom the test will be used do not fall into this category. High numbers of deaf children have additional special needs and many may therefore be expected to display atypical patterns of BSL development. As our knowledge of normal BSL development increases, so does the need to explore these atypical patterns. Research based on atypical signers can help us to test specific hypotheses relating to the source of the problem. Indeed, studies of atypical signers can shed light on normal processes of language acquisition. Analysis of clinical case studies can, in turn, lead to more carefully planned intervention to address the difficulties faced by individuals in language development.

10.9 The future

10.9.1 Developing other sign language assessments

The present study has contributed to the field of BSL development and its assessment. Assessments are also required in countries where other sign languages are used. The methods used in the present study can be adapted to the assessment of other sign languages, to the benefit of deaf children, professionals and researchers; indeed, there has been interest from several countries in doing so.

There is also the potential to develop computer-based assessment materials (Kuntze 2000) that bypass the need for trained testers at all as the test is administered individually or in groups via specially designed computer software. The format of the BSL receptive test would lend itself to administration in this way.

10.9.2 Cochlear implants

A key question to consider is what role the future holds for the use of BSL with deaf children. Cochlear implantation is rapidly being adopted as a solution to the problems faced by deaf children in acquiring language. Some parties view this as a step towards a significant reduction in the population of deaf sign language users and a threat to the very existence of sign languages. However, there will always be children for whom cochlear implants are not appropriate. Carney & Moeller (1998) suggest that, of the 15 million people in the United States with a significant hearing impairment, less than 1% are potential candidates for a cochlear implant. Similar statistics for the UK population have not been reported.

There is growing recognition that sign language has a role to play in relation to cochlear implant users. Progress in sign language acquisition can be used as a pre-selection measure to screen out children with language disorders, for whom an implant may be ineffective (Shipgood, personal communication 2000). In addition, recent research suggests that age-appropriate language development in sign before implantation may lead to greater benefits post-implantation (Coerts *et al.* 1996). What remains to be established by future studies is the effect a cochlear implant has on these children's communication, in sign language as well as spoken language. Work currently underway, following up a small group of children involved in standardisation of the BSL test who have since received cochlear implants, will shed light on this area. Careful monitoring of sign language development remains a key issue, to which the BSL receptive test can make a valid contribution.

10.9.3 Universal neonatal hearing screening

The indication that universal neonatal hearing screening (UNHS) will be implemented nationally in the UK in the near future (Institute of Hearing Research 2001) brings with it the issue of the most appropriate form of intervention to use with newly diagnosed deaf infants. Recent research from areas where UNHS has been implemented suggest that quality intervention using spoken or sign language can be successful in developing children's language to an age-appropriate level (Yoshinaga-Itano *et al.* 1997). Again, regular measurement of language development in either language must be viewed as an essential part of the intervention approach.

10.10 Conclusion

Many hearing children with speech and language difficulties benefit from the use of signing, as an alternative or augmentative method of communication. There is general agreement that this enables them to better express themselves, assists with their socio-emotional development and allows access to education. Ironically for deaf children, there remains resistance to the use of BSL where this is required. Brennan (1999:2) states that:

"most current educational policy and practice with regard to deaf pupils is essentially exclusive: it either intentionally and explicitly or implicitly, and

possibly inadvertently, excludes the use of British Sign Language within primary and secondary education."

The result of this policy is large numbers of deaf children left educationally frustrated, underdeveloped sign language teaching and limited sign language educational resources. Research documenting the 'achievements' of deaf children continues to focus exclusively on their deficits, rather than their strengths.

The present study has sought to address this situation by acknowledging the importance of BSL to deaf children who use it. The development of a measure of BSL development based on children acquiring BSL under optimal conditions sets the standard for all deaf children and recognises the place of BSL in deaf education.

The End

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APPENDICES

Appendix 3.1 Timetable of sign language development from Woll (1998)

Stages of BSL acquisition

0–9 months

Babbling and gestures

- As discussed above, within the first 9 months sign babbling and the first copying of sign-related gross motor gestures of parents occur.
- Independent gestures (including those which are sometimes described as the first signs) occur at the end of this period.

9 months – 1;0

Pointing

- Non-linguistic pointing to self, other people and objects appears.

1;0 – 1;5

Pronominal reference, vocabulary

- Pointing to people drops out in this period, although pointing to objects is maintained.
- The first true signs appear at this stage. There is often over-generalisation (e.g. CAR used to refer to cars and buses).

1;6 – 1;11

Pronominal reference

- Linguistic pointing to other people appears.

Morphology

- Verbs appear in the lexicon, but there is no productive verb morphology, with only citation forms of verbs used (i.e. no subject or object agreement in agreement verbs, no use of pro-forms in spatial verbs).
- There is no use of derivational morphology and consequently no morphological distinction between nouns and verbs.

Syntax

- The first two-sign utterances appear.
- In contrast to adult signing, where verb inflection, for example, is used to mark subject and object on agreement verbs, sign order is used to mark semantic relations.

2;0 – 2;5

Phonology

- Phonology differs greatly from that of adult signers, with regular patterns of reductions of contrast and omissions of phonological features. There appears to be a universal pattern of handshape development, with maximally visually contrasting handshapes (e.g. fist, pointing hand, flat hand) appearing first. There has been less research on location and movement, but it appears that children substitute simple for more complex movements, and often exhibit perseveration in movement. Some research from ASL suggests that sign location within the centre of the child's visual field (e.g. signs made on the face or body) is mastered earlier than signs in the periphery (e.g. signs located on the top of the head).

Pronominal reference

- Pointing to addressee (YOU) appears at about 2 years. Some children show evidence of self/addressee reversal errors (e.g. YOU PICK meaning I PICK).
- Pointing to third person begins slightly later, and by 2;5 first, second and third person are correctly distinguished.

Morphology

- Verbs requiring agreement begin to be used, but are most often produced in citation form, with agreement omitted, or as unanalysed rote forms.
- There is often over-generalisation of the verb inflection rule, with plain verbs inflected, where this is not grammatical in adult BSL.
- The first morphological distinctions between nouns and verbs occur, but the contrast is made incorrectly.

2;6 – 2;11

Morphology

- First appearance of classifiers used in spatial verbs. However these appear to be unanalysed wholes, with no evidence of productive use. These early classifiers often use unmarked or incorrect handshapes.
- Verbs do not yet show morphological marking of manner (either through facial expression or altered movement).
- The first productive use of verb agreement occurs at the beginning of this period.
- Noun/verb pairs are distinguished but this is frequently in non-adult ways, for example, by marking one of the pair with a distinctive facial expression, body posture, or speed of movement.

3;0 – 3;5

Morphology

- Inflection of spatial verbs for movement or manner occurs, but children do not yet combine these. Thus if movement exhibits inflection, manner is signalled separately from the verb.
- The first correct use of classifiers occurs at this stage.
- Verb agreement is mastered in sentences where reference is made to objects present in the environment. However, omission of verb agreement with abstract spatial loci continues until well after 3;0.
- The first correct use of some number and aspect morphemes is found with spatial and agreement verbs.

3;6 – 3;11

Phonology

- Lexical compounds are used, but these are articulated without the characteristic phonological pattern (i.e., both parts of the compound are stressed).

Morphology

- Spatial and agreement verbs now have both movement and manner, but these are produced sequentially rather than simultaneously; towards the end of this period, there is the beginning of co-ordinated usage of both.
- Verb agreement begins to be found with abstract loci, but this occurs without coordinated establishment of referents at those loci.

4;0 – 4;11

Phonology

- Innovative compounds appear, although they are not adult-like either in phonology or in meaning.

Morphology

- Overt establishment of loci associated with referents is still absent in the first part of this stage. A moderate degree of control of the use of abstract loci, including their establishment, use and maintenance, is achieved by 4;11.
- Children still make occasional over-generalisations of verb inflection rules, although agreement with single subject is usually correctly marked.
- The noun-verb distinction is clear, but innovative forms are still seen in addition to correct forms.

5;0 – 5;11

Morphology

- The mastery of most morphology is completed and used with reasonable skill, though the most complex polymorphemic forms still cause difficulty.

Between 6 and 10 years, there is ongoing development of the requirements of narrative. While acquisition of most structures has been completed at the sentence level, the application of grammatical structures to the requirements of narrative, including cohesion, use of narrative role, etc., is still developing during this period.

8;0 – 8;11

Morphology

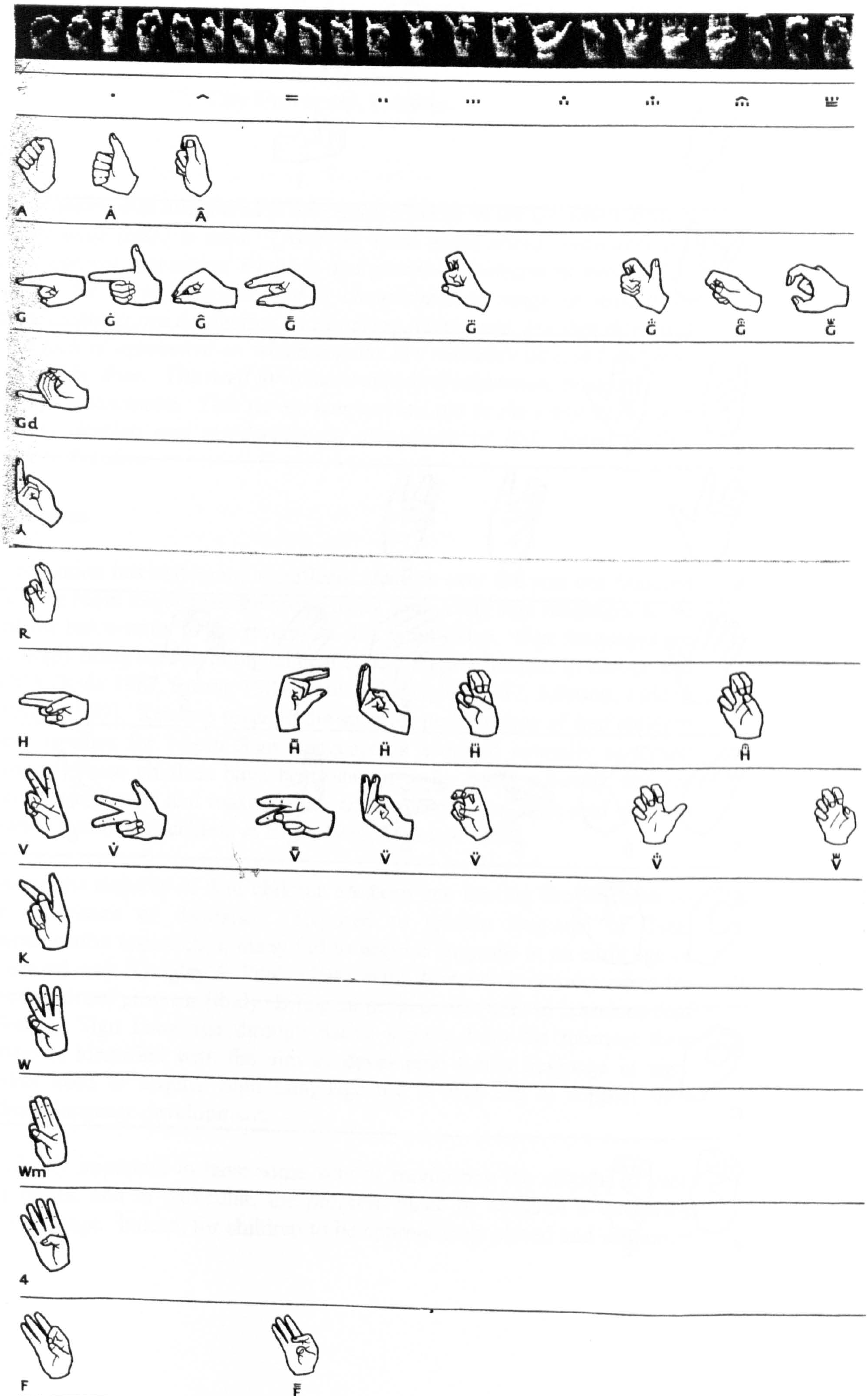
- The use of classifiers and spatial verbs is largely mastered, although some errors on complex forms are still noted.

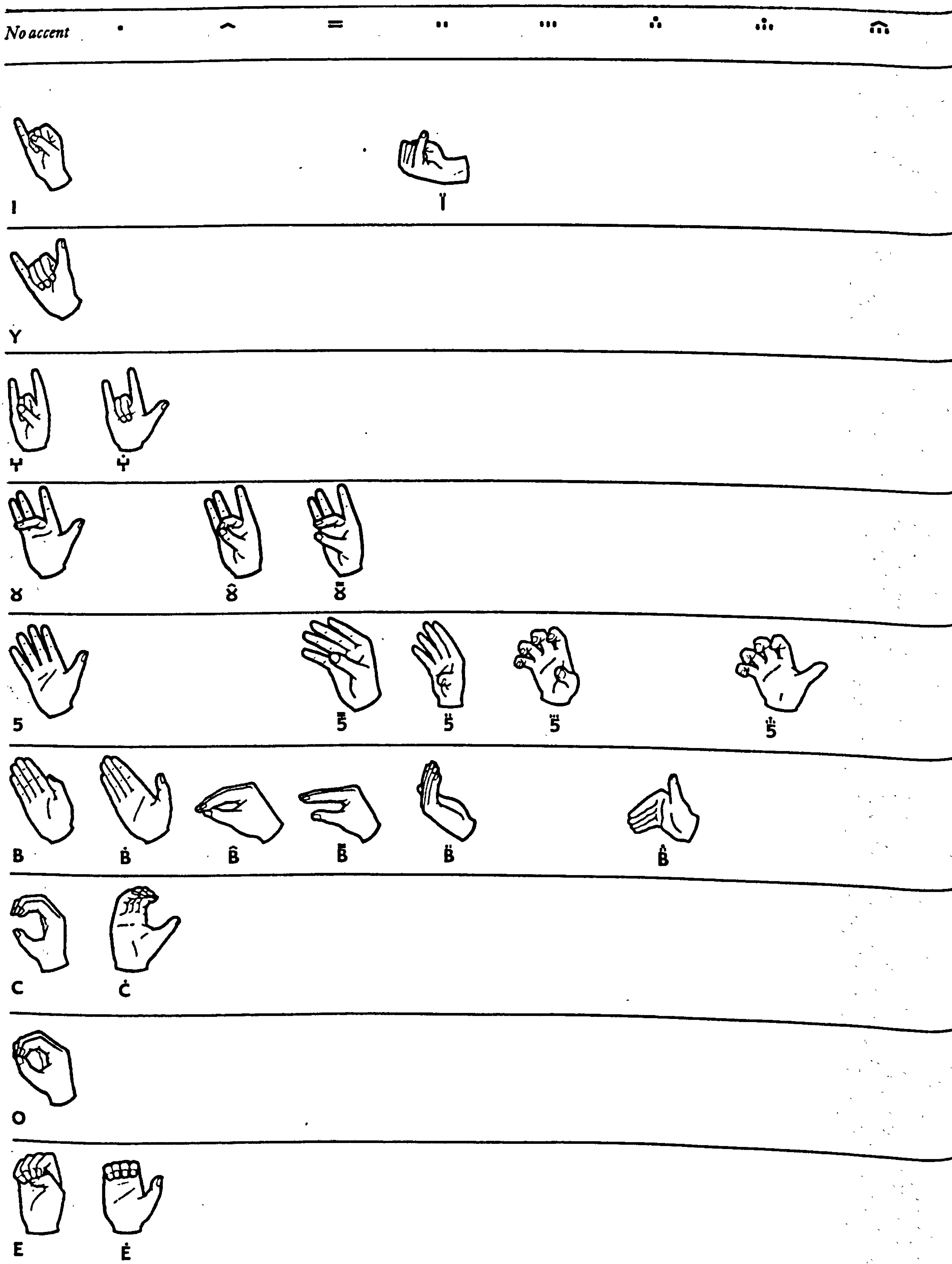
9;0 – 9;11

Morphology

- Mastery of the productive use of classifiers and spatial verbs is completed.

Appendix 3.2 BSL Handshapes (from Brien 1989)

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In Deafness & Education, Oct 1998.

The Need for an Assessment of Deaf Children's Signing Skills

Rosalind Herman
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Abstract

A questionnaire was distributed to education services in the UK where British Sign Language (BSL) is used. Questions were asked about communication policies, current assessment methods and perceived assessment needs. The results of the survey suggest that a comprehensive range of aspects of children's signing are recognised as requiring assessment, but that there is a general lack of agreement on which aspects are routinely assessed and how this should be done. The need for a more standard assessment protocol to be developed is discussed. This survey was carried out in the early stages of a project to develop and standardise an assessment of BSL, based at City University, London.

Introduction

Deaf education has undergone significant changes over the past one hundred years, none more major than the swing away from using sign languages at the end of the last century to the reverse of that trend today. Sign languages are increasingly being used in bilingual deaf education programmes in Europe and the USA (Kyle 1987, Strong 1988, Paul and Quigley 1987, Johnson, Liddell and Erting 1989). Reasons relate to the superior performance of deaf children in deaf families for whom Sign Language is acquired naturally as a first language. These children have been shown to be better adjusted, achieve higher literacy levels and make greater academic progress than deaf children in hearing families (Stuckless & Birch 1966, Meadow 1968).

However, the majority of deaf children are born into hearing families with no prior experience of deafness. Exposed to spoken language or Total Communication approaches, many fail to acquire language at an early age or in a natural way (Quigley & Paul, 1994), with devastating consequences for their educational progress (ibid). Bilingual programmes seek to introduce deaf children to Sign Language through native signers from the moment their deafness is identified with the aim of developing a first language in sign. Families need to acquire Sign Language too if they are to support their children's language development.

It is clearly important to have some way of monitoring the success of such programmes, and in particular, the progress made by children in acquiring Sign Language. Indeed, for children to be appropriately placed and supported in education, we need to be able to fully describe their communication skills and needs as part of the statementing process. With the exception of the pioneering work of Kyle and colleagues at Bristol University (Kyle 1990, Jansma 1994), there has been little research in the UK on assessment of BSL and there are as yet no standardised measures which can be used by professionals working with deaf children to assess children's developing competence in Sign Language.

The present study reports the results of a postal questionnaire developed to investigate if and how deaf children's signing skills are being assessed in educational contexts where BSL is used. In the questionnaire, questions were asked about the communication policies in the schools and units where the respondents worked; current policy on assessment in terms of what was assessed and how; who was involved in assessment and what assessment needs were perceived to be. The questionnaire was circulated to schools in the UK as part of a project at City University, London, to develop and standardise an assessment of BSL.

The sample

The questionnaire (see appendix) was distributed via Speech & Language Therapy services for deaf children and Teachers of the Deaf working in schools and units listed in the RNID Directory as using BSL as part of their communication policy. These two groups of professionals were identified as having been traditionally involved in the assessment of deaf children's communication. In some schools, Deaf staff are employed to assist with Sign Language assessment and development, therefore a covering letter asked the recipient to pass the questionnaire on to the person responsible for assessing signing skills in their school or unit in order to access these individuals.

A total of forty-four questionnaires were distributed and twenty-nine completed forms (66%) were returned. Twelve of these were completed by Speech & Language Therapists and twelve by Teachers of the Deaf, all of whom were hearing. Five were completed by professionals who described themselves variously as follows: a Communicator (a hearing individual with some signing skills but who is not a fully qualified interpreter), a Sign Communication/Training Co-ordinator (a hearing person with high level signing skills and a qualification in Deaf Studies), two Deaf Instructors (Deaf people working in school settings with native signing skills) and a Deaf person employed on a project to develop materials for Sign Language assessment in a school for deaf children.

All of the respondents reported that their schools used signing in some form, however a variety of communication approaches were presented. Five schools described themselves as bilingual (British Sign Language (BSL)/English) and a further four as "moving towards a bilingual policy". Fifteen schools reported that they adopted a Total Communication policy and one previously oral unit was described as "moving towards Total Communication". Four schools used terms such as "child-centred communication" or "accessible communication" or "Sign Supported English (SSE)/ BSL/ Makaton". SSE is the use of key signs alongside spoken English; Makaton is a sign vocabulary originally developed from BSL and used mainly within the learning disabled population.

Are signing skills assessed in school?

Of the twenty-nine respondents, twenty-two (76%) reported that they were assessing signing in some way and seven said that they were not attempting to do so. All seven respondents were working in Total Communication contexts. Five of these added comments to their form: one noted that s/he only worked with one deaf child who was fully integrated and that therefore no assessment of signing was necessary. Another pointed out that there were time and cost implications in assessing signing, hence signing was not assessed. Two schools were currently engaged in training staff in signing before looking at the children's skills. One school felt that use of SSE led to good English in their children and therefore did not see the need to assess signing.

When asked whether they were satisfied with the current assessment format, nine (45%) of the twenty respondents answering this question reported satisfaction, although there were comments relating to the need to share ideas on assessment and difficulty in finding time to complete assessments. One respondent felt that, although satisfactory at present, the situation might change in the near future with less verbal children entering the school. Eleven respondents reported that they were not satisfied, frequently noting problems with the lack of training and limited or no access to native BSL users. One person commented on the danger of an unstructured approach to BSL assessment.

How are signing skills assessed?

A variety of assessment methods were described: observation of live conversation, video analysis of a conversation with either another child or a Deaf adult, a video of "sign tasks" (not specified), video of children re-telling a story they had watched in cartoon form, asking graded questions on a signed story, adapting existing tests of spoken language (e.g. Test for the Reception of Grammar, Derbyshire Language Scheme, Sentence Comprehension Test), Webster profiles, Council for the Advancement of Communication with Deaf People (CACDP) assessments.

Respondents were asked what, specifically, was assessed. Some respondents provided general answers such as "receptive and expressive skills" and "language development", whereas others identified features of BSL such as proforms, classifiers, time markers, role shift, multichannel signs, facial expression, placement, modifiers. In addition, vocabulary, conversational skills with Deaf and hearing partners, fluency, handshapes, fingerspelling and attention were areas to be considered. There was the little overlap between what was being assessed in different schools.

Who is involved in assessment?

Most respondents reported that a variety of people were involved in assessing children's signing. Typically, the Teacher of the Deaf and Speech and Language Therapist were identified. Many respondents felt that a Deaf adult should be involved. This was the case in only 11 (28%) settings. The need for a broad cross section of people to be involved in assessment was stated, comprising Deaf adults who are native BSL users, preferably with training, Speech and Language Therapists, Teachers of the Deaf and/or mainstream teachers and parents.

Perceived assessment needs: training

The need for specific training in assessment was investigated. Twenty-two people answered this question and all but one felt that training was essential. The need for recognised qualifications in BSL, training in BSL linguistics and knowledge of BSL development were cited. The latter was expanded by several respondents to include knowledge of the differences in BSL development for deaf children with deaf parents compared with deaf children from hearing backgrounds. Specific training on the development of hand function and how to understand child BSL was also felt to be a training need.

Further training was needed in transcription of BSL, selection of features of BSL to assess, distinguishing immature versus deviant BSL and how to move from assessment to planning and teaching. More general training in assessment was also felt to be necessary by many respondents, e.g. the appropriate situations to sample, materials to use, elicitation techniques and use of video.

What assessment tools are needed?

All but two respondents answering this question identified a need for BSL assessments to be developed. Those most frequently mentioned were vocabulary assessments and tests of syntax which were norm-referenced. Other suggested assessments were: receptive and expressive tests, test of concept development, comprehension of BSL questions, stories and instructions, visual tests and tests involving explanations. Assessments which took account of communication in real-life situations were felt to be important and the need for assessment to be economical on time was repeatedly stressed.

Discussion

This study has presented information on how deaf children's signing skills are currently assessed in the UK. Of those schools where some form of signing is used who completed the questionnaire, over 75% regularly assess signing in some way. Looking across all respondents, a comprehensive range of aspects of children's signing are recognised as requiring assessment but there is a lack of agreement between different schools on which aspects are routinely assessed and how this should be done. As a result, signing appears to be assessed in an ad hoc way in all but a few settings. Furthermore, the methods described are necessarily subjective in nature. A forum is clearly needed in which ideas on assessment may be shared in order to develop a range of more objective procedures.

The type of communication approach adopted influences the approach to assessment. The majority of schools adopt a Total Communication approach where signing is typically used alongside spoken English. In such cases, assessment of signing separately from English may not be considered. Indeed, all seven schools where signing was not assessed were using a Total Communication approach. Where children are perceived as communicating mainly in English, albeit bimodally using SSE or Signed English, standard English assessments are used. A danger here is that important aspects of language development will be missed: non-English communication may be ignored or wrongly labelled as gesture when it may in fact be linguistic; conversely, gesturing may be interpreted as being linguistic.

Research on the language development of deaf children exposed to Total Communication has suggested that many go beyond the input they receive to create language structures which more closely resemble Sign Language than English (Gee & Goodhart, 1988). Knowledge of Sign Language, its development and assessment cannot therefore be ignored by those concerned with deaf children's language development.

In some educational settings, translations of tests of spoken English are used. It should be noted, however, that there are problems with this approach. Vocabulary frequency has never been recorded for BSL, so direct borrowing of English vocabulary assessments is not appropriate. In addition, vocabulary differences exist between spoken and sign languages, e.g. an English word may not have an equivalent single sign. Moreover, where vocabulary items in Sign Language are denoted by pointing (e.g. body parts), the level of task difficulty is necessarily affected. Similarly with syntax, certain spoken language constructions, e.g. passive sentences, do not have direct equivalents in Sign Language where the preferred structure is quite different.

Use of assessments developed to examine adult BSL skills (CACDP examinations) is used in some settings. These assessments are graded to look at different levels of skill in BSL, however they have not been designed with a developmental sequence in mind and are therefore not appropriate to use with young children.

In schools where BSL is used as part of a bilingual approach, the need to assess features of BSL separately from English is readily identified but, as mentioned above, there exists much variation between schools in the features to select and how this is achieved. Furthermore, it is unlikely that developmental norms for any of these features are being used; in many cases, they are simply not available.

Most respondents acknowledge the need to involve people with different skills and knowledge when assessing children's signing skills. In practice, the majority of assessors work in teams but often lack the necessary expertise, in particular access to native BSL users. In a few cases, assessors work in isolation. Three teachers of the deaf reported that they alone assessed signing skills and felt unqualified to do so, especially in view of their limited knowledge of Sign Language. Three deaf instructors also worked alone and felt that, although fluent in BSL, they would benefit from wider discussion of and training in assessment. The availability of such training is currently limited and should be identified as an area for future development.

Finally there is a clear need for published assessment tools. Some schools and services are developing their own assessments, however these are not yet widely available. The need to develop norm-referenced tests was raised by many respondents. Such tests are organised developmentally based on empirical data. However the difficulty in developing norm referenced tests with deaf children is highlighted by the recent work of Kyle and colleagues (1990). A vocabulary measure was developed and administered to deaf children of different ages who were exposed to signing at school. The majority of subjects were from hearing families. The results contained such a high degree of variability that no consistent order of difficulty for items could be isolated. The research team concluded that no standardisation was therefore possible.

Although tests are typically most needed for deaf children from hearing families, there are difficulties in standardising assessments on this group because of the variability of performance on language measures. Ideally, any standardisation should use a more homogeneous population. When looking at the spoken language development of deaf children it has been customary to use tests which have been standardised first on hearing children and secondly on deaf children (a number of tests have been standardised on deaf children in the USA e.g. the Grammatical Analysis of Elicited Language (GAEL) Moog & Geers 1979). The most appropriate population to use when standardising a test of Sign Language is children from native signing backgrounds. These children receive consistent input in Sign Language from birth and are thus in a position to acquire Sign Language normally. The language performance of deaf children from hearing families can then be compared with this group.

This study was carried out in the early stages of developing a BSL assessment at City University, London. An assessment battery encompassing receptive and productive signing subtests has since been piloted on children from native signing families aged three to eleven years and a standardisation study is currently being carried out. It is hoped that the finished assessment will go some way towards meeting the need for an available range of repeatable and comprehensive assessment procedures. It is also hoped that it will lead to greater discussion on Sign Language assessment by professionals working with deaf children.

Note: We are grateful to North Thames Regional Health Authority for funding a Deaf research assistant to this project which will be completed at the end of 1998.

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Survey of BSL assessment practices in the UK

Background information

What is your role? (e.g. Speech & Language Therapist, Qualified Teacher, Teaching Assistant/Instructor, other? (please specify)

What is your hearing status? Deaf/Hearing

What is your level of signing skill: e.g. CACDP I, II, III or other? (please specify)

Is the school in which you work primary/ secondary/ both primary and secondary?

What is the communication policy in your school? (e.g. Total Communication/ Bilingualism/ other (please specify)

How many Deaf staff are employed at your school?

Assessment of Signing Skills in Deaf Children: Questionnaire

1. Are aspects of children's signing routinely assessed in your school?
If yes, which aspects are assessed?

How is this assessment carried out?
e.g. using a published test (which one?)
using own test/task (describe)
general observation/video
other procedures (please describe)

2. Do you feel there are problems in trying to assess children's signing skills? If so, please describe these.

3. Do you feel that specific training is needed to assess children's signing skills? If yes, what sort of training is needed?

4. Who is/are responsible for assessing children's signing skills in your school?

Do you feel that this is satisfactory? If not, why not?

5. Who do you feel should be involved in assessing children's signing skills?

6. Do you feel it would be useful to have more available tests of children's signing skills? If yes, what sort of tests?

COMMENTS:

Appendix 5.1: Details of children included in pre-pilot trial 1

Subject	Gender	Age	Child deaf/hearing	Parents deaf/hearing	Type of school
1	f	5;09	deaf	hearing	TC/bilingual
2	f	5;09	deaf	hearing	"
3	f	5;06	deaf	hearing	"
4	m	7;03	deaf	hearing	"
5	f	9;01	deaf	hearing	"
6	m	10;09	deaf	hearing	"
7	m	9;11	deaf	hearing	"
8	m	8;07	deaf	hearing	"
9	f	10;05	deaf	hearing	"
10	f	4;07	deaf	hearing	"
11	m	2;09	hearing	deaf	hearing
12	m	2;09	hearing	deaf	"
13	f	7;08	deaf	deaf	"
14	f	11;00	deaf	deaf	oral deaf
n=14	f=9 m=6	mean =7;04	deaf=12 hearing=2	deaf=4 hearing=10	

Appendix 5.2: Vocabulary pictures used in pre-pilot trial 1

Vocabulary item	Tested receptively/ expressively	Vocabulary item	Tested receptively/ expressively
APPLE	rec	MAN	rec
BALL	rec	MILK	exp
BAT	exp	MONKEY	exp
BED	rec	PEN	rec
BLANKET	exp	PLATE	exp
BIKE	rec	SCISSORS	rec
BOX	rec	SHOE	exp
BREAD	exp	SPOON	rec
BOY	exp	TABLE	rec
CAR	rec	TEA	exp
CAKE	rec	TEDDY	exp
CAT	exp	WALL	exp
CHAIR	exp	PERSON-STANDING	rec
CUP	rec	PERSON-HIDE	rec
CUPBOARD	rec	PERSON-WALKING	rec
DOG	exp	PERSON-SLEEPING	exp
DOLL	exp	PERSON-SITTING	exp
EGG	exp	PERSON-EATING	rec
GIRL	exp	PERSON-FEEDING-BABY	exp
HAT	rec	PERSON-POURING-TEA	exp
HOUSE	rec	PERSON-WASHING-CAR	rec

Appendix 5.3: Details of children involved in pre-pilot trial 2

Subject	Gender	Age	Child	Parents	Type of school
1	f	3;06	deaf	hearing	TC/bilingual
2	f	5;10	deaf	hearing	TC/bilingual
3	m	4;08	deaf	hearing	TC/bilingual
4	m	3;04	deaf	hearing	TC/bilingual
TOTALS	f=2 m=2	mean =4;03			

Appendix 6.1: Sample letter to parents and consent form

Dear Parent,

I am a Speech & Language Therapist based at City University, London, and am currently developing a language assessment to look at BSL development in children. The language tests will look at the children's understanding and use of particular grammatical features in BSL. The children will watch a short video and then retell the story and also look through a picture booklet with a deaf researcher and answer some questions. This will take about 30 minutes per child and we will be video-recording the test sessions.

Please will you fill in and return the attached form letting me know whether or not you agree to your child taking part in the language tests on Friday, and also whether you would be prepared to give your permission for me to use the video clips in teaching Speech & Language Therapy students about language development in deaf children.

Thank you very much for your co-operation with this project.

Ros Herman

Lecturer/Researcher in Language Development in Deaf Children.

Project to develop a language assessment in BSL

Consent Form

Date:

Name of child:

* I do/do not give permission for my child to take part in a 30 minute language test.

* I do/do not give permission for the video recording of my child to be used in the training of Speech & Language Therapy students.

* delete as appropriate

Signature of parent/guardian:

Thank you once again for your co-operation.

Appendix 6.2 Family questionnaire

Family Questionnaire

Name of parent:
Date:

1. **Please fill in the table below including all the people who live in your home**

Person:	Age of children	Deaf/Hearing D/H	Job	Education	Preferred languages used at home	Other languages used at work child's school, Deaf Club etc.
1. e.g. mother						
2.						
3.						
4.						
5.						
6.						

Preferred languages may be:
British Sign Language = natural language of Deaf people, different to English
BSL plus lip patterns
Signed English = signs which follow English grammar and word order
Signs and some spoken English
Signs and some written English
Spoken English only

2. **Who usually looks after you child/children in the home?**

mother father grandparent childminder other - who?

If this person is not mentioned in the table above, what is their preferred language?

3. **Do you think you change your communication with your child at different times?**
e.g. use lip patterns if child is hearing or wearing hearing aids
use voice if child is wearing hearing aids
use lip patterns if child uses them
use more English signing if child does
use more English signing if helping child with homework
other times

Why?

4. **Do you think you communicated differently with your child/children when they were younger?**
e.g. used more lip patterns when child was younger
used more/less voice before
used more/less English signing before
other ways...

Why?

Thank you for your help. All information is strictly confidential.

Appendix 6.3: Subjects involved in pilot study

Subject	Gender	Age at testing	Deaf or Hearing	Subject	Gender	Age	Deaf or Hearing
1	f	3;02	h	23	f	7;05	d
2	m	3;07	d	24	f	7;06	h
3	f	3;07	h	25	f	7;11	d
4	f	3;09	d	26	m	8;01	d
5	f	3;11	d	27	f	8;05	d
6	m	3;11	d	28	m	8;08	h
7	f	3;11	h	29	m	9;00	h
8	m	4;03	h	30	f	9;00	d
9	m	4;03	h	31	m	9;01	d
10	f	4;11	d	32	f	9;02	d
11	m	5;00	d	33	m	9;10	d
12	m	5;00	d	34	m	10;05	d
13	f	5;03	h	35	f	10;06	d
14	m	5;03	d	36	f	10;07	d
15	m	5;07	h	37	f	10;10	h
16	m	5;08	h	38	f	11;00	d
17	m	5;09	d	39	m	11;03	d
18	m	6;00	d	40	m	11;05	d
19	m	6;02	d	41	f	11;06	d
20	m	6;07	d	**Totals n=41**	**f=20 m=21**	**mean= 7.1 yrs**	**d=28 h=13**
21	f	6;10	d				
22	f	7;05	h				

Appendix 6.4 Pilot vocabulary checklist

Vocabulary item	Child's sign: 1 = London 2 = Leeds 3 = Scotland 4= no response, wrong response/homesign	Can child recognise the test sign? If so, indicate which test sign: 1/2/3
aeroplane		
apple		
ball		
baby/bath		
banana		
bed		
bike		
book		
boy/child		
box		
car		
cup		
dog/collar		
girl		
hat		
headphones		
hearing aid		
house		
ice-cream		
letter		
mummy		
pencil		
scissors		
table		
teddy		

Appendix 6.4 Pilot BSL receptive test score sheet

	Linguistic feature assessed	Gloss of BSL receptive target and description of picture	R	Descriptions of distracter pictures (lexically, syntactically or phonologically contrastive)
		Practice items:		
p1	*Two sign combination*	*MUMMY STAND* *woman standing*	*1 2 3 4*	*woman sitting* *child standing*
p2	*Two sign combination*	*CHILD TELEPHONE* *child on the telephone*	*1 2 3*	*child reading* *child sleeping*
p3	*Two sign combination*	*MUMMY TELEPHONE* *woman on the telephone*	*1 2 3*	*child talking on the telephone; woman standing by telephone*
		Main test items:		
1a	Two sign combination	MUMMY WALK woman walking	**1** 2 3	child walking; child sitting
1b	Two sign combination	CHILD EAT boy eating plate of food	1 **2** 3	mother drinking; mother eating
2a	Two sign combination	BABY SLEEP baby sleeping	1 **2** 3	baby sitting in high-chair; boy sleeping
2b	Two sign combination	MUMMY READ woman sitting down reading	**1** 2 3	woman standing; child sitting down reading
3a	Negation	ICE-CREAM NOTHING child with no ice-cream	1 2 **3**	child with ice cream but no drink; child with ice-cream and drink
3b	Negation	HEADPHONE NOTHING child with no headphones	1 2 3	child wearing headphones and drink; child with headphones and no drink
4a	Negation	NOT-LIKE EAT child rejecting food	1 2 3 4	child with plate of food, not eating; child enjoying eating food; child rejecting drink
4b	Negation	NOT-DROP child holding cup carefully	1 2 3 4	child with broken cup on floor; child throwing cup; broken cup
5a	Negation	CAN'T-REACH small child reaching up for teddy on top of cupboard	1 2 3	taller child taking teddy from top of cupboard; small child climbing chair
5b	Negation	NOT-SLEEPING child reading in bed	1 2 3	child sleeping in bed; baby sleeping in cot
6a	Negation	HEARING-AID NOTHING dog with ball	1 2 3 4	child with hearing aid and ball; child with hearing aid but no ball; hearing aid
6b	Negation	HAT NOTHING snowman with no hat	1 2 3 4	child with hat but no shoes; snowman with hat; snowman with hat but no shoes
7a	Number/ distribution	APPLE LOTS lots of apples	1 2 3 4	a few apples; one apple; person carrying heavy shopping

Key to symbols used:

R = response options (numbers indicate number and arrangement of pictures on page in test booklet; emboldened number represents target picture)

p = practice item (not scored)

a/b = division of test items for split-half analysis

7b	Number/ distribution	CAR ROW ROW ROW three rows of parked cars	1 2 3 4	row of three parked cars; one parked car; shelves of books
8a	Number/ distribution	QUEUE queue of people at bus stop	1 2 3 4	single person standing at bus stop; crowd of people at bus stop; fence
8b	Number/ distribution	ONE-TEDDY one teddy	1 2 3	group of three teddies; rows of teddies
9a	Number/ distribution	STACK-BOXES stacked boxes	1 2 3	one box; rows of boxes
9b	Number/ distribution	FEW-CUPS three cups	1 2 3	rows of cups; one cup
10a	Spatial verb + handling classifier	PUSH-BIKE boy pushing bike	1 2 3 4	boy pushing a pram; boy vacuuming; boy pushing a car
10b	Spatial verb + handling classifier	DRINK-FROM-MUG boy drinking from a mug	1 2 3 4	boy drinking from a bowl; boy drinking from tea-cup; boy drinking from a can
11a	Spatial verb + handling classifier	EAT-SANDWICH boy eating a sandwich	1 2 3 4	boy eating crisps; boy eating biscuit; boy eating large burger
11b	Spatial verb + handling classifier	GIVE-SMALL-PILE-BOOKS boy giving a small pile of books to a woman	1 2 3 4	giving a large pile of books; giving one book; holding books
12b	Size & shape specifier	TEDDY SMALL small teddy	1 2 3 4	big teddy; small pencil; small cup
12a	Size & shape specifier	PENCIL THICK thick pencil	1 2 3 4	thin pencil; thin book; thick book
13a	Size & shape specifier	CURLY-HAIR person with long curly ringlets	1 2 3 4	long wavy hair; short straight hair; long frizzy hair
13b	Size & shape specifier	CHECK-GLOVES check gloves	1 2 3 4	horizontal striped gloves; vertical striped gloves; spotty gloves
14a	Size & shape specifier	SPOTS-ALL-OVER spotty jumper	1 2 3 4	jumper with rows of spots; large spots; squares
14b	Size & shape specifiers	THICK-STRIPES-DOWN-TROUSERS trousers with thick vertical stripes	1 2 3 4	trousers with thin stripes; " " thick horizontal stripes; " " thin horizontal stripes
15a	Noun-verb agreement	PENCIL pencil	1 2 3 4	person writing with pencil; person painting picture; page of writing
15b	Noun-verb agreement	AEROPLANE aeroplane on runway	1 2 3 4	aeroplane flying; telephone; person talking on phone
16a	Noun-verb agreement	CUT (VERB) child cutting paper with scissors	1 2 3 4	scissors; cut out paper shapes; knife
16b	Noun-verb agreement	DRINK (VERB) boy drinking from beaker	1 2 3 4	can of coke; cup; boy with drink in front of him

17	Noun-verb agreement	DRIVE (VERB) person driving a car	1 2 3 4	empty parked car; driving a train; riding a bike
18a	Spatial verb	BOOK ON book on bed	1 2 3	book under bed; box on bed
18b	Spatial verb	CUP UNDER cup under table	1 2 3	cup under chair; cup on table
19a	Spatial verb	DOG IN dog's head visible from the open top of a box	1 2 3	dog in front of box; dog behind box
19b	Spatial verb	BALL TABLE ON ball on table	1 2 3 4	ball on chair; doll on table; ball under table
20a	Spatial verb	BOX TEDDY IN teddy visible from open top of box	1 2 3 4	teddy sitting on box; teddy sitting on wall; ball on box
20b	Spatial verb	BOX UNDER BED box visible under bed	1 2 3 4	box on bed hairbrush under bed box
21a	Spatial verb	BOY-SIT-TOP-LEFT-SIDE boy sitting on the top left side of a box	1 2 3 4	boy sitting on top right side of a box; boy sitting inside box on right; boy sitting next to box
21b	Spatial verb	DOG-LIE-INSIDE-RIGHT dog lying inside box to the right	1 2 3 4	dog inside box to the left; dog on top of box on right; dog on top of box on left
22a	Spatial verb	CAR BEHIND house with car parked behind	1 2 3 4	car parked in front of house; car parked alongside house; car on its own
22b	Spatial verb	DOG-IN-FRONT dog lying in front of a box	1 2 3 4	dog behind box; dog walking away from box; dog sitting next to box
23a	Spatial verb	CUP-RIGHT BOOK-LEFT table with cup on right, book on left	1 2 3 4	table with cup on left, book on right; cup on book in centre of table; cup and book in centre of table
23b	Spatial verb	THREE-HOUSE-BOTTOM-LEFT crossroads with row of three houses aligned vertically in bottom left quadrant	1 2 3 4	houses aligned vertically in bottom right quadrant; vertically in top left quadrant; horizontally in bottom left quadrant
24a	Spatial verb	HOUSE TOP-RIGHT crossroads with a house in the top right quadrant	1 2 3 4	house in the top left quadrant; house in bottom right quadrant; house in bottom left quadrant
24b	Spatial verb	ROW-OF-CARS BOTTOM-LEFT row of parked cars at the bottom of the picture	1 2 3 4	row of cars at the top of the picture; rows of parked cars; single car
p4	*Indexing*	***Practice item:*** *ICE CREAM*	*1 2*	*scissors*
25a	Indexing	CHILD boy	1 2	dog
25b	Indexing	SCISSORS scissors	1 2	pencil

26a	Indexing	MUMMY	1 2 3	dog child
26b	Indexing	BED	1 2 3	chair table
27a	Indexing	CUP	1 2 3 4	ball box hat
27b	Indexing	APPLE	1 2 3 4	car bike chair
28a	Agreement verb	BOOK GIVE-DOWN mother gives book to child	1 2 3 4	child gives book to mother; mother holds book; child holds book
28b	Agreement verb	CHILD BOOK SHOW-TO-SIDE boy and girl sitting on the floor next to each other, boy shows girl book	1 2 3 4	child shows mother book; mother shows child book; mother reads book
29a	Agreement verb	CHILD LOOK-UP boy seated on the floor looks up at his mother seated on a chair	1 2 3 4	mother looks down at child playing; mother and child look at each other; mother reads while child plays
29b	Agreement verb	MUMMY LETTER GIVE-TO-SIDE woman hands letter to man standing at her side	1 2 3 4	woman posts letter; woman holding letter; woman standing
30	Agreement verb	CHILD POINT-LEFT MUMMY POINT-RIGHT MUMMY-FOLLOW-CHILD woman walking behind boy towards the left of picture	1 2 3 4	boy follows woman; boy stands next to woman; boy walking alone
31a	Spatial verb + body part classifier	POUR-WATER-OUT OTHER-BOY-HAIR-WET two boys in bath, one pours water on other'shair	1 2 3 4	boy pours water on his hair; two boys pour water on each other; boy pours water on floor by bath
31b	Spatial verb + body part classifier	BOY HIT-OUT GIRL FACE-HURT boy punches girl's face	1 2 3 4	girl with bruised face; boy kicking girl; boy doing karate punch alone
32	Spatial verb + body part classifier	WASH-OWN-BACK two boys in bath, one washes his back	1 2 3 4	one boy washes other boy's back; boy in bath alone; two boys in bath, one washes his hair
33a	Embedded clause	DOG NO COLLAR EAT-BIG-BONE small dog with no collar eating big bone	1 2 3 4	small dog with collar eating a bone; large dog with no collar eating big bone; small dog with no collar standing
33b	Embedded clause	CHILD COAT RAIN NOTHING child wearing a coat in the sunshine	1 2 3 4	child wearing a coat in the rain; child with no coat in the sunshine; two children playing in the sun
34a	Embedded clause	HOLD-UMBRELLA-MOVE-ALONG man holding open umbrella walking away from a house	1 2 3 4	man holding open umbrella standing; man holding closed umbrella; man walking along road

34b	Embedded clause	TREE-BIG SIT-DOWN EAT-BANANA boy sitting under big tree eating a banana	1 2 3 4	boy sitting under a small tree eating banana; boy sitting under big tree; boy standing under big tree
35a	Spatial verb + movement classifier	LORRY-GO-UPHILL lorry going up a hill	1 2 3 4	lorry going down a hill; lorry driving on level road lorry driving along hill top
35b	Spatial verb + movement classifier	PERSON-COME-DOWN-ESCALATOR man standing on descending escalator	1 2 3 4	man standing on ascending escalator; two people standing on descending escalator; group of people descending escalator
36	Spatial verb + movement classifier	TWO-PEOPLE-MEET man and woman walking towards each other	1 2 3 4	man and woman standing beside each other; man and woman walking away from each other; man follows woman

Appendix 6.5 Video tape of test used in pilot phase

Appendix 6.6a: Parent/Teacher Questionnaire (3-6yrs)

Name of parent/teacher:
Was the questionnaire completed as an interview or written?
Interviewer's name (if applicable):

Name of child:
Child's age:

Please answer these questions about your child's understanding and use of BSL.

UNDERSTANDING OF BSL					
1. Tick the signs s/he understands when you sign the following sentences. Tick if you normally need to repeat the signs or point as well as sign for him/her to understand		**Yes**	**No**	**Repeat**	**Point**
a	BALL THERE FETCH				
b	BOWL AND SPOON FETCH FOR ME				
c	FETCH BOOK BIG ME				
d	BOWL AND SPOON FETCH FOR ME				
e	TOUCH THAT NO!				
f	COME HERE NOW WE GO OUT				
g	FETCH BOOK KITCHEN ON TABLE				
h	PICK UP CUP UNDER TABLE				
i	GIVE TO DADDY OUTSIDE IN CAR				
j	BOOKS FETCH A LOT				
k	BOOK FETCH ONLY ONE				
l	SWEET NOW ONE, MORE LATER				
SIGN PRODUCTION					
2. Tick how much of these sentences s/he can sign correctly		**1-2 signs**	**mostly correct, some mistakes**	**all correct**	
a	BALL THERE FETCH				
b	BOWL AND SPOON FETCH FOR ME				
c	BIG BOOK ME WANT				
d	JUMPER RED AND WHITE ME WANT				
e	TOUCH THAT NO!				
f	COME HERE WANT TO GO OUT NOW				
g	BOOK KITCHEN ON TABLE				
h	CUP UNDER TABLE				
I	DADDY OUTSIDE IN CAR				
j	HAVE BOOKS A LOT				
k	HAVE BOOK ONLY ONE				
l	SWEET NOW ONE, MORE LATER				
LOOKING AT BOOKS					
3. When you sign a story with a book, does s/he ask...		**Yes**	**No**		
a	THAT WHAT? (POINTS TO PICTURE)				
b	NEXT WHAT?				
c	WHY/WHAT FOR?				
4. How much can s/he tell you about a story from a book s/he knows well?		**1-2 things**	**most of it, some mistakes**	**whole story**	

Appendix 6.6b: Parent/Teacher Questionnaire (7-11yrs)

Name of parent/teacher:
Was the questionnaire completed as an interview or written?
Interviewer's name (if applicable):

Name of child:
Child's age:

Please answer these questions about your child's understanding and use of BSL.

	UNDERSTANDING OF BSL				
	1. If you sign this to your child, how much can s/he understand? Tick if you normally need to repeat the signs or point as well as sign for him/her to understand	**Yes**	**No**	**Repeat**	**Point**
a	FETCH BOOKS, SOCKS, PENCIL CASE AND HAIRBRUSH				
b	BOOK YELLOW, THIN, BRING FOR ME				
c	JUMPER THICK "V" NECK, RED-BLACK STRIPED, BRING FOR ME				
d	SHIRT-BLUE WITH WHITE STRIPES, SHORTS BLUE, SOCKS WITH SPOTS AND BLACK SHOES LACE UP, PUT ON NOW				
e	TOUCH NO - VERY DANGEROUS WILL BURN BAD				
f	COME HERE NOW, WE ALLOUT IN CAR TO SEE FRIENDS, YOU KNOW, HAVE SMALL DOG				
g	FETCH BOOK SCHOOL'S UPSTAIRS IN SISTER'S BEDROOM UNDER WARDROBE				
h	FETCH KEYS IN LIVING ROOM ON TABLE NEXT TO BOOKSHELF BY WINDOW				
i	TELL TEACHER GIVE BOOK TO JOHN SMITH IN CLASS 4				

	SIGN PRODUCTION			
	2. When you sign a story, does your child ask any of these questions?	**Yes**	**No**	
a	WHO/WHAT THAT?			
b	WHAT NEXT?			
c	WHY/WHAT FOR?			
	3. Which of these can your child sign him/herself correctly?	**1-2 signs**	**mostly correct, some mistakes**	**all correct**
a	FETCH BOOKS, SOCKS, PENCIL CASE AND HAIRBRUSH			
b	BOOK YELLOW, THIN, BRING FOR ME			
c	JUMPER THICK "V" NECK, RED-BLACK STRIPED, BRING FOR ME			

Appendix 6.6b: Parent/Teacher Questionnaire 7-11yrs (cont.)

3. Which of these can your child sign him/herself correctly?		1-2 signs	mostly correct, some mistakes	all correct
d	SHIRT-BLUE WITH WHITE STRIPES, SHORTS BLUE, SOCKS WITH SPOTS AND BLACK SHOES LACE UP, PUT ON NOW			
e	TOUCH NO - VERY DANGEROUS WILL BURN BAD			
f	COME HERE NOW, WE ALLOUT IN CAR TO SEE FRIENDS, YOU KNOW, HAVE SMALL DOG			
g	FETCH BOOK SCHOOL'S UPSTAIRS IN SISTER'S BEDROOM UNDER WARDROBE			
h	FETCH KEYS IN LIVING ROOM ON TABLE NEXT TO BOOKSHELF BY WINDOW			
i	TELL TEACHER GIVE BOOK TO JOHN SMITH IN CLASS 4			

STORYTELLING

4. How well can your child sign a story?		Yes	No
a	Tells only beginning and end		
b	Tells most of story, some parts missing		
c	Tells full story		

TALKING ABOUT PAST/FUTURE

5. How much could your child tell you about these things which happened in the past or will happen in the future?		1-2 signs	most of it, some mistakes	all correctly
a	BEEN FRIEND'S HOUSE, GARDEN PLAY, FOOTBALL THEN TEA, AGAIN OUT FOOTBALL			
b	SCHOOL TRIP TOMORROW, TEACHER SAID MUST SANDWICHES, DRINK, CRISPS AND MONEY, 50P, MUST READY TOMORROW FOR SCHOOL			

Thank you for your time.

Appendix 6.7 Correlation of scores obtained by different scorers as a measure of interscorer reliability

		SCORER A	SCORER B
SCORER A	Pearson Correlation	1.000	.998**
	Sig. (2-tailed)	.	.000
	N	41	12
SCORER B	Pearson Correlation	.998**	1.000
	Sig. (2-tailed)	.000	.
	N	12	12

** Correlation is significant at the 0.01 level (2-tailed).

Appendix 6.8 Correlations of initial and retest scores as a measure of test-retest reliability

	.	**Initial test score**	**Retest score**
Initial test score	**Pearson Correlation**	1.000	.907**
	Sig. (2-tailed)	.	.002
	N	41	8
Retest score	**Pearson Correlation**	.907**	1.000
	Sig. (2-tailed)	.002	.
	N	8	8

** Correlation is significant at the 0.01 level (2-tailed).

Appendix 6.9: Analyses of age and raw score

Descriptives
SCORERA

	N	Mean	Std. Deviation
AGE GROUP			
youngest	10	32.2000	4.6619
middle	12	44.0000	4.6904
eldest	9	48.3333	2.29123
Total	31	41.4516	7.8309

ANOVA
SCORERA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1360.077	2	680.039	39.702	.000
Within Groups	479.600	38	17.129		
Total	1839.677	40			

Post Hoc Multiple Comparisons
Dependent Variable: SCORERA
Bonferroni

					95% Confidence Interval	
(I) AGEGROUP	(J) AGEGROUP	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
youngest	middle	-15.7490(*)	2.96690	.000	-23.1799	-8.3181
	eldest	-23.2157(*)	3.45254	.000	-31.8630	-14.5684
middle	youngest	15.7490(*)	2.96690	.000	8.3181	23.1799
	eldest	-7.4667	3.53131	.062	-16.3112	1.3779
eldest	youngest	23.2157(*)	3.45254	.000	14.5684	31.8630
	middle	7.4667	3.53131	..062	-1.3779	16.3112

* The mean difference is significant at the .05 level

Appendix 6.10 Analysis of pilot scores according to subject gender

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Test scores	Female	20	38.1500	14.0010	3.1307
	Male	21	33.9048	11.1665	2.4367

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Test scores	Equal variances assumed	.696	.409	1.076	39	.289	4.2452	3.9452	-3.7348	12.2252
	Equal variances not assumed			1.070	36.328	.292	4.2452	3.9673	-3.7982	12.2887

Appendix 6.11 Analysis of deaf and hearing subjects' scores

Group Statistics

	Hearing status	N	Mean	Std. Deviation	Std. Error Mean
Test score	Deaf	10	33.5000	12.2406	3.8708
	Hearing	10	29.5000	14.6761	4.6410

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Test scores	Equal variances assumed	.230	.637	.662	18	.516	4.0000	6.0434	-8.6966	16.6966
	Equal variances not assumed			.662	17.438	.517	4.0000	6.0434	-8.7260	16.7260

Appendix 7.1a Details of subjects involved in standardisation phase

Child ID	Child age	Child gender 1=f 2=m	Child hearing status 1=d 2=h	Fam. hearing status 1=d 2=h	Fam. birth status 1=n 2=i	Post-code	Geo loc.	School 1=res 2=day 3=un 4=msr 5=ms	Exp BSL 1=dp 2=bil 3=hp 4=sch 9=mis	Deaf rels. os=1 ys=2 oys=3 tw=4 or=5 ors=6 no=7 mis=9	BSL dev	BSL pilot y=1 n=2
138	106	2	1	1	1	99999999	08	1	1	2	99	2
137	156	1	1	1	1	N21 1EY	12	2	1	2	99	2
136	146	2	1	1	1	G45 0EW	08	2	1	2	18	1
135	138	2	1	2	2	LS6 3SP	06	4	2	1	99	2
134	136	1	1	1	1	G64 3BS	08	2	1	1	07	1
133	135	1	1	2	1	SE9 3TU	12	3	4	7	99	2
132	135	1	1	2	1	SE26 6XJ	12	3	4	7	99	2
131	134	2	1	2	1	SE2 9QL	12	2	4	9	99	2
130	131	2	1	1	1	LU2 7YT	02	3	1	7	15	1
129	130	1	2	1	1	OT8 8DG	04	5	1	2	99	2
128	130	2	1	2	1	LS9 6HS	06	4	2	7	99	2
127	130	1	1	2	2	99999999	12	2	4	9	99	2
126	128	1	1	2	1	HU10 6BB	01	2	4	2	10	2
125	127	2	1	1	1	BB5 6EH	01	2	1	1	54	2
124	127	2	1	2	2	N22 5SB	12	3	4	7	48	2
123	127	2	1	1	1	IG6 1GX	12	2	1	1	12	2
122	127	2	1	1	1	NE9 6IP	01	1	1	1	10	2
121	126	1	1	1	1	LS13 4EG	06	4	2	7	30	2
120	126	2	1	1	1	DY4 8DW	06	2	1	1	99	1
119	126	2	1	2	1	E16 3DL	12	3	4	7	99	2
118	126	2	1	1	1	G75 8EF	08	2	1	2	09	2
117	123	1	1	2	1	99999999	01	4	4	2	99	2
116	123	2	1	2	1	LS13 2J5	06	4	2	2	18	1
115	123	1	1	1	1	DE11 3JX	02	1	1	2	24	2

114	123	2	1	1	1	NE9 5HB	01	1	1	2	11	2
113	122	2	1	1	1	G45 OEW	08	2	1	1	36	1
112	122	2	1	1	1	LB8 2JD	02	2	1	1	14	2
111	122	1	1	2	1	N4 2QH	12	2	4	1	84	2
110	120	1	1	1	1	LS18	06	4	2	2	99	1
109	119	1	1	1	1	PO30 5NL	04	1	1	7	30	2
108	118	2	1	1	1	NE10 9RH	01	1	1	1	18	2
107	118	1	1	1	1	99999999	02	1	1	1	99	2
106	117	2	1	2	1	99999999	04	1	4	7	48	2
105	117	2	1	2	1	NG9 2QN	02	2	4	7	21	2
104	116	2	1	2	1	LS13 2J5	06	4	2	2	18	2
103	116	1	1	1	1	DA7 4PG	04	3	1	2	99	2
102	114	1	1	2	1	SW2 5AE	12	2	3	7	12	2
101	112	2	1	1	1	DE75 7FL	02	1	1	2	99	2
100	110	1	2	1	1	N3	12	5	1	1	06	2
099	110	1	1	1	1	DE72 3GT	02	1	1	3	11	1
098	108	2	2	1	1	OT8 8DG	04	5	1	2	99	2
097	107	2	1	1	1	EH23 4HR	08	1	1	7	99	1
096	107	2	1	1	1	99999999	02	2	1	2	99	2
095	106	1	1	1	1	LU2 8TZ	02	2	1	6	24	2
094	104	1	2	1	1	LS18	06	5	1	2	21	1
093	103	1	1	2	1	LS10 4QD	06	4	2	7	12	2
092	103	1	1	2	2	E16 4HX	12	3	4	9	99	2
091	103	1	1	1	1	G64 1PJ	08	2	1	2	18	1
090	102	2	1	2	1	99999999	01	2	4	5	99	2
089	102	2	1	2	1	99999999	01	2	4	9	99	2
088	102	2	1	1	1	SW170HD	12	2	1	2	99	2
087	101	1	2	1	1	N3 0BE	12	5	1	7	11	1
086	099	1	1	2	2	N17	12	3	4	9	99	2
085	099	2	1	2	1	LS10 3UB	06	4	2	7	99	1
084	099	2	1	2	2	LS8 5HY	06	4	2	2	30	2
083	099	1	1	1	1	DE11 3JX	02	1	1	1	18	1
082	099	2	1	2	2	E15 3DB	12	3	4	7	99	2
081	098	2	1	2	2	NW11	12	3	4	7	99	2
080	098	1	1	2	1	N178DAU	12	3	4	7	99	2
079	097	1	1	2	1	BS30 6PN	05	2	4	4	99	2

078	097	1	1	2	1	BA1 2XT	05	2	4	7	29	2
077	097	1	1	2	1	N16	12	3	4	7	99	2
076	095	1	2	2	1	LS13	06	4	2	1	99	1
075	095	2	1	2	1	LS26 0BX	06	4	2	7	12	2
074	094	1	2	1	1	LS16 6EE	06	5	1	7	06	2
073	093	1	1	2	1	LS13	06	4	2	1	24	2
072	092	2	1	2	2	N22 6LE	12	3	4	7	48	2
071	092	2	1	1	1	DA7 4PG	04	3	1	1	99	2
070	092	1	1	2	1	BN2 6WN	04	1	4	7	24	2
069	092	1	1	2	2	E3	12	3	4	9	99	2
068	091	2	1	1	1	99999999	08	1	1	2	99	1
067	091	2	1	2	1	SW2 5QA	12	2	4	7	24	2
066	090	1	1	1	2	LS8	06	4	2	3	18	2
065	090	1	1	1	1	NG5 3GT	02	2	1	7	09	2
064	089	1	1	2	1	LS13 2J5	06	4	2	1	99	2
063	088	1	1	1	1	NW5 4QA	12	2	1	3	99	2
062	088	2	1	1	1	NW5 4QA	12	2	1	3	99	2
061	086	2	1	2	1	LS10 3UB	06	4	2	7	99	2
060	086	2	1	2	1	SE155HW	12	2	4	4	99	2
059	086	2	1	2	1	SE155HW	12	2	4	4	99	2
058	084	1	1	2	2	E6 2BJ	12	3	4	9	99	2
057	084	2	1	1	1	SW170HD	12	2	1	1	99	2
056	084	1	1	2	1	E8 3BJ	12	2	3	7	99	2
055	083	1	1	2	1	BS6 5HU	05	2	3	7	99	2
054	082	2	1	1	1	B32 1RP	06	2	1	7	30	2
053	082	1	1	2	1	NP9 3QT	09	2	4	7	24	2
052	079	1	1	2	2	E16 4HX	12	3	4	9	99	2
051	077	2	2	1	1	NW6	12	5	1	7	18	1
050	077	2	1	1	1	WV124SG	06	2	1	7	12	1
049	077	1	1	1	1	99999999	02	2	1	3	99	2
048	077	1	2	1	1	LU3 1SX	02	5	1	2	99	2
047	076	1	1	1	1	LU2 8TZ	02	2	1	6	42	2
046	075	2	1	1	1	ML2 8LP	08	2	1	3	27	1
045	075	1	2	1	1	EH23 4HR	08	5	1	1	99	2
044	072	2	1	2	1	LS28	06	4	2	7	99	2
043	072	1	1	2	1	99999999	02	2	4	9	99	2

042	071	1	1	1	1	NE9 5HB	01	2	1	1	11	2
041	071	2	1	2	2	E2	12	2	4	1	99	2
040	071	2	1	1	1	B24 8EN	06	2	1	1	45	1
039	071	1	1	1	1	BS15 7DE	05	2	1	7	12	2
038	071	1	1	2	1	BS30 6PN	05	2	4	1	06	2
037	071	2	1	1	1	BN13 1DL	04	1	1	7	99	2
036	070	1	2	1	1	RM3 9HD	03	5	1	7	10	1
035	068	2	1	2	1	LS18	06	4	2	7	24	2
034	067	1	1	2	1	99999999	01	2	4	1	99	2
033	067	1	1	1	1	G64 1PJ	08	5	1	1	18	1
032	066	2	1	2	2	SW178LH	12	2	4	9	99	2
031	065	1	2	1	1	RM3 9HD	03	5	1	7	10	2
030	064	1	1	1	2	LS8 5HY	06	4	2	1	12	1
029	064	2	1	1	1	EN2 0DP	12	2	1	7	13	2
028	062	2	1	1	1	99999999	10	2	1	9	99	2
027	062	1	1	1	1	DE21 6NE	02	1	1	1	99	2
026	060	2	1	1	1	OT8 0BE	04	2	1	7	99	2
025	059	2	1	1	1	99999999	01	2	1	2	24	2
024	059	1	1	1	1	N9 7PR	12	2	1	6	08	2
023	058	1	2	1	2	LU3 1JX	02	5	1	2	27	2
022	058	2	1	1	1	LU4 9FF	02	3	1	2	08	1
021	058	1	1	1	2	LS8 5HY	06	4	2	1	12	2
020	057	1	1	2	1	BS2 9RN	05	2	4	7	11	2
019	057	1	1	1	1	LS18	06	4	1	1	12	1
018	055	1	2	1	1	N3 OBE	12	5	1	7	11	1
017	054	1	1	2	1	DE55 1BS	02	3	4	1	12	2
016	051	2	2	1	1	N3 1YN	12	5	1	7	14	2
015	051	2	2	1	1	N3 1YN	12	5	1	7	10	2
014	050	1	1	1	1	99999999	02	2	1	1	99	2
013	049	1	2	1	1	99999999	02	3	1	9	99	2
012	049	2	1	1	1	SE18 3LA	12	2	1	7	99	2
011	048	1	1	1	1	BT36 6NX	10	2	1	7	08	2
010	047	1	1	1	1	BS10 5LS	05	2	1	4	08	2
009	047	1	2	1	1	NW6	12	5	1	7	18	1
008	047	2	1	1	1	99999999	10	2	1	9	18	2
007	045	1	2	1	1	OT8 8DG	04	5	1	1	99	2

006	045	2	1	1	1	B14 6QG	06	2	1	7	21	2
005	042	1	1	1	2	LU3 1JX	02	3	1	7	12	2
004	038	1	2	1	1	EN2 0DP	12	5	1	1	08	2
003	038	1	1	1	1	W10 4RQ	12	3	1	7	18	2
002	036	2	1	1	1	HA9 8TL	12	4	1	7	24	2
001	036	1	1	1	1	NG6 0GX	02	5	1	7	11	2

Appendix 7.1b Key to table of subject details

Child ID: 3 digit code in sequence according to age

Child age: age in months, 3 digits

Child gender:
1=female
2=male

Child hearing status:
1=deaf
2=hearing

Family hearing status:
1=at least one parent deaf BSL user
2=both parents hearing

Parental birth status:
1=at least one parent native
2=both parents immigrant
9=missing data

Family geographical location in the UK
01=North
02=East Midlands
03=East Anglia
04=South East
05=South West
06=West Midlands
07=North West
08=Scotland
09=Wales
10=Northern Ireland
11=Yorks & Humber
12=London

Post-code
8 digits
99999999= missing data

Type of school:
1=residential school for the deaf
2=day school for the deaf
3=hearing impaired unit
4=resourced mainstream
5=mainstream

Exposure to BSL:
1=from birth, min. one parent native BSL user
2=exposure pre 3 years on established bilingual BSL/English programme
3=exposure pre 3 years from parents who are skilled BSL users plus exposure at school in TC or new bilingual BSL/English programme
4=exposure mainly at school, TC or new bilingual BSL/English programme

Other significant deaf family members:
1=one or more older deaf siblings
2=one or more younger deaf siblings
3=one or more older and one or more younger deaf siblings
4=deaf twin
5=one or more other deaf relatives
6=one or more deaf siblings and one or more other deaf relatives
7=no deaf relatives
9=missing data

BSL development : age in months when used first signs, 2 digits
99=missing data

Child in pilot study:
1=yes
2=no

Appendix 7.2 Sample picture card used in vocabulary check

Appendix 7.3 BSL receptive skills test score sheet

	Target	Response	P/F
P1	*CHILD EAT*	1 **2** 3	
P2	*MUMMY READ*	**1** 2 3	
P3	*TEDDY SMALL*	1 2 **3** 4	
1	LOTS APPLE	1 **2** 3 4	
2	CARS ROW ROW ROW	1 2 **3** 4	
3	ICE-CREAM NOTHING	1 2 **3**	
4	NOT-LIKE EAT	**1** 2 3 4	
5	BOOK ON	1 **2** 3	
6	ONE-TEDDY	**1** 2 3	
7	DRIVE	1 **2** 3 4	
8	HAT NOTHING	1 2 **3** 4	
9	BALL TABLE ON	**1** 2 3 4	
10	TWO-PEOPLE-MEET	1 2 3 **4**	
11	DOG IN	1 2 **3**	
12	PERSON-GO-DOWN-ESCALATOR	1 **2** 3 4	
13	CHILD LOOK-UP	1 2 3 **4**	
14	FEW-CUP	1 2 **3**	
15	CAR BEHIND	**1** 2 3 4	
16	CURLY-HAIR	1 2 **3** 4	
17	BOX UNDER BED	1 2 3 4	
18	BOOK-GIVE-TO-CHILD	1 2 3 4	

Appendix 7.3 Vocabulary score sheet

	VOCABULARY	Child's sign: UK/South 1 UK/North 2 other O wrong X	If child uses a different sign, can s/he recognise the test sign? Yes√ No X
1	APPLE		
2	BALL		
3	BED		
4	BOOK		
5	BOX		
6	BOY⁺		
7	CHILD⁺		
8	CAR		
9	COAT		
10	CUP		
11	DOG*		
12	COLLAR*		
13	HAT		
14	HEADPHONES		
15	HEARING-AID		
16	ICE-CREAM		
17	LETTER		
18	MUMMY		
19	PENCIL		
20	TABLE		
21	TEDDY		
22	UMBRELLA		
	Total named and recognised correctly Which version of the test will be suitable: UK/South / UK/North		

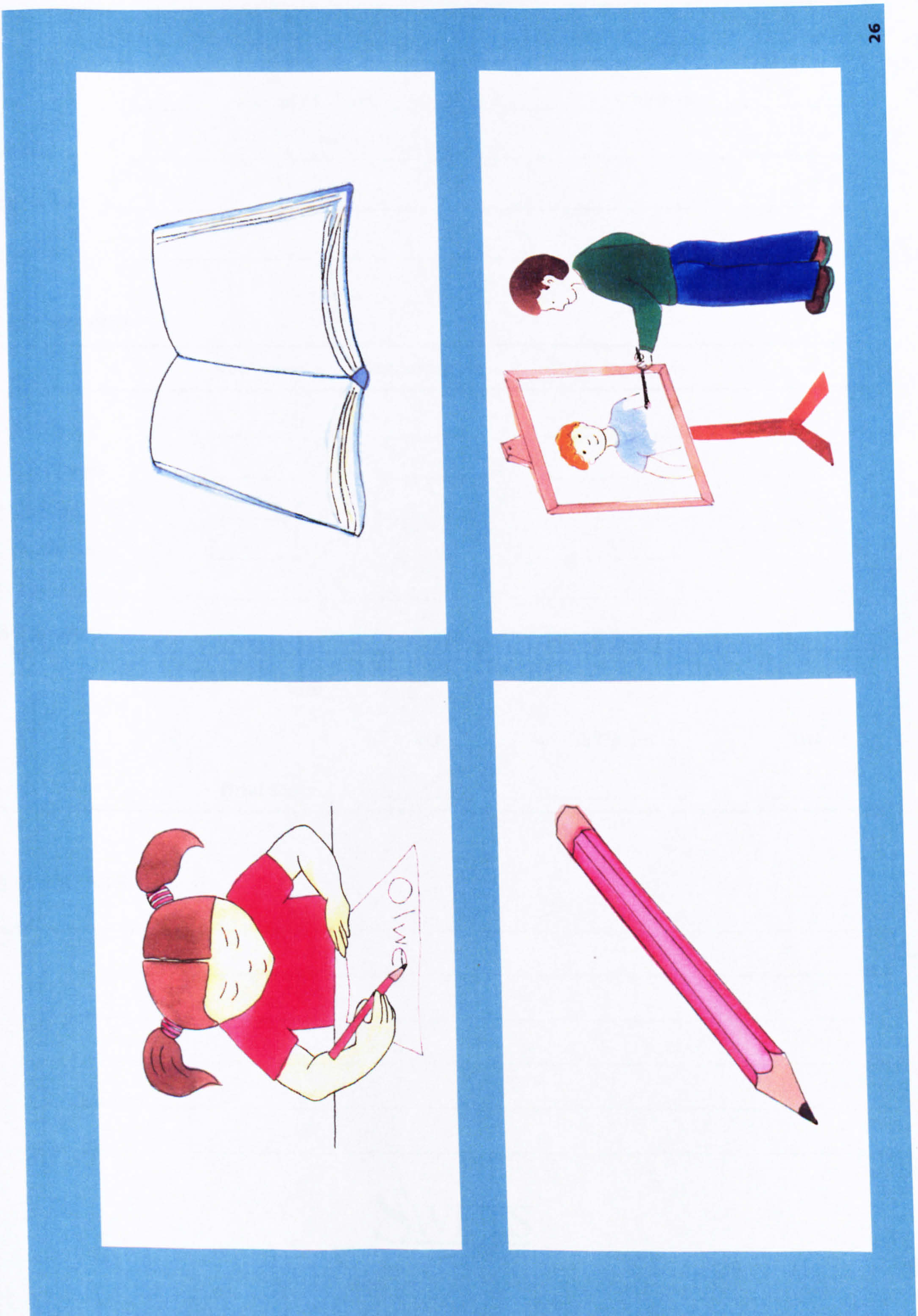
⁺ BOY and CHILD are produced using the same picture

* DOG and COLLAR are produced using the same picture

19	BOY-DRINK	1 2 3 4	
20	BOY HIT-GIRL FACE-HURT	1 2 3 4	
21	PENCIL THICK	1 2 3 4	
22	THICK-STRIPE-DOWN-TROUSERS	1 2 3 4	
23	NOT-SLEEP	1 2 3	
24	QUEUE	1 2 3 4	
25	HOLD-UMBRELLA-WALK	1 2 3 4	
26	PENCIL	1 2 3 4	
27	POUR-WATER-OTHER-BOY HAIR WET	1 2 3 4	
28	HEADPHONE NOTHING	1 2 3	
29	MUMMY LETTER GIVE	1 2 3 4	
30	CHILD COAT RAIN NOTHING	1 2 3 4	
31	CAN'T-REACH	1 2 3	
32	CHILD BOOK-SHOW-TO-SIDE	1 2 3 4	
33	DOG NO COLLAR EAT-BIG-BONE	1 2 3 4	
34	DOG-IN-FRONT	1 2 3 4	
35	NOT-DROP-CUP	1 2 3 4	
36	HEARING-AID NOTHING	1 2 3 4	
37	EAT-SANDWICH	1 2 3 4	
38	ROW-CAR-BOTTOM-LEFT	1 2 3 4	
39	DOG-LIE-INSIDE-RIGHT	1 2 3 4	
40	HOUSE-TOP-RIGHT	1 2 3 4	
	Raw Score (total number of passes): Standard Score (see Table 6):		

Appendix 7.4 Video tape of test used in standardisation phase

Appendix 7.5 Sample test plate from BSL receptive test



Appendix 7.6 Sample SON score sheet (Junior version)

SON-R 2½-7

Snijders-Oomen Nonverbal Intelligence Test

J.Th. Snijders, P.J. Tellegen, M. Winkel, J.A. Laros, B.J. Wijnberg-Williams

---

name: ______________________________ test date ____-____-____

age: ____;____ sex: m / f code ___|___|___|___|___|___ birth date ____-____-____

institute: ______________________________

department: ______________________________

examiner: ______________________________

TEST SCORES

	Raw score	Standard score	Reference age
1. Mosaics	______	______	____;____
2. Categories	______	______	____;____
3. Puzzles	______	______	____;____
4. Analogies	______	______	____;____
5. Situations	______	______	____;____
6. Patterns	______	______	____;____
sum		______	

	IQ	**80%-int**	**pct**
Total score	______	____-____	______

COMMENTS

____

____

____

____

____

____

SWETS
TEST SERVICES

1. MOSAICS

part I: item 1-6

Only the red squares are used. The number of squares varies per item, the child is given the precise number of squares needed for the item. 'Shifted' is counted as being correct.

Items 1-3: Frame for both examiner and child. **Starting with item 4** the examiner removes his or her own frame and does not demonstrate the item. **Entry-item 5**: only one frame for the child.

part II: example A

Introduce the yellow squares. Demonstrate example A in the child's frame. **Starting with example A** present the squares in the box, leave the third compartment closed.

part II: item 7-15

Time limit: 2½ minutes per item.

In part II the subtest is also discontinued when two consecutive mistakes have been made.

Introduce the red/yellow squares before starting **item 9**, the three compartments are then all open.

1	2	**3**	4	**5**	6		7	8	9	10	11	12	13	14	15		score	
						A												

2. CATEGORIES

part I: items 1-7

Cards numbered 1 and 2 are done by the examiner in **item 1**. The child lays the cards numbered 3-6. Cards numbered 1 and 2 are done by the examiner in **items 2-5**. The child lays the cards numbered 3-8. The examiner no longer demonstrates the cards **starting with item 6**.

part II: example A

Demonstrate example A first and then let the child do it him or herself.

part II: items 8-15

Draw the child's attention to the right hand page, lay the cards numbered 1-5 down on the left hand page. Both alternatives must be correct. Use the cardboard cover for **items 10 and 11**, now the child has to point to the alternatives. Both pictures must be correct. The cardboard cover is no longer used **from item 12 on**.

1	2	**3**	4	**5**	6	7		8	9	10	11	12	13	14	15		score	
							A											

3. PUZZLES

part I: items 1-6

Use the example picture. Demonstrate the puzzle in the frame in **item 1**, take piece 3 out, let the child place it in the frame. Demonstrate the puzzle in **item 2**, take pieces 2 and 3 out, let the child place them in the frame. In **items 3-6** the puzzle is no longer demonstrated. The pieces numbered 1, 2 and 3 are placed on the table in front of the child, place piece number 1 in the frame and let the child finish the puzzle.

part II: example A

Demonstrate example A and let the child also do it him or herself. The frame is no longer used **starting with example A**.

part II: items 7-14

Time limit: 2½ minutes per item.

In part II the subtest is also discontinued when two consecutive mistakes have been made.

1	2	3	4	5	6		7	8	9	10	11	12	13	14	score
						A									

4. ANALOGIES

part I: items 1-10

Example blocks are used in items 1 to 7.

part II: example A

The blocks representing the alternatives should be placed on the cardboard cover. Demonstrate (II-b) and look for the correct alternative to (III-b) together with the child. Place the chosen alternatives in the (II-b) and (III-b) positions. Demonstrate the example once more without using the carboard cover, place the chosen alternatives in the (II-b) and (III-b) positions.

part II: items 11-17

Use the cardboard cover, and first draw the child's attention to the right hand page. Take the cover off. Look for the correct solution to (II-b) together with the child, let the child find the solution to (III-b) without aid. Place the chosen alternatives in the (II-b) and (III-b) positions. **Starting with item 14** the blocks representing the chosen alternatives are no longer placed in the (II-b) and (III-b) positions, the child only has to point to the alternatives.

1	2	3	4	5	6	7	8	9	10		11	12	13	14	15	16	17	score
										A								

5. SITUATIONS

part I: items 1-6

Place card 1 yourself and let the child place cards 2 to 4.

part II: example A

Draw the child's attention to the right hand page. Lay cards 1-5 on the left hand page. Demonstrate the example and let the child do it also.

part II: items 7-14

In **items 7 and 8** the cards are placed on the left hand page and the child chooses. In **items 9 and 10** the alternatives are first covered with the cardboard cover, draw the child's attention to the drawing and then show the alternatives. **Beginning with item 11** the cardboard cover is no longer used. **Beginning with item 12** both pictures must be correct, correct placement in the larger picture is not necessary.

1	2	**3**	4	**5**	6		7	8	9	10	11	12	13	14		score	
						A											

6. PATTERNS

part I: items 1-10

Demonstrate the drawing in items 1 to 10, pay attention to the direction in which you draw. The child copies the drawing.

part II: items 11-16

Time limit: 2½ minutes per item.

In part II the subtest is also discontinued when two consecutive drawings are incorrect.

1	2	**3**	4	**5**	6	7	8	9	10		11	12	13	14	15	16		score	

Appendix 7.7 Sample SON score sheet (Senior version)

SON-R

Snijders-Oomen Non-verbal Intelligence Test

- J.Th. Snijders, N. Snijders-Oomen, J.A. Laros, M.A.H. Huijnen, P.J. Tellegen -

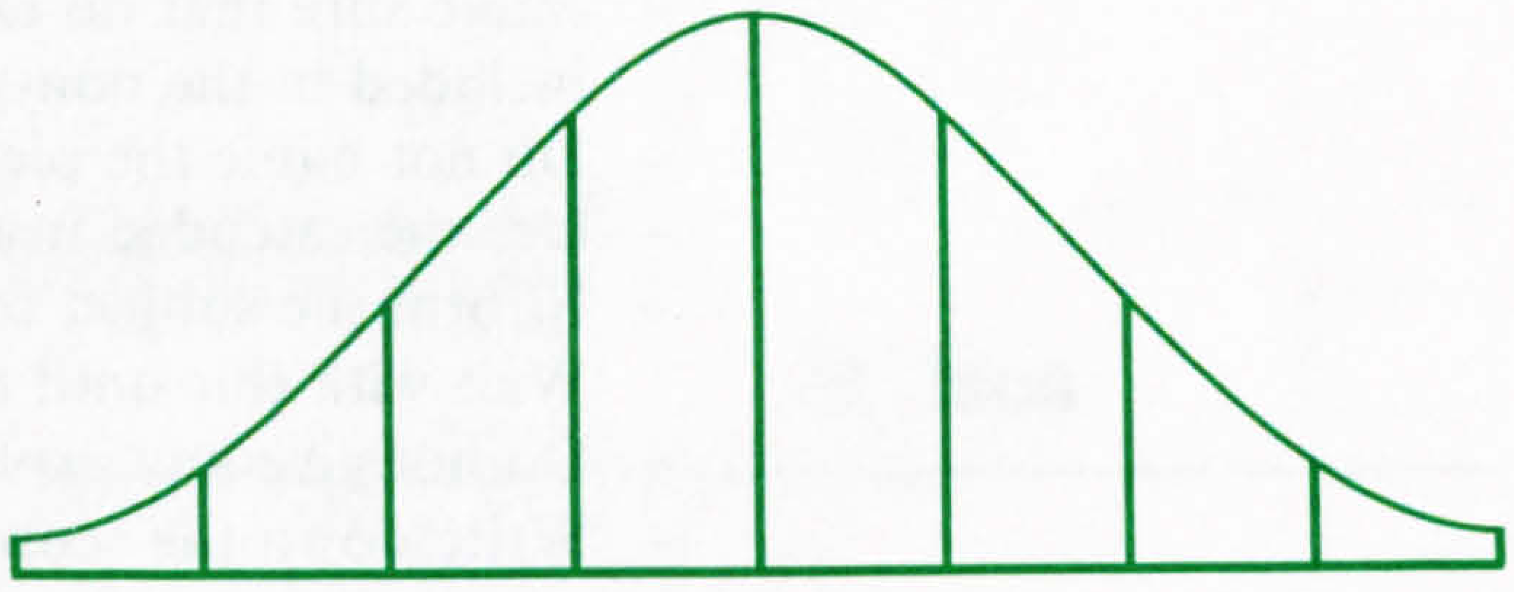
name ______________________ test date ____ - ____ - ____

age ____ ; ____ sex m/f code |_|_|_|_|_|_| birth date ____ - ____ - ____

institute ______________________

department ______________________ grade ____

examiner ______________________



TEST SCORES

	R	N	(E²)	L	(80%-int)		
1. Cat	___	___	(___)	___	(___–___)	Cat	(A)
2. Mos	___	___	(___)	___	(___–___)	Mos	(S)
3. Hid	___	___	(___)	___	(___–___)	Hid	(P)
4. Pat	___	___	(___)	___	(___–___)	Pat	(S)
5. Sit	___	___	(___)	___	(___–___)	Sit	(C)
6. Ana	___	___	(___)	___	(___–___)	Ana	(A)
7. Sto	___	___	(___)	___	(___–___)	Sto	(C)
subt. mean	☐						

60 70 80 90 100 110 120 130 140

	N	(E²)	L̃	(80%-int)	
Spec. IQ	___	(___)	___	(___–___)	Spec. IQ
Gen. IQ			___	(___–___)	Gen. IQ

60 70 80 90 100 110 120 130 140

Ho (subtests) $T_i = T_j$ n.s. / $p < .05$ / $p < .01$

Descriptive: ref. age ____ ; ____ Stand.IQ ____ cum. ____ % norm population

cum. ____ % deaf population

cum. ____ % ______________

COMMENTS

Scoring form and memory aids

General instructions

- Always use both examples A and B; example C is for use only when example **B** is not independently solved.
- Give help and correction only with the examples.
- Make sure that no extra information is given in the verbal instruction other than included in the non-verbal instruction.
- Do not name the pictures used.
- Use the extended instructions with the first items if necessary.
- Inform the subject following each item whether the solution is correct or incorrect. Wait with this until the answer is complete or until the time limit is exceeded.
- Do not give any explanation following an incorrect answer.
- Write down the score (good = 1, false = 0).

Subtests with a time limit

- Begin using the stopwatch at example B.
- When in doubt, ask if the subject is finished with the item.
- Stop the subject when the time is up, unless he is almost finished. Score the item as incorrect.
- When the subject is clearly unable to solve the item he may stop before the time is up.

Adaptive test procedure

- *score:* The score for each series is the same as the number of the last administered item minus the number of errors in the series.
- *a-series:* Start with the first item. Go on until a total of two errors in this series has been made.
- *b-series:* Start with the item that has the same number as the score of the preceeding series minus one. Go on until a total of two errors in this series have been made.
- *c-series:* Idem
- *Exception:* If the first three items *(1a, 2a, 1b)* are incorrect, the subtest is discontinued.

---

1. Categories

- Wait with feedback and scoring until the subject has pointed to both pictures.
- Do not mention the concept on which the similarity is based.

	1	2	3	4	5	6	7	8	9	last item	number incorrect	score
a-series	34	25	13	24	35	14	23	15	34	___	– ___	= ___
b-series	45	12	35	15	13	24	35	14	23	___	– ___	= ___
c-series	15	14	23	45	13	24	35	34	25	___	– ___	= ___

1. Cat ☐

2. Mosaics

Maximum time: 2 minutes per item.

- The number of different sorts of squares varies per item.
- Always make sure that the relevant compartments are uncovered, and no others.
- Introduce the new sorts of squares.
- Let the subject put the squares back after completing each item.

	1	2	3	4	5	6	7	8	9	10	last item	number incorrect	score
a-series											____	– ____	= ____
	2 kinds		4 kinds of squares					6 kinds					
b-series											____	– ____	= ____
	2 kinds		4 kinds of squares					6 kinds					

2. Mos ☐

3. Hidden Pictures

Fixed time: 1½ minute per search form.

- Complete example A together with the subject.
- Let the subject search for 1 minute on example B.
- Point out the undiscovered pictures in both examples.
- The subject is required to point out clearly with his finger where the pictures are to be found.
- Mark correct answers by drawing a single line through the figure, mark incorrect answers by drawing an 'X' through the figure. Use a red pencil.
- All four search forms should be presented to the subject, unless the subject fails completely on the first two.
- Do not tell the subject how many pictures can be found in a search form; do not name the search object.
- The calculation of the raw score should occur following the test session.

	number correct	number incorrect	score
Picture 1	____	– ____	= ____
Picture 2	____	– ____	= ____
Picture 3	____	– ____	= ____
Picture 4	____	– ____	= ____
			____

3. Hid ☐

4. Patterns

Maximum time for item 1-5: 2 minutes per item.
Maximum time for item 6-9: 4 minutes per item.

- Give the subject a pencil and eraser.
- Use the correction key if necessary.

	1	2	3	4	5	6	7	8	9	last item	number incorrect	score
a-series										____	– ____	= ____
	maximum time: 2 minutes					maximum time: 4 minutes						
b-series										____	– ____	= ____
	maximum time: 2 minutes					maximum time: 4 minutes						

4. Pat ☐

5. Situations

- Point out each item with more openings than the previous item.
- When an item has more than one opening let the subject indicate in which opening each picture belongs.
- Wait with feedback and scoring until the subject has pointed to all pictures.

	1	2	3	4	5	6	7	8	9	10	11	last item		number incorrect		score
a-series	4	3	2	14	16	142	25	268	82	436	0275	____	–	____	=	____
b-series	2	4	3	35	62	34	25	682	32	439	5300	____	–	____	=	____
c-series	1	4	1	56	34	63	61	627	41	245	8452	____	–	____	=	____

5. Sit ☐

6. Analogies

- Do not mention the concept on which the transformation is based.

	1	2	3	4	5	6	7	8	9	10	11	last item		number incorrect		score
a-series	3	2	4	2	3	1	1	2	4	3	1	____	–	____	=	____
b-series	2	3	3	4	2	3	2	1	2	4	4	____	–	____	=	____
c-series	1	2	4	2	1	4	3	4	3	3	2	____	–	____	=	____

6. Ana ☐

7. Stories

Maximum time: 3 minutes per item.

- Place the first two cards from example A in the correct sequence; let the subject arrange the rest of the cards.
- Let the subject arrange all the cards in example B.
- Use the frame for the examples and for the first items with four cards.
- The cards should be given to the subject in the numbered sequence and should be put away in the same order.

	1	2	3	4	5	6	7	8	9	10	last item		number incorrect		score
a-series	koch	mead	peak	huxley	wundt	french	watson	maslow	spinoza	jackson	____	–	____	=	____
b-series	marx	knox	selz	kant	taylor	fisher	galton	plato	sigmund	hilgard	____	–	____	=	____

7. Sto ☐

ISBN 90 01 803687

Appendix 7.8 Sample CELF Preschool score sheet

CELF-PRESCHOOL

Clinical Evaluation of Language Fundamentals–Preschool

Elisabeth H. Wiig, Wayne Secord, Eleanor Semel

RECORD FORM

THE PSYCHOLOGICAL CORPORATION®
HARCOURT BRACE JOVANOVICH, INC.

Name ______

Address ______

Age ______ Gender ______ Class ______

School/Site ______

Teacher ______

Examiner ______

	Year	Month	Day
Test Date			
Birth Date			
Chronological Age			

Scoring Summary	Raw Score	Standard Scores: Standard Score	Standard Scores: Points – or +	Standard Scores: Confidence Interval ____% Level	Percentile Ranks: Percentile Rank	Percentile Ranks: Confidence Interval
Linguistic Concepts				to		to
Basic Concepts				to		to
Sentence Structure				to		to
Sum of 3 Standard Scores						
RECEPTIVE LANGUAGE SCORE				to		to
Recalling Sentences in Context				to		to
Formulating Labels				to		to
Word Structure				to		to
Sum of 3 Standard Scores						
EXPRESSIVE LANGUAGE SCORE				to		to
Sum of 6 Standard Scores						
TOTAL LANGUAGE SCORE				to		to
Sum of 6 Subtest Raw Scores						
AGE EQUIVALENT ______				to		
Sum of 6 Subtest Standard Scores ______ ÷ 6 = ______ (mean)						

Diagnostic Impressions/Strengths and/or Weaknesses

09-03382C

Linguistic Concepts

Picture Stimuli	Repetitions	Discontinue Rules
Stimulus Manual 1	None allowed	3 years: 5 consecutive zero scores (errors or no responses) 4–6 years: 4 consecutive zero scores (errors or no responses)

Familiarization **Look at these animals. Let's see if you know them. Point to the cat** (pause). (Repeat and demonstrate, if necessary.) **Point to the turtle. Point to the . . . [elephant, monkey, tiger].**

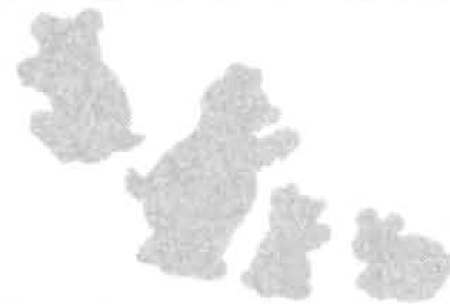
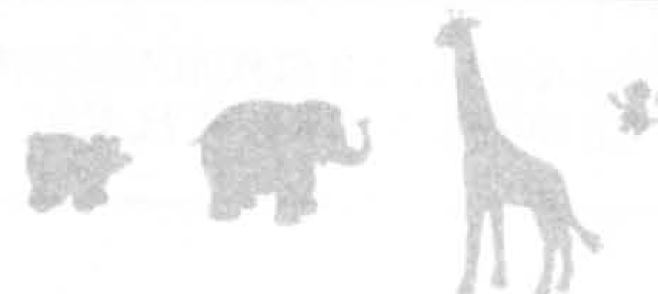
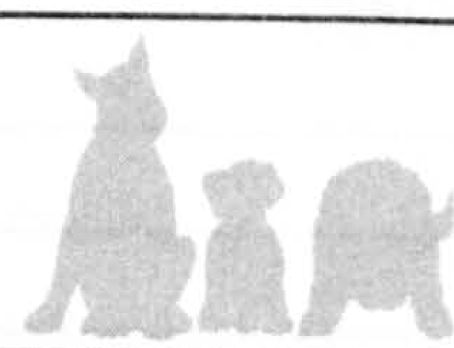
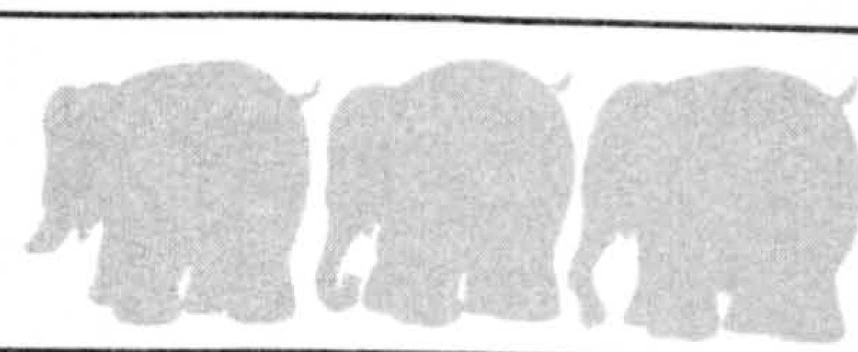
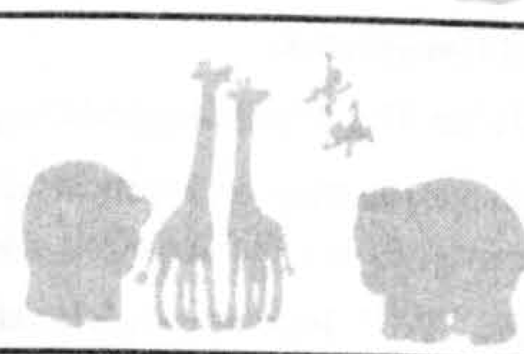
Familiarization 1 cat, turtle, elephant, monkey, tiger

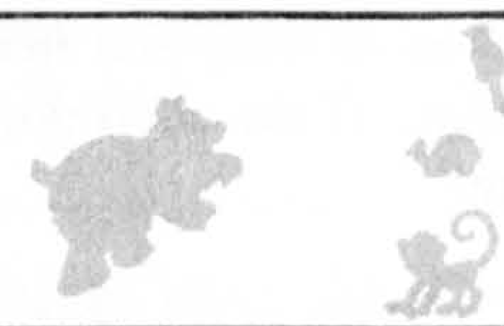
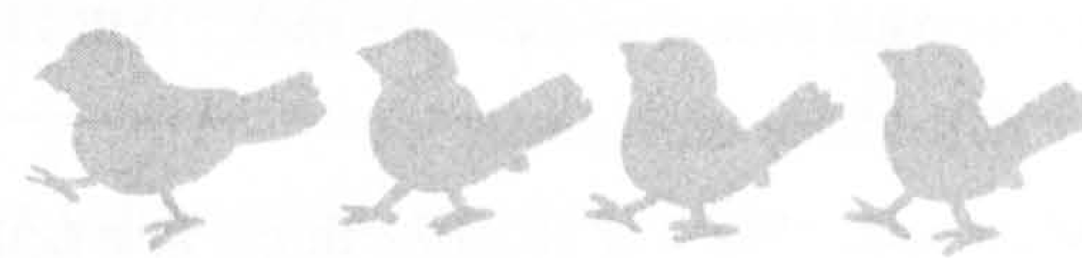
Familiarization 2 bird, dog, giraffe, fish, bear

Trial 1 Point to the bird that is not flying.

Trial 2 Point to the dog and the monkey.

Circle *1* for a correct response, *0* for an incorrect response, or *NR* for no response.

			Score	
1. Point to one of the bears.		1	0	NR
2. Point to the elephant first, and then point to the giraffe. (The child must point to the elephant first.)		1	0	NR
3. Point to either the dog or the bird.		1	0	NR
4. Point to a dog, but not the one that is eating.		1	0	NR
5. Point to a fish or a cat.		1	0	NR
6. When I point to a tiger, you point to a giraffe. (The child must point AFTER the examiner points.)		1	0	NR
7. Point to the cat and then to the bird. (The child must point to the cat first.)		1	0	NR
8. Point to the elephant next to the giraffe.		1	0	NR
9. Point to the bear, the turtle, and the fish. (The child may point in any order.)		1	0	NR
10. Point to the first elephant in line.		1	0	NR
11. After I point to a monkey, you point to an elephant and a giraffe. (The child may point to the animals in any order AFTER the examiner points.)		1	0	NR

			Score		
12.	Point to the turtle before you point to a fish. (The child must point to the turtle first.)		1	0	NR
13.	Point to the animal in the middle.		1	0	NR
14.	Point to the monkey before you point to the turtle and the cat. (The child must point to the monkey first, and then to the turtle and cat in any order.)		1	0	NR
15.	Point to all the animals except the bird. (The child may point in any order.)		1	0	NR
16.	Point to the last bird in line.		1	0	NR
17.	Point to either one of the monkeys and all of the tigers. (The child may point in any order.)		1	0	NR
18.	Point to some of the tigers. (The child must point to two tigers.)		1	0	NR
19.	Before you point to the bear, point to a tiger. (The child must point to a tiger first.)		1	0	NR
20.	Point to the giraffe after you point to an elephant and a monkey. (The child must point to an elephant and a monkey in either order before pointing to the giraffe.)		1	0	NR
			Raw Score		

Item Analysis for Linguistic Concepts

Category		**Items**
Coordination	and	9 **11** **14** **17** **20**
Inclusion/Exclusion	one, either/or, but not, or, all except, either one	1 3 4 5 **15** **17**
Spatial	next to, first, middle, last	8 10 13 16
Temporal Relation/Order	first, and then, when, after, before	2 6 7 **11** 12 **14** 19 **20**
Quantitative	all except, all, some	**15** **17** 18

Commands	**Items**
One-Level	1 3 4 5 6 8 10 13 15 16 18
Two-Level	2 7 11 12 17 19
Three-Level	9 14 20

Item Analysis for Recalling Sentences in Context

Category		**Items**		
Simple	active	3	9	
	with noun modification	7	8	**18**
	with negation	**12**	**16**	**18**
	with coordination	5	14	17
	with infinitive	**12**	**18**	
Complex	with relativization/subordination	13	15	**16**
Imperative		1		
Interrogative	what/where	2	4	6
	with noun modification	10		
	with coordination	11		

Recalling Sentences in Context

Picture Stimuli	Repetitions	Discontinue Rules
Stimulus Manual 2	None allowed	3 years: 5 consecutive zero scores (errors or no responses) 4-6 years: 4 consecutive zero scores (errors or no responses)

Circle the score in the *ER* column for an exact repetition of the stimulus. If the response is not an exact repetition, write the response **verbatim in the space** provided, or indicate changes on the sentences. Circle *NR* for no response. See page 11 in the *Examiner's Manual* for scoring guidelines.

Title Page The Big Move

Page 2 The Kings had lived in a big, old, white house for a long time. They were moving to a new house in a different part of the city. Mom told the children—Laura, Robert, and Jimmy (point to each child left to right)—about moving. "We will pack our clothes, toys, and books—all of our things—into boxes. The movers will come and put the boxes and our furniture into a big truck called a moving van. Then the movers will drive the moving van to our new house," she said.

Page 3 Jimmy was excited about moving to a new house. He clapped his hands and said, **"We are moving!"** What did Jimmy say? (Encourage repetition of the stimulus. If the child does not respond, say, "Jimmy said, 'We are moving!'"; "Tell me what Jimmy said" or tell the child, "Say, 'We are moving!'")

<u>Trial 1</u> **"We are moving!"**

Page 4 Laura was worried about her cat. She said, **"Will Fluffy move, too?"** What did Laura say? (Prompt and model a response, if necessary.)

<u>Trial 2</u> **"Will Fluffy move, too?"**

"Yes," Mom said, "We will all move to the new house—even Fluffy."

Page 5 Robert knew that packing for the move would be hard work. He said, **"I will help."** What did Robert say?

<u>Trial 3</u> **"I will help."**

Page 6 Mom needed all of the children to help. They started packing in the boys' bedroom. They put Robert's and Jimmy's toys, books, and clothes into boxes. When they had packed almost everything in the bedroom, Laura opened the closet door. She saw a big, blue box in the closet. Laura said, **"Look at this."** What did Laura say?

<u>Item 1</u> **"Look at this."** ______________________

Page 7 Jimmy saw the box, too, and said, **"What is that?"** What did Jimmy say?

<u>Item 2</u> **"What is that?"** ______________________

Page 8 Robert saw the box and went into the closet to get it. He picked up the box and took it out of the closet. He said, **"I can carry it."** What did Robert say?

<u>Item 3</u> **"I can carry it."** ______________________

Page 9 Jimmy was curious. He ran to open the box and said, **"What is in there?"** What did Jimmy say?

<u>Item 4</u> **"What is in there?"** ______________________

	Error Count	ER	1 Err	2+ Errs	No Response
Item 1	☐	2	1	0	NR
Item 2	☐	2	1	0	NR
Item 3	☐	2	1	0	NR
Item 4	☐	2	1	0	NR

Page 10 Jimmy pulled so hard on the box that the lid popped off. Robert, Jimmy, and the box crashed to the floor. Jimmy was surprised and said, **"I fell and hurt myself."** What did Jimmy say?

<u>Item 5</u> **"I fell and hurt myself."** ______________________

Page 11 The box was full of old clothes. There were hats, dresses, coats, and shoes. Mom said, **"Where did those come from?"** What did Mom say?

<u>Item 6</u> **"Where did those come from?"** ______________________

Page 12 Mom had forgotten that she put this box of old clothes in the closet a long time ago. Mom pulled something out of the box and told Laura, **"Here are your old baby shoes."** What did Mom say?

<u>Item 7</u> **"Here are your old baby shoes."** ______________________

Page 13 The children looked at all the old clothes. They thought it might be fun to dress up in them. Jimmy said to Robert, **"You can wear this old coat."** What did Jimmy say?

<u>Item 8</u> **"You can wear this old coat."** ______________________

	Error Count	ER	1 Err	2 Errs	3+ Errs	No Response
Item 5	☐	3	2	1	0	NR
Item 6	☐	3	2	1	0	NR
Item 7	☐	3	2	1	0	NR
Item 8	☐	3	2	1	0	NR

		Error Count	ER	1 Err	2–3 Errs	4+ Errs	No Response
Page 14	Laura found an old dress and put it on. Laura and Robert laughed and laughed. Laura said, **"I look just like Mom in this!"** What did Laura say?						
	Item 9 **"I look just like Mom in this!"** ______	☐	3	2	1	0	NR
Page 15	Jimmy thought that Robert and Laura looked funny in the old clothes. He wanted to wear something, too. Jimmy said, **"Can I wear these old cowboy boots?"** What did Jimmy say?						
	Item 10 **"Can I wear these old cowboy boots?"** ______	☐	3	2	1	0	NR
Page 16	The children played in the old clothes for a little while. Then they went back to work packing more toys and clothing into the boxes. Soon, Robert and Jimmy grew tired. They didn't want to pack anymore. Robert said, **"Can we go outside and play now, Mom?"** What did Robert say?						
	Item 11 **"Can we go outside and play now, Mom?"** ______	☐	3	2	1	0	NR
Page 17	Laura was tired of packing and wanted to play, too. She said, **"I don't want to work by myself."** What did Laura say?						
	Item 12 **"I don't want to work by myself."** ______	☐	3	2	1	0	NR
Page 18	Mom knew that everyone was tired and hungry. It was time to eat. The children helped Mom make hamburgers for dinner. Robert said, **"I am so hungry that I can eat two."** What did Robert say?						
	Item 13 **"I am so hungry that I can eat two."** ______	☐	3	2	1	0	NR
Page 19	Jimmy liked to eat his hamburger a special way. He said, **"I am putting ketchup and mustard on my hamburger."** What did Jimmy say?						
	Item 14 **"I am putting ketchup and mustard on my hamburger."** ______	☐	3	2	1	0	NR
Page 20	Laura, Robert, and Mom ate their hamburgers. Then they were ready to have some ice cream. Mom said to Jimmy, **"If you clean your plate, you can have dessert, too."** What did Mom say?						
	Item 15 **"If you clean your plate, you can have dessert, too."** ______	☐	3	2	1	0	NR
Page 21	Robert told Jimmy, **"You won't grow tall if you don't eat."** What did Robert say?						
	Item 16 **"You won't grow tall if you don't eat."** ______	☐	3	2	1	0	NR

		Error Count	ER	1 Err	2–3 Errs	4 Errs	5+ Errs	No Response
Page 22	Jimmy ate his hamburger and had ice cream. After everyone helped clean up, it was time for bed. Mom tucked the boys in and told them, **"Tomorrow we will finish packing, and the moving van will come."** What did Mom say?							
	Item 17 **"Tomorrow we will finish packing, and the moving van will come."** ______	☐	4	3	2	1	0	NR
Page 23	Laura was sleepy, but happy. She said, **"I can't wait to move to our new house tomorrow!"** What did Laura say?							
	Item 18 **"I can't wait to move to our new house tomorrow!"** ______	☐	4	3	2	1	0	NR
Page 24	The next day, Mom and the children finished packing. The movers came and put all of the boxes and the furniture into the moving van. Then they drove the van to the new house. Mom and the children drove to the new house, too.							
Page 25	When they arrived, Robert, Laura, and Jimmy started to explore their new house. Fluffy did, too.							
	Raw Score							

Formulating Labels

Picture Stimuli	Repetitions	Discontinue Rules
Stimulus Manual 1	One repetition allowed	3 years: 5 consecutive zero scores (errors or no responses) 4–6 years: 4 consecutive zero scores (errors or no responses)

The targeted response for each item is in parentheses. Record all responses **verbatim** in the spaces provided. See pages 13–17 in the *Examiner's Manual* for scoring guidelines. Circle *NR* for no response.

Trial 1 What is this? (boat/sailboat)

Trial 2 What is the baby doing? (crying)

		Score			
1.	What is the girl doing? (riding)	2	1	0	NR
2.	What are these? [Point to the buttons.] (buttons)	2	1	0	NR
3.	What is the man doing? (pouring)	2	1	0	NR
4.	What is the girl doing? (pushing)	2	1	0	NR
5.	What is this? (flag)	2	1	0	NR
6.	What is this? (sock)	2	1	0	NR
7.	What is this? (alligator)	2	1	0	NR
8.	What is this? (piano)	2	1	0	NR
9.	What is the woman doing? (cutting)	2	1	0	NR
10.	What is this? (web)	2	1	0	NR
11.	What is this? (bridge)	2	1	0	NR
12.	What is the boy doing? (wrapping)	2	1	0	NR
13.	What is the woman doing? (sewing)	2	1	0	NR
14.	What is this? (arrow)	2	1	0	NR
15.	What is this? (parade)	2	1	0	NR
16.	What is this? (octopus)	2	1	0	NR
17.	What is this? (turkey)	2	1	0	NR
18.	What is this? (map)	2	1	0	NR
19.	What is this? (globe)	2	1	0	NR
20.	What is this? (thermometer)	2	1	0	NR
	Raw Score				

Basic Concepts

Picture Stimuli	Repetitions	Discontinue Rules
Stimulus Manual 1	One repetition allowed	3 years: 5 consecutive zero scores (errors or no responses) 4–6 years: 4 consecutive zero scores (errors or no responses)

Introduce each item by saying, **"Point to. . . ."** or **"Show me. . . ."** Circle the letter corresponding to the child's response. Correct responses are underlined. Circle *1* for a correct response, *0* for an incorrect response, or *NR* for no response.

Trial 1 the one who is big A B C

Trial 2 the one who is sad A B C

			Score		
1.	the one that is inside	A B C	1	0	NR
2.	the one who is pointing up	A B C	1	0	NR
3.	the one that is empty	A B C	1	0	NR
4.	the one who is first	A B C	1	0	NR
5.	the one that is cold	A B C	1	0	NR
6.	the one who is tall	A B C	1	0	NR
7.	the one that is long	A B C	1	0	NR
8.	the one that shows many	A B C	1	0	NR
9.	the one that is full	A B C	1	0	NR
10.	the one who is alone	A B C	1	0	NR

			Score		
11.	the one that is slow	A B C	1	0	NR
12.	the one who is dry	A B C	1	0	NR
13.	the one that is hard	A B C	1	0	NR
14.	the ones that are the same	A B C	1	0	NR
15.	the one who is at the bottom	A B C	1	0	NR
16.	the one that is large	A B C	1	0	NR
17.	the ones that are different	A B C	1	0	NR
18.	the one that is last	A B C	1	0	NR
	Raw Score				

Sentence Structure

Picture Stimuli	Repetitions	Discontinue Rules
Stimulus Manual 1	None allowed	3 years: 5 consecutive zero scores (errors or no responses) 4–6 years: 4 consecutive zero scores (errors or no responses)

Introduce each item by saying, **"Point to. . . ."** Circle the letter corresponding to the child's response. Correct responses are underlined. Circle *1* for a correct response, *0* for an incorrect response, or *NR* for no response.

Trial 1 It smells good. A̲ B C

Trial 2 I can eat this. A B C̲

			Score		
1.	The boy is sleepy.	A B C̲	1	0	NR
2.	The bear is in the wagon.	A B C̲	1	0	NR
3.	The mouse is under the chair.	A B̲ C	1	0	NR
4.	It's all gone.	A̲ B C	1	0	NR
5.	The girl is swimming.	A B̲ C	1	0	NR
6.	The man opened the door.	A B C̲	1	0	NR
7.	The boy is crying because his airplane is broken.	A B̲ C	1	0	NR
8.	The girl took some flowers to her mother.	A B̲ C	1	0	NR
9.	She is climbing and he is swinging.	A B̲ C	1	0	NR
10.	The man who is sitting under the tree is wearing a hat.	A̲ B C	1	0	NR
11.	Where does the boy play baseball?	A B C̲	1	0	NR

			Score		
12.	The woman caught a big fish.	A̲ B C	1	0	NR
13.	The spotted puppy is in the box.	A̲ B C	1	0	NR
14.	The girl is not painting.	A B C̲	1	0	NR
15.	Don't touch!	A̲ B C	1	0	NR
16.	He will eat the apple.	A B̲ C	1	0	NR
17.	He is ready to go to bed.	A B̲ C	1	0	NR
18.	She can get the book.	A̲ B C	1	0	NR
19.	The boy was followed by his cat.	A̲ B C	1	0	NR
20.	The girl is being pushed by the boy.	A B C̲	1	0	NR
21.	Mom showed the dog the cat.	A̲ B C	1	0	NR
22.	The boy saw a girl who was carrying a hammer.	A B C̲	1	0	NR
			Raw Score		

Word Structure

Picture Stimuli	Repetitions	Discontinue Rules
Stimulus Manual 3	One repetition allowed	3 years: 5 consecutive zero scores (errors or no responses) 4–6 years: 4 consecutive zero scores (errors or no responses)

Correct responses are in parentheses. Circle *1* for a correct response, *0* for an incorrect response, or *NR* for no response.

Trial 1 a. This boy is standing.
b. This boy is ___. (sitting)

Trial 2 a. This girl has two balloons.
b. This girl has two ___. (dolls)

		Score		
1.	a. This doll is out of the box. b. This doll is ___. (in/inside the box)	1	0	NR
2.	a. Here a girl is playing. b. Here a girl is ___. (sleeping)	1	0	NR
3.	a. Here are three frogs. b. Here are three ___. (bugs)	1	0	NR
4.	a. The hat is under the chair. b. The hat is ___. (on the chair)	1	0	NR
5.	a. The cat is his. b. The dog is ___. (hers)	1	0	NR
6.	a. She is waving at him. b. He is waving at ___. (her)	1	0	NR
7.	a. This is his wagon. b. This is ___. (her bike)	1	0	NR
8.	a. This is the boy's sock. b. This is the ___. (girl's shoe)	1	0	NR
9.	a. Here Betty is giving a present to her. b. Here Betty is giving a present to ___. (him)	1	0	NR
10.	a. Here is a shoe. It is blue. b. Here is a shoe. ___. (it is/it's red)	1	0	NR
11.	a. The baby eats. b. The baby ___. (sleeps)	1	0	NR

		Score		
12.	a. Who is sitting? She is sitting. b. Who is standing? ___. (He is standing)	1	0	NR
13.	a. Who is happy? He is. b. Who is sick? She ___. (is)	1	0	NR
14.	a. He is feeding himself. b. She is dressing ___. (herself)	1	0	NR
15.	a. Here is a baby. The baby is crawling. b. Here is a girl. The ___. (girl is walking)	1	0	NR
16.	a. This is dinner. She cooked the dinner. b. This is a cake. He ___. (baked the cake)	1	0	NR
17.	a. This is a bubble. Yesterday, he blew the bubble. b. This is a ball. Yesterday, he ___. (threw the ball)	1	0	NR
18.	a. Here is a flower. This boy picked it. b. Here are some flowers. This girl picked ___. (them)	1	0	NR
19.	a. This boy is skating. This boy will skate. b. This boy is painting. This boy ___. (will paint)	1	0	NR
20.	a. Here the girl is riding. b. Here is the horse that she ___. (rode)	1	0	NR
		Raw Score		

Behavioral Observation Checklist

Check the behaviors that you observed during testing. Consider the child's age as you respond to each item.

Physical Activity Level

- The child's activity level throughout the test was generally:
  __ appropriate __ not active enough
  __ too active
- Overall, the child was fidgety/restless:
  __ never __ most of the time
  __ some of the time

Attention to Task

- The child maintained attention:
  __ throughout testing __ some of the time
  __ most of the time __ never
- The child's attention to task generally lasted:
  __ more than 10 min. __ 3 to 5 min.
  __ 5 to 10 min. __ less than 3 min.
- The child engaged in off-task behaviors:
  __ never __ often
  __ occasionally

Response Latency

- Responses were generally given in:
  __ 10 to 15 seconds __ more than 30 seconds
  __ 15 to 30 seconds
- Response rate was generally:
  __ appropriate __ too slow
  __ too rapid

Fatigue/Boredom/Frustration

- The child evidenced fatigue, boredom, and/or frustration during the test:
  __ never __ often
  __ rarely
- Fatigue, boredom, and/or frustration became evident:
  __ never __ after 10 min.
  __ after 15 min. __ after 5 min.

Level of Interaction

- The child:
  __ participated willingly __ refused to cooperate
  __ participated under duress
- The child engaged in test-appropriate conversation:
  __ most of the time __ very little
  __ sometimes

Item Analysis for Formulating Labels

Category	Items					
Nouns						
Animate	7	16	17			
Inanimate	2	5	6	8	10	11
	14	15	18	19	20	
Verbs						
Transitive	3	9	12	13		
Intransitive	1	4				

Item Analysis for Basic Concepts

Category	Items				
Attribution	5	11	12	13	
Dimension/Size	6	7	16		
Direction/Location/Position	1	2	4	15	18
Number/Quantity	3	8	9	10	
Equality	14	17			

Item Analysis for Sentence Structure

Category	Items		
Verb Phrase	1	4	5
	6	16	18
Prepositional Phrase	2	3	
Wh-Interrogative	11		
Imperative	15		
Modification	12	13	
Indirect Object	8	21	
Negative	14		
Passive	19	20	
Infinitive	17		
Coordination	9		
Relative Clause	10	22	
Subordinate Clause	7		

Item Analysis for Word Structure

Category	Items		
Prepositions	1	4	
Nouns			
Plural/Possessive	3	8	
Verb Tense			
Third Person Singular	11		
Regular Past Tense	16		
Irregular Past Tense	17	20	
Future Tense	19		
Present Progressive	2		
Contractible Copula	10		
Uncontractible Copula	13		
Contractible Auxiliary	15		
Pronouns			
Subject	12		
Object	6	9	18
Possessive	5	7	
Reflexive	14		

Appendix 7.9 Sample CELF score sheet

CELF-R UK

Clinical Evaluation of Language Fundamentals-Revised

Eleanor Semel   Elisabeth H. Wiig   Wayne Secord

Record Form

THE PSYCHOLOGICAL CORPORATION
HARCOURT BRACE & COMPANY, PUBLISHERS

Name ______________________________

Address ______________________________

Age ______________ Sex ______________ Year ______________

School ______________________________

Teacher ______________________________

Examiner ______________________________

	Year	Month	Day
Test Date			
Birth Date			
Chronological Age			

Other Relevant Data

Ages 5-7 Scoring Summary	Raw Score	Standard Scores: Standard Score	Standard Scores: Points – or +	Standard Scores: Confidence Interval (___% Level)	Percentile Ranks: PR	Percentile Ranks: Confidence Interval
Linguistic Concepts				to		to
Sentence Structure				to		to
Oral Directions				to		to
SUM OF 3 STANDARD SCORES						
RECEPTIVE LANGUAGE SCORE				to		to
Word Structure				to		to
Formulated Sentences				to		to
Recalling Sentences				to		to
SUM OF 3 STANDARD SCORES						
EXPRESSIVE LANGUAGE SCORE				to		to
SUM OF 6 STANDARD SCORES			See *Examiner's Manual* Table 3.4 for minimum differences required for significance.			
MEAN OF SUBTESTS (SUM ÷ 6)						
TOTAL LANGUAGE SCORE				to		to
Age Equivalent ________				to		

Ages 8 and Above Scoring Summary	Raw Score	Standard Scores: Standard Score	Standard Scores: Points – or +	Standard Scores: Confidence Interval (___% Level)	Percentile Ranks: PR	Percentile Ranks: Confidence Interval
Oral Directions				to		to
Word Classes				to		to
Semantic Relationships				to		to
SUM OF 3 STANDARD SCORES						
RECEPTIVE LANGUAGE SCORE				to		to
Formulated Sentences				to		to
Recalling Sentences				to		to
Sentence Assembly				to		to
SUM OF 3 STANDARD SCORES						
EXPRESSIVE LANGUAGE SCORE				to		to
SUM OF 6 STANDARD SCORES			See *Examiner's Manual* Table 3.4 for minimum differences required for significance.			
MEAN OF SUBTESTS (SUM ÷ 6)						
TOTAL LANGUAGE SCORE				to		to
Age Equivalent ________				to		

Receptive/Expressive Differences		Prevalence: Percentage of Sample	Prevalence: Obtained Difference
Higher Score (Receptive or Expressive)		1%	≥30
minus		5%	≥20
Lower Score (Receptive or Expressive)	–	10%	≥16
		15%	≥12
Difference		25%	≥ 8

Receptive/Expressive Differences		Prevalence: Percentage of Sample	Prevalence: Obtained Difference
Higher Score (Receptive or Expressive)		1%	≥30
minus		5%	≥20
Lower Score (Receptive or Expressive)	–	10%	≥16
		15%	≥12
Difference		25%	≥ 8

Supplementary Subtests	Raw Score	Standard Scores: Standard Score	Standard Scores: Points – or +	Standard Scores: Confidence Interval (___% Level)	Percentile Ranks: PR	Percentile Ranks: Confidence Interval
Listening to Paragraphs				to		to
Word Associations				to		to
Word Classes				to		to
Semantic Relationships				to		to
Sentence Assembly				to		to

Supplementary Subtests	Raw Score	Standard Scores: Standard Score	Standard Scores: Points – or +	Standard Scores: Confidence Interval (___% Level)	Percentile Ranks: PR	Percentile Ranks: Confidence Interval
Listening to Paragraphs				to		to
Word Associations				to		to
Linguistic Concepts				to		to
Sentence Structure				to		to
Word Structure				to		to

Linguistic Concepts

Use	Picture Stimuli	Repetitions	Discontinue Rule
Ages 5-7 Required to compute Receptive Language score and CELF-R Total Language score **Ages 8 +** Supplementary subtest	*Stimulus Manual 1*	None allowed	4 consecutive zero scores (errors or no responses)

Special Considerations: Do not administer this subtest to pupils with colour blindness that impairs discrimination of red, blue, or yellow.

Circle 1 for a correct response, 0 for an incorrect response, and NR for no response.

Demonstration and Trial: Listen carefully to my instructions. First, I will point to some lines. I will point to a yellow line (point) **a red one** (point) **and a blue one** (point). **Now you point to a blue line** (pause, repeat if necessary). **Point to a red line** (pause). **Now let's do it together. Let's point to a yellow line at the same time** (point). **Let's point to a red line at the same time** (point). **If at any time you can't do what I ask you to do, point to the stop sign** (point to the stop sign). **Now let's do it again. Point to a yellow line; point to a blue line; point to a green line** (The student should point to the stop sign.)

		Score		
1.	Point to the line that is not yellow.	1	0	NR
2.	Instead of pointing to a blue line, point to the red line.	1	0	NR
3.	Point to the blue line and to the red line. (The pupil may point simultaneously or separately.)	1	0	NR
4.	If you see a blue line, point to a yellow line.	1	0	NR
5.	Point to any one of the blue lines.	1	0	NR
6.	Point to either a red line or a blue line.	1	0	NR
7.	Point to all the lines except the blue one.	1	0	NR
8.	Don't point to the yellow line until I point to the blue line.	1	0	NR
9.	When I point to a red line, point to a blue line. (The pupil should point to the stop sign.)	1	0	NR
10.	Point to a blue line if you see a red line. (The pupil should point to the stop sign.)	1	0	NR
11.	After I point to a blue line, you point to a red line and a yellow line. (The pupil may point simultaneously or separately.)	1	0	NR
12.	Point to a blue line before you point to a yellow line.	1	0	NR
13.	Point to some of the yellow lines.	1	0	NR
14.	Point to a yellow line after you point to the red line.	1	0	NR
15.	Before you point to the blue line, point to a red line.	1	0	NR
16.	After you point to a yellow line, point to a red line.	1	0	NR
17.	After I point to a red line, you point to a blue line after you point to a yellow line.	1	0	NR
18.	Point to either of the blue lines and all of the red lines.	1	0	NR
19.	Point to all the red lines and all but one of the yellow lines.	1	0	NR
20.	If the red line is first, point to the yellow line. (The pupil should point to the stop sign).	1	0	NR
	Raw Score			

Item Analysis for Linguistic Concepts

Category	Items
Inclusion/Exclusion not, except, either or, all, all but one, either	1 6 **7** **18** **19**
Coordination and	3 **11** **18** **19**
Temporal after, before	**11** 12 14 15 16 17
Conditional instead of, if, until, when	2 4 8 9 10 **20**
Quantitative all, some, any one, all but one, first	5 **7** 13 **19** **20**

Observations

Word Structure

Use	Picture Stimuli	Repetitions	Discontinue Rule
Ages 5-7 Required to compute Expressive Language Score and CELF-R Total Language score **Ages 8 +** Supplementary subtest	*Stimulus Manual 1*	One allowed	None; all items must be administered.

Circle 1 for a correct response, 0 for an incorrect response, and NR for no response. Correct responses are in colour.

Trial 1: Here is a boy and here is a . . .(**girl**) **Trial 2:** Here is a woman and here is a . . . (**man**)

"Sometimes we will be talking about 3 children named Mark, Ann, and Ben. Here is Mark;here is Ann; and here is Ben."

	Score		
A. Regular Plurals			
1. Here is one dog. Here are two __________.(**dogs**) (If the pupil says puppies, indicate this and mark the item as correct.)	1	0	NR
2. Here is one cat. Here are two __________. (**cats**) (If the pupil says kittens, indicate this and mark the item correct.)	1	0	NR
3. Here is one watch. Here are two __________. (**watches**)	1	0	NR
B. Irregular Plurals			
4. Here is a tooth. Here are some _________. (**teeth**)	1	0	NR
5. Here is a foot. Here are two _______ . (**feet**)	1	0	NR
6. Here is a man. Here are two ______ . (**men**)	1	0	NR
Reminder:(This page is to remind the pupil of the children's names.) Say "**Remember the names of the children are Mark** (point), **Ann** (point), **and Ben** (point)."			
C. Noun Possessives			
7. Whose bike is this? It is ________. (**Mark's**)	1	0	NR
8. Whose bike is this? It is _________. (**Ann's**)	1	0	NR
D. Personal Pronouns			
The girl has a new hat. The hat belongs to her.			
9. The girl has a new watch. The watch belongs to _______. (**her**)	1	0	NR
10. The boy has some new skis. The skis belong to _______. (**him**)	1	0	NR
11. They have a radio to share. The radio belongs to all of ______. (**them**)	1	0	NR
E. Possessive Pronouns			
The boy bought a new dog. The dog is his.			
12. His father bought a new coat. The coat is ________. (**his**)	1	0	NR
13. His mother bought a new dress. The dress is ________. (**hers**)	1	0	NR
14. They all bought a new car. The car is _______. (**theirs**)	1	0	NR
F. Third Person Singular			
15. Here Mark types. Here he ________. (**writes/draws**)	1	0	NR
16. Here Ann jumps. Here she _______. (**swims**)	1	0	NR
G. Regular Past Tense			
17. Here is Mark jumping the fence. This is the fence Mark has ________. (**jumped**)	1	0	NR
18. Here is Ann climbing a ladder. Here is the ladder Ann has________. (**climbed**)	1	0	NR
19. Here is Ben painting a picture. This is the picture Ben has_________. (**painted**)	1	0	NR
Continued on next page **Subtotal**			

Word Structure Continued

H. Irregular Past Tense	Score		
20. Here is Mark writing a letter. This is the letter Mark _____. **(wrote/has written)**	1	0	NR
21. Here is Ann getting a present. This is the present Ann ____. **(got/has got)** (If the pupil says *received,* prompt one time with "Can you say it another way?" and repeat the item.)	1	0	NR
22. Here is Ben making an aeroplane. This is the aeroplane Ben ____. **(made/has made)** (If the pupil substitutes the word *built* indicate this and count the item as correct.)	1	0	NR
I. Auxiliary + ing			
For the following two items, if the pupil says the present tense without the auxiliary, e.g. swing instead of ***are swinging*** for Item 23, prompt one time with **"Can you say it another way ? Remember, here Mark is fishing** (point) **and here . . . "** (repeat item, e.g.., "Ann and Mark . . .")			
Here Mark is fishing.			
23. Here Ann and Mark ____. **(are swinging)**	1	0	NR
24. Here Ben ____. **(is running)**	1	0	NR
J. Derivation of Nouns from Verbs			
25. This man paints. He is called a ____. **(painter)**	1	0	NR
26. This girl jogs. She is called a ____. **(jogger)** (If the pupil substitutes the word *runner,* indicate this and count the item as correct.)	1	0	NR
27. This woman teaches. She is called a ____. **(teacher)**	1	0	NR
K. Adjective Derivation			
28. Mother said, 'You can't eat because your hands have dirt on them.' She could have said, "You can't eat because your hands are ____. " **(dirty)**	1	0	NR
29. The teacher said, 'We won't go outside with this much noise in the room.' She could have said, "We won't go outside because it's too ____." **(noisy)**	1	0	NR
30. Ann said, 'Mark, you have all the luck,' She could have said, "You are very ____." **(lucky)**	1	0	NR
L. Formation of Comparative and Superlative			
31. This boy is a fast runner, but this boy is even____, **(faster)**	1	0	NR
32. and this boy is the ____. **(fastest)**	1	0	NR
33. This man is strong, but this man is a bit ____, **(stronger)**	1	0	NR
34. and this man is the ____. **(strongest)**	1	0	NR
M. Demonstratives			
35. Mark said, "I don't want those apples. I'll take some of _____." **(those/these)**	1	0	NR
36. Ann said, "I want this book, and I want _______." **(that book/one)**	1	0	NR
Raw Score			

Observations

Items Analysis for Word Structure

Category	Items
Phonological Conditioning	
Regular Plurals	1 2 3
Noun Possessives	7 8
Third Person Singular	15 16
Regular Past Tense	17 18 19
Irregular Forms	
Irregular Plurals	4 5 6
Irregular Past Tense	20 21 22
Derivational Forms	
Nouns from Verbs	25 26 27
Adjective Derivation	28 29 30
Comparative and Superlative	31 32 33 34
Verb Complex Auxiliary + ing	23 24
Pronominalization	
Personal Pronouns	9 10 11
Possessive Pronouns	12 13 14
Demonstratives	35 36

Sentence Structure

Use	Picture Stimuli	Repetitions	Discontinue Rule
Ages 5-7 Required to compute Receptive Language score and CELF-R Total Language score **Ages 8 +** Supplementary subtest	*Stimulus Manual 1*	None Allowed	4 consecutive zero scores (errors or no responses)

Circle the letter corresponding to the pupils response. Then circle 1 for a correct response, 0 for an incorrect response, and NR for no response. Correct responses are in colour. Precede each item with ***"Show me . . ."***

Demonstration: The boy has a ball. **D**

Trial: The clown lost the balloon. **A**

Item		Score		
1. The man who is carrying his umbrella is walking out of the door.	**A** B C D	1	0	NR
2. The girl is not climbing.	A B **C** D	1	0	NR
3. The girl is crying because she lost her pet.	**A** B C D	1	0	NR
4. The baby is between the mother and the father.	A **B** C D	1	0	NR
5. The girl has a big, spotted, black and white dog.	**A** B C D	1	0	NR
6. The man has a new, shiny, white car.	**A** B C D	1	0	NR
7. The lamp is behind the chair.	A **B** C D	1	0	NR
8. The boy is counting his money to buy an ice cream.	A B **C** D	1	0	NR
9. The girl is walking home from the shop.	A **B** C D	1	0	NR
10. The dog that is wearing a collar is eating a big bone.	A **B** C D	1	0	NR
11. The boy who is sitting under the big tree is eating a banana.	A B **C** D	1	0	NR
12. The boy wanted to swim across the pool to sit with his friends.	**A** B C D	1	0	NR
13. The boy is sitting at the piano.	A B **C** D	1	0	NR
Subtotal				

Item		Score		
14. The woman showed the girl the baby.	A B C **D**	1	0	NR
15. The woman asked, "How much does this apple cost?"	A **B** C D	1	0	NR
16. The boy is being followed by the dog.	A **B** C D	1	0	NR
17. The boy is eating an ice cream.	A B C **D**	1	0	NR
18. The cat is not being chased by the dog.	A B C **D**	1	0	NR
19. The girls have dressed.	**A** B C D	1	0	NR
20. The postman gave the parcel to her.	A B C **D**	1	0	NR
21. The girl is wearing a raincoat even though she doesn't need it.	A B C **D**	1	0	NR
22. Mother asked, "Who is that?"	**A** B C D	1	0	NR
23. Father said, "Shouldn't you take out the rubbish?"	A B **C** D	1	0	NR
24. The boy will build an aeroplane.	A B **C** D	1	0	NR
25. Mother said, "Shouldn't you play the piano now?"	A **B** C D	1	0	NR
26. The girl asked, "Where have you hidden the present?"	A B **C** D	1	0	NR
Raw Score				

Item Analysis for Sentence Structure

Category	Item			
Verb Phrase	17	19	24	
Prepositional Phrase	4	7	9	13
Wh-Interrogative	15	22	26	
Modification	5	6		
Indirect Object	14	20		
Negative	2	**18**		
Passive	16	**18**		
Infinitive	8	12		
Relative Clause	1	10	11	
Subordinate Clause	3	21		
Indirect Request	23	25		

Observations

Oral Directions

Use		Picture Stimuli	Repetitions	Discontinue Rule
Ages 5+	Required to compute Receptive Language score and CELF-R Total Language score	*Stimulus Manual 2*	None allowed	4 consecutive zero scores (errors or no responses)

Circle 1 for a correct response, 0 for an incorrect response, and NR for no response.

Trial 1 : Point to the circle (pause)**. Point to the triangle** (pause)**. Point to the square** (pause).

Trial 2 : Point to the small square and point to the white circle. Go (pause)**. Point to the big square and point to the black circle. Go** (pause).

Trial 3 : Now you point to the first circle and the last triangle. Go.

		Score		
1. Point to the black circle; point to the white square. Go.	● (1) ■ □ (2) ○	1	0	NR
2. Point to the white triangle and the black square. Go.	○ ■ (2) ▲ △ (1)	1	0	NR
3. Point to the first big black triangle. Go.	▴ ▵ ▲ (1) ▲ △	1	0	NR
4. Point to the first triangle. Go.	□ △ (1) ○ △	1	0	NR
5. Point to the big black triangle and the first white square. Go.	▴ ▲ (1) □ (2) □ △	1	0	NR
6. Point to the first black triangle and the last small white circle. Go.	▲ (1) △ ▲ ○ ◦ ◦ (2)	1	0	NR
7. Point to the last white square; point to the small black circle. Go.	● • (2) ◦ □ □ (1)	1	0	NR
8. Point to the first black square; point to the last white circle. Go.	○ ● ■ (1) ■ ○ (2)	1	0	NR
9. Point to the last small white square. Go.	▪ ▫ ▫ (1) ■ □	1	0	NR
10. Point to the second triangle and the fourth square. Go.	△ □ △ (1) □ ▫ □ (2)	1	0	NR
11. Point to the small circle on the right of the black triangle. Go.	○ ◦ ▲ ○ ◦ (1)	1	0	NR
12. Point to the last white triangle and the first black square. Go.	△ △ (1) ▲ ■ (2) ■	1	0	NR
13. Point to the last big white square and the last small black circle. Go.	• • (2) ▫ ▲ □ □ (1)	1	0	NR
14. Point to the black triangle;point to the white square; point to the big circle. Go.	△ ▲ (1) ■ □ (2) ○ (3) ◦	1	0	NR
15. Point to the first big white square to the right of the small white triangle. Go.	▪ □ ■ ▵ □ (1) ▪ ■	1	0	NR
16. Point to the white square, small circle, and black triangle. Go.	◦ (2) ○ ■ △ □ (1) ▲ (3)	1	0	NR
17. Point to the big white square, the big black circle, and the smallest triangle. Go.	▫ ● (2) ▲ □ (1) ▴ ○ ▴ (3)	1	0	NR
18. Point to the third triangle; point to the first circle. Go.	▵ ○ (2) ▲ △ (1) • △	1	0	NR
19. Point to the small circle; point to the biggest triangle;point to the small black square. Go.	▵ △ (2) ■ ▵ ○ ▪ (3) ◦ (1)	1	0	NR
20. Point to the second circle; point to the third square; point to the first triangle. Go.	○ ▵ (3) △ □ ◦ (1) □ □ (2)	1	0	NR
21. Point to the last small black circle to the left of the big black square. Go.	● • • (1) ■ ◦ ● •	1	0	NR
22. Point to the third square, the second triangle, and the last circle.Go.	□ ◦ ○ (3) □ ▵ △ (2) □ (1)	1	0	NR
	Raw Score			

Item Analysis for Oral Directions

	Orientation							
	No Orientation		Serial Orientation			Left-Right Orientation		
Greatest No. of Modifiers in a Command	1	2	1	2	3	1	2	3
Commands	Item Numbers							
One-Level			4		3 9	11		15 21
Two-Level	1 2		10 18	7 8 5 12	6 13			
Three-Level	14 16	17 19	20 22					

Observations

Formulated Sentences

Use	Picture Stimuli	Repetitions	Discontinue Rule
Ages 5+ Required to compute Expressive Language score and CELF-R Total Language score	*Stimulus Manual 2*	One repetition allowed	4 consecutive zero scores (or no responses)

Write the pupil's responses verbatim in the space provided.
Refer to Tables 2.1 and 2.2 in Section 2 of the *Examiner's Manual* for scoring guidelines.

Demonstration: books
Trial: shoes

		Score				
1.	car	3	2	1	0	NR
2.	gave	3	2	1	0	NR
3.	before	3	2	1	0	NR
4.	when	3	2	1	0	NR
5.	after	3	2	1	0	NR
6.	if	3	2	1	0	NR
7.	and	3	2	1	0	NR
8.	because	3	2	1	0	NR
9.	but	3	2	1	0	NR
10.	or	3	2	1	0	NR
11.	although	3	2	1	0	NR
12.	tall	3	2	1	0	NR
13.	either	3	2	1	0	NR
14.	neither	3	2	1	0	NR

Before presenting the remaining items, say, **"Now, I'll give you two words to use in the same sentence. You can use the words in any order you choose, but you must use both words in the same sentence. Here's the next picture."**

15.	and	because	3	2	1	0	NR
16.	whatever	until	3	2	1	0	NR
17.	and	but	3	2	1	0	NR
18.	before	if	3	2	1	0	NR
19.	whenever	until	3	2	1	0	NR
20.	after	unless	3	2	1	0	NR
		Column Totals					
(See page 9 for Item Analysis)		**Raw Score**					

Recalling Sentences

Use	Picture Stimuli	Repetitions	Discontinue Rule
Ages 5+ Required to compute Expressive Language score and CELF-R Total Language score	None	None allowed	4 consecutive zero scores (no responses or sentences the 4 + errors)

Circle 3 if response is repeated exactly, 2 if there is one error, 1 if there are two to three errors, 0 if there are four or more errors, and NR if there is no response. Mark errors on the sentence or write an incorrect response verbatim in the space provided.

Demonstration: Turn left at the postbox.

Trial: The boat sailed across the lake.

		OK	1 err	2-3 err	4 + err	No Response
1.	The dog chased the cat.	3	2	1	0	NR
2.	Did the boy kick the ball?	3	2	1	0	NR
3.	The train was followed by the car.	3	2	1	0	NR
4.	Was the car followed by the police?	3	2	1	0	NR
5.	Didn't the rabbit eat the carrot?	3	2	1	0	NR
6.	The boy was not chased by the girl.	3	2	1	0	NR
7.	The boy and the girl picked the flowers.	3	2	1	0	NR
8.	Wasn't the ice cream bought by the girl?	3	2	1	0	NR
9.	Has the mouse been chased by the cat?	3	2	1	0	NR
10.	If the hat is too big, the man won't buy it.	3	2	1	0	NR
11.	The ball was not thrown by the boy or the girl.	3	2	1	0	NR
12.	The man who painted the railings was very kind.	3	2	1	0	NR
13.	The dog chased the ball, and the cat didn't follow.	3	2	1	0	NR
14.	The girl did not like the boy who lived down the street.	3	2	1	0	NR
15.	The big, brown dog chased the red ball.	3	2	1	0	NR
16.	The man stopped to pick up some milk even though he was late for work.	3	2	1	0	NR
17.	The trumpets and violins were played by the musicians.	3	2	1	0	NR
18.	If she would have baked some biscuits, they would have been eaten.	3	2	1	0	NR
19.	The boy sent a letter to the lady who moved away last year.	3	2	1	0	NR
20.	The children cut and pasted the pictures and hung them on the wall.	3	2	1	0	NR
21.	The woman has read the twelve big, heavy, brown books.	3	2	1	0	NR
22.	The man who sits on the bench next to the oak tree is our mayor.	3	2	1	0	NR
23.	After the family had finished dinner, they decided to go for a ride in the country.	3	2	1	0	NR
24.	The boy who didn't turn up for practice wasn't allowed to play in the team until a week later.	3	2	1	0	NR
25.	The postman sorted, labelled, bundled, and delivered the magazines.	3	2	1	0	NR
26.	The man in the house next door promised to water our flowers during our holiday.	3	2	1	0	NR
	Column Totals					
	Raw Score					

Formulated Sentences and Recalling Sentences Continued

Item Analysis for Formulated Sentences

Word Category	Items					
Noun	1					
Verb	2					
Modifier	12					
Conjunctions						
Coordinating	7	9	10	**15**	17	
Subordinating	3	4	5	6	8	11
	15	16	18	19	20	
Correlative	13	14				

Observations

Item Analysis for Recalling Sentences

Category	Items				
Active	1				
with noun modification	15	21			
with coordination	7	13	20		
with conjunction deletion	25				
with subordinate clause	10	16	23		
with relative clause	12	14	19	22	24
(elliptical)	26				
Passive	3				
with coordination	**11**	17			
negative	6	**11**			
with subordinate clause	18				
Interrogative	2				
passive	4	**8**	9		
negative	55	**8**			

Word Classes

Use	Picture Stimuli	Repetitions	Discontinue Rule
Ages 5-7 Supplementary subtest **Ages 8 +** Required to compute Receptive Language score and CELF-R Total Language score	*None*	None allowed	4 consecutive zero scores (errors or no responses)

Circle the words given in response. Then circle 1 for a correct, 0 for an incorrect pair, and NR for no response. Correct responses are in colour. Precede each item with "Listen"'

Trial 1:	**girl**	**boy**	car	table
Trial 2:	slow	**nurse**	**doctor**	rain
Trial 3:	**big**	happy	near	**little**

					Score		
1.	**tiger**	**lion**	tree	baby	1	0	NR
2.	**far**	**near**	big	late	1	0	NR
3.	table	**red**	**blue**	hat	1	0	NR
4.	sad	**slow**	small	**fast**	1	0	NR
5.	books	**shoes**	bread	**socks**	1	0	NR
6.	spoon	bath	**car**	**garage**	1	0	NR
7.	**money**	**change**	matches	crayons	1	0	NR
8.	**down**	old	thin	**up**	1	0	NR
9.	flying	drinking	**stretching**	**bending**	1	0	NR
10.	**seed**	**tree**	duck	hand	1	0	NR
11.	run	**cry**	eat	**laugh**	1	0	NR
12.	**borrow**	**lend**	make	add	1	0	NR
13.	**before**	when	under	**after**	1	0	NR
14.	**seconds**	metres	**minutes**	winter	1	0	NR
15.	**smoke**	lamp	rain	**fire**	1	0	NR
16.	**lorry**	teacher	**bus**	horse	1	0	NR
17.	happy	**rainy**	**windy**	slowly	1	0	NR
18.	**cliff**	**hill**	house	grass	1	0	NR
				Subtotal			

					Score		
19.	run	**sleep**	**night**	talk	1	0	NR
20.	**early**	fast	**morning**	following	1	0	NR
21.	covered	**connected**	slanted	**joined**	1	0	NR
22.	among	**ahead**	until	**front**	1	0	NR
23.	**beside**	become	**below**	beware	1	0	NR
24.	truth	**success**	nature	**failure**	1	0	NR
25.	cold	**rough**	hard	**smooth**	1	0	NR
26.	**cruel**	bright	sad	**kind**	1	0	NR
27.	below	**away**	mile	**distant**	1	0	NR
				Raw Score			

Item Analysis for Word Classes

Category	Items								
Semantic Class	1	2	5	7	9	**14**	16	17	18
Opposite	**2**	4	8	11	12	**13**	24	25	26
Spatial	**2**	6	**13**	21	22	23	27		
Temporal	10	**13**	**14**	15	19	20			

Observations

Sentence Assembly

Use	Picture Stimuli	Repetitions	Discontinue Rule
Ages 5-7 Supplementary subtest **Ages 8 +** Required to compute Expressive Language score and CELF-R Total Language score	*Stimulus Manual 2*	One repetition allowed	4 consecutive zero scores (errors or no responses)

Check the blank next to the pupil's responses. The pupil must give 2 of the sentence responses listed for an item to be scored as correct. Circle 1 for a correct response, 0 for an incorrect response, and NR for no response. If the pupil gives a response not listed, record it in the space provided.

Demonstration: tall | the boy | is
a) The boy is tall.
b) Is the boy tall?

Trial 1: kicked | the girl | the boy
a) The girl kicked the boy.
b) The boy kicked the girl.

Trial 2: is | in the chair | the kitten
a) The kitten is in the chair.
b) Is the kitten in the chair?

Item	Score
1. saw | the dog | the woman ___a) The woman saw the dog. ___b) The dog saw the woman.	1 0 NR
2. the man | the dog | chased by | was ___a) The man was chased by the dog. ___b) The dog was chased by the man. ___c) Was the man chased by the dog? ___d) Was the dog chased by the man?	1 0 NR
3. in the box | the ball | is ___a) The ball is in the box. ___b) Is the ball in the box?	1 0 NR
4. tall | strong | the man | and | is ___a) The man is tall and strong. ___b) The man is strong and tall. ___c) Is the man tall and strong? ___d) Is the man strong and tall?	1 0 NR
5. they watched | they ate | dinner | TV | before ___a) They watched TV before they ate dinner. ___b) They ate dinner before they watched TV. ___c) Before they ate dinner, they watched TV. ___d) Before they watched TV, they ate dinner.	1 0 NR
6. the girl | the present | the man | gave ___a) The man gave the girl the present. ___b) The girl gave the man the present.	1 0 NR
7. the girls | the boys | walking | were | with ___a) The boys were walking with the girls. ___b) The girls were walking with the boys. ___c) Were the boys walking with the girls? ___d) Were the girls walking with the boys? ___e) The girls were with the boys walking. ___f) The boys are with the girls walking.	1 0 NR
8. the team | the girls | going to join | are ___a) The girls are going to join the team. ___b) Are the girls going to join the team?	1 0 NR

Item	Score
9. bone | lost | is | the dog's ___a) The dog's bone is lost. ___b) Is the dog's bone lost?	1 0 NR
10. the boy | the race | to win | going | isn't ___a) The boy isn't going to win the race. ___b) Isn't the boy going to win the race?	1 0 NR
11. the fence | to fall off | going | is | the girl ___a) The girl is going to fall off the fence. ___b) Is the girl going to fall of the fence?	1 0 NR
12. on the table | the ball | put | will | you ___a) You will put the ball on the table! ___b) Will you put the ball on the table? ___c) Put the ball on the table, will you?	1 0 NR
13. and | is running | is falling | the girl | the boy ___a) The girl is running and the boy is falling. ___b) The boy is running and the girl is falling. ___c) The boy is falling and the girl is running. ___d) The girl is falling and the boy is running.	1 0 NR
14. is painting | is cutting | and | the man | the girl | the grass | the house ___a) The man is painting the house, and the girl is cutting the grass. ___b) The girl is cutting the grass, and the man is painting the house. ___c) The girl is painting the house, and the man is cutting the grass. ___d) The man is cutting the grass, and the girl is painting the house.	1 0 NR
15. the car | I | dad bought | that | like ___a) I like the car that Dad bought. ___b) Dad bought the car that I like. ___c) The car that I like Dad bought. ___d) The car that Dad bought I like.	1 0 NR
16. the lamp | the woman | the table | put | didn't | on ___a) The woman didn't put the lamp on the table. ___b) Didn't the woman put the lamp on the table?	1 0 NR
Subtotal	

Sentence Assembly Continued

Item	Score
17. [the] [played] [sister] [and] [and] [brother] [the piano] [the guitar] ___a) The brother and sister played the piano and the guitar. ___b) The sister and brother played the piano and the guitar. ___c) The sister and brother played the guitar and the piano. ___d) The brother and sister played the guitar and the piano.	1 0 NR
18. [the girl] [the boy] [a letter] [send] [did] ___a) The girl did send the boy a letter. ___b) Did the girl send the boy a letter? ___c) The boy did send the girl a letter. ___d) Did the boy send the girl a letter?	1 0 NR
19. [it] [it] [I want] [expensive] [even though] [is] ___a) Even though it is expensive, I want it. ___b) I want it even though it is expensive.	1 0 NR
20. [the man] [the boy] [was lost] [whose] [by] [dog] [was met] ___a) The man was met by the boy whose dog was lost. ___b) The boy was met by the man whose dog was lost. ___c) The man whose dog was lost was met by the boy. ___d) The boy whose dog was lost was met by the man.	1 0 NR
21. [she left] [she caught] [the house] [the bus] [after] ___a) After she left the house, she caught the bus. ___b) She caught the bus after she left the house.	1 0 NR
22. [was tall] [her head] [who] [the girl] [bumped] ___a) The girl who was tall bumped her head. ___b) The girl who bumped her head was tall.	1 0 NR
Raw Score	

Item Analysis for Sentence Assembly

Category	Items			
Declarative, Active	1	**3**	**9**	
with coordination	**4**	13.	14	17
with prepositional phrase	**7**	**16**		
negative	**10**	**16**		
with infinitival phrase	**8**	**10**		
with direct and indirect object	6	**18**		
with subordinate clause	5	19	21	
with relative clause	15	**20**	22	
Declarative, Passive	**2**	**20**		
Imperative	**12**			
Interrogative	**3**	**9**		
passive	**2**			
with coordination	**4**			
with prepositional phrase	**7**	**12**	**16**	
with infinitival phrase	**8**	**10**	11	
negative	**10**	**16**		
with direct and indirect object	**18**			

Semantic Relationships

Use	Picture Stimuli	Repetitions	Discontinue Rule
Ages 5-7 Supplementary subtest **Ages 8 +** Required to compute Receptive Language score and CELF-R Total Language score	*Stimulus Manual 2*	One repetition allowed	Discontinue by section only. 4 consecutive 0 scores per section (errors or no responses)

Check the blank next to the pupil's responses. Circle 1 for a correct response, 0 for an incorrect response, and NR for no response. The pupil must give both responses indicated in colour for an item to be scored as correct.

Trial 1: A man is bigger than
a) a house c) **a spoon**
b) **a coin** d) a plane

Trial 2: Jim was hit by Fred. John was hit by Frank. who was hit?
a) **Jim** c) Fred
b) **John** d) Frank

Comparative Relationships	Score
1. Footballs are bigger than ___a) bicycles ___c) **apples** ___b) **pencils** ___d) cars	1 0 NR
2. Birds are faster than ___a) **tortoises** ___c) rockets ___b) **kites** ___d) planes	1 0 NR
3. Books are heavier than ___a) TVs ___c) chairs ___b) **feathers** ___d) **letters**	1 0 NR
4. Hours are longer than ___a) **minutes** ___c) **seconds** ___b) days ___d) mornings	1 0 NR
5. Rooms are smaller than ___a) flowers ___c) tables ___b) **buildings** ___d) **houses**	1 0 NR
Subtotal	

Semantic Relationships Continued

Score

6. Water is wetter than — 1 0 NR
___a) **sand** ___c) **ice**
___b) milk ___d) juice

7. Flowers are shorter than — 1 0 NR
___a) **trees** ___c) **people**
___b) butterflies ___d) grass

8. Oranges are sweeter than — 1 0 NR
___a) **lemons** ___c) sugar
___b) **chips** ___d) chocolate

Subtotal

Spatial Relationships

9. The elephant sat on the mouse. The mouse was — 1 0 NR
___a) **under the elephant** ___c) sitting down
___b) on top ___d) **on the bottom**

10. The coat was in the box. The box was on the bed. The coat was — 1 0 NR
___a) under the bed ___c) **on the bed**
___b) **in the box** ___d) in the bed

11. The ball rolled to the left of the fence. The ball was — 1 0 NR
___a) under the fence ___c) **at the side of it**
___b) **to the left of the fence** ___d) to the right of it

12. Mary ran before Bill, Tim ran after Bill. Mary was — 1 0 NR
___a) last ___c) in the middle
___b) **first** ___d) **in front of Tim**

13. The tree was in front of the house. The fence was at the back of it. The house was — 1 0 NR
___a) **in the middle** ___c) in front of the tree
___b) **behind the tree** ___d) at the back of the fence

Subtotal

Passive Relationships

14. Jerry and Tom were pushed by Bob, and Sue helped. Who pushed? — 1 0 NR
___a) Jerry ___c) **Bob**
___b) Tom ___d) **Sue**

15. John was not picked, but Mary was. Ann was picked instead of Sam. Who was picked? — 1 0 NR
___a) **Mary** ___c) **Ann**
___b) Sam ___d) John

16. Jim was taught by Mary. Bill was taught by Ellen. Who was taught? — 1 0 NR
___a) **Bill** ___c) Mary
___b) **Jim** ___d) Ellen

17. Ken was hit by Tim who was hit by Al and Bob. Who was hit? — 1 0 NR
___a) **Tim** ___c) Bob
___b) **Ken** ___d) Al

18. Sally was followed by Dan and Jo, and Laura walked with her. Who was followed? — 1 0 NR
___a) Dan ___c) **Sally**
___b) Jo ___d) **Laura**

Score

19. Paul was chosen by Mary, and John was chosen by both. Who was chosen? — 1 0 NR
___a) Mary ___c) both
___b) **Paul** ___d) **John**

20. Jim said "Vincent was caught by Don. Don was caught by Joseph." Who was caught? — 1 0 NR
___a) Joseph ___c) Jim
___b) **Vincent** ___d) **Don**

21. Mary was driven by Alice, Fred went along and Jerry was left behind. Who was driven? — 1 0 NR
___a) **Mary** ___c) **Fred**
___b) Alice ___d) Jerry

Subtotal

Temporal Relationships

22. Monday comes between — 1 0 NR
___a) **Saturday and Wednesday** ___c) **Sunday and Tuesday**
___b) Tuesday and Wednesday ___d) Thursday and Saturday

23. Thursday comes between — 1 0 NR
___a) Tuesday and Wednesday ___c) Sunday and Tuesday
___b) **Saturday and Friday** ___d) **Wednesday and Saturday**

24. In the same year, May comes after — 1 0 NR
___a) **March** ___c) October
___b) August ___d) **January**

25. Noon is later than — 1 0 NR
___a) **dawn** ___c) afternoon
___b) **morning** ___d) evening

26. In the same year, July comes before — 1 0 NR
___a) June ___c) **November**
___b) May ___d) **August**

27. Spring comes between — 1 0 NR
___a) **Autumn and Summer** ___c) Summer and Autumn
___b) Autumn and Winter ___d) **Winter and Summer**

28. Bonfire Night comes between — 1 0 NR
___a) **Easter and Christmas** ___c) **Halloween and New Year's Eve**
___b) May Day and Harvest Festival ___d) Valentine's Day and Spring Bank Holiday

Subtotal

Raw Score

Item Analysis for Semantic Relationships

Category	Items							
Comparative	1	2	3	4	5	6	7	8
Spatial	9	10	11	12	13			
Passive	14	15	16	17	18	19	20	21
Temporal	22	23	24	25	26	27	28	

Word Associations

Use	Picture Stimuli	Repetitions	Discontinue Rule
Ages 5+ Supplementary subtest and replacement subtest for Expressive Language score	None	None allowed	No discontinue rule. Administer all items.

Allow 60 seconds per item for response. Write the pupil's responses verbatim in the space provided. Refer to the guidelines in Table 2.3 in the Examiner's Manual *to score this subtest.*

Demonstration: I am going to tell you some things to wear. . . .
Trial: Now tell me the names of some foods you eat.

1. Now tell me the names of as many animals as you can think of. Do it as quickly as you can. Start now.

Subtotal

2. Now tell me as many ways to get from one place to another as you can think of. Do it as quickly as you can. Start now.

Subtotal

3. Now tell me as many names as you can think of for kinds of work people do. Do it as quickly as you can. Start now.

Subtotal

Raw Score

Behavioural Observations for Word Associations

Did the pupil:
- ❑ use obvious grouping (associative clustering) strategies?
- ❑ produce the series fluently?
- ❑ avoid repetitions?

Note: The observations above are typical behaviours.

Did the pupil:
- ❑ name items randomly, shifting from one subgroup to another?
- ❑ pause frequently between item?
- ❑ repeat more than one item in any category?

Were repetitions immediate ___ or delayed ___?

Listening to Paragraphs

Use	Picture Stimuli	Repetitions	Discontinue Rule
Ages 5 + Supplementary subtest and replacement subtest for Receptive Language score	None	One repetitions of questions only	No discontinue rule. Administer all items for age specified.

Circle 1 for a correct response, 0 for an incorrect response, and NR for no response. For ambiguous but possibly correct answers, probe one with ***"Can you tell me more?"***

Trial Paragraph for Pupils 5-0 to 9-11 Years

For her birthday, Lisa's grandmother gave her a pretty gold ring. The ring had Lisa's name on it. The ring was old and a little scratched, but it still sparkled beautifully.

1. What did Lisa get for her birthday? (a gold ring)
2. Who gave the ring to Lisa? (her/Lisa's grandmother)
3. What was on the ring? (her/Lisa's name)

Trial Paragraph for Pupils 10-0 Years and Older

Tim knew that he had quite a job today. His parents had agreed to give him their old dining room table. He didn't need his own dining room table, but he did need a desk. When he got home from school, he headed straight for the garage. He carefully checked over the table that was going to demand most of his time that evening. It was not in good condition. It needed some repairs, some sanding, and a good paint job. Tim worked all evening to complete the job. He tightened all the legs on the table and completely sanded it down to prepare it for painting. And then, to show everyone he was a good football fan, he painted it purple and white, the colours of his favourite team.

1. Why did Tim want the dining room table? (He needed a desk.)
2. What was wrong with the table? (needed repairs, poor condition)
3. How long did it take Tim to fix the table? (all evening)
4. What colours did Tim paint it? (purple and white)

Listening to Paragraphs Continued

Paragraphs for Pupils 5-0 to 6-11 Years

Karen and Tina decided to go ice skating. They packed all their things and headed for the pond behind Karen's house. When they got to the pond, they both put on their skates. Tina looked at Karen and laughed. She pointed to Karen's skates and laughed even harder. Karen didn't know why Tina was laughing. Then she looked at her skates and saw that they both had wheels on them!

	Score		
1. What did Karen and Tina decide to do? Correct: go skating Prompt for "go behind a house." Incorrect: behind Tina's house	1	0	NR
2. Where was the pond? Correct: behind the house, behind Karen's house, in Karen's back garden Incorrect: response referring to wrong child's house	1	0	NR
3. What did they do when they got to the pond? Correct: put on skates, laughed Incorrect: go skating	1	0	NR
4. Why was Tina laughing? Correct: must mention wrong skates, different skates, or funny skates	1	0	NR

Christine opened her cupboard door. "Shoes, I need my gym shoes, or I won't be allowed to go to gym class." She hunted and hunted through her cupboard but had no luck in finding them. "Where could they be?" she thought. Then she got an idea. "Why don't I go through my brother's cupboard? He's always borrowing things and not returning them." She looked in her brother's cupboard but still couldn't find them. On her way downstairs to ask her mother, she spotted them. "You leave them alone, Max. They're not for you to chew on." Max barked, dropped his prize, and ran towards the next room.

5. Why did Christine have to find her gym shoes? Correct: must mention gym class	1	0	NR
6. Where did she look first? Correct: in her cupboard	1	0	NR
7. Where did she look second? Correct: in her brother's room/cupboard	1	0	NR
8. Where did she find them? Correct: must refer to Max/her dog having them Incorrect: on stairs	1	0	NR
Raw Score			

Paragraph for Pupils 7-0 to 7-11 Years

Christine opened her cupboard door. "Shoes, I need my gym shoes, or I won't be allowed to go to gym class." She hunted and hunted through her cupboard but had no luck in finding them. "Where could they be?" she thought. Then she had an idea. "Why don't I go through my brother's cupboard? He's always borrowing things and not returning them." She looked in her brother's cupboard but still couldn't find them. On her way downstairs to ask her mother, she spotted them. "You leave them alone, Max. They're not for you to chew on." Max barked, dropped his prize, and ran towards the next room.

	Score		
1. Why did Christine have to find her gym shoes? Correct: must mention gym class	1	0	NR
2. Where did she look first? Correct: in her cupboard	1	0	NR
3. Where did she look second? Correct: in her brother's room/cupboard	1	0	NR
4. Where did she find them? Correct: must refer to Max/her dog having them Incorrect: on stairs	1	0	NR

Mary couldn't decide on a costume for the Halloween party. Last year, she went as a clown, and the year before that she went as a ghost. "This year, it's got to be something different," she thought to herself. Still undecided, Mary telephoned her friends to find out what they were doing. "Just as I thought, everyone is going as a clown or a ghost or a witch." Then she got an idea. "Why don't I turn on the TV tonight and watch 'The Horror Theatre'? Maybe that will help me think."

5. Where was Mary going? Correct: to a Halloween or fancy dress party/dance	1	0	NR
6. What costume did Mary wear last year? Correct: clown	1	0	NR
7. What did Mary find out when she telephoned her friends? Correct: what they were wearing, types of costumes, that they were wearing the same things Incorrect: They were watching "The Horror Theatre"/ watching a film.	1	0	NR
8. Why did she decide to watch "The Horror Theatre"? Correct: to get ideas for / think of / get suggestions for a costume	1	0	NR
Raw Score			

Paragraphs for Pupils 8-0 to 8-11 Years

Mary couldn't decide on a costume for the Halloween party. Last year, she went as a clown, and the year before that she went as a ghost. "This year, it's got to be something different," she thought to herself. Still undecided, Mary telephoned her friends to find out what they were doing. "Just as I thought, everyone is going as a clown or a ghost or a witch." Then she got an idea. "Why don't I turn on the TV tonight and watch 'The Horror Theatre'? Maybe that will help me think."

	Score		
1. Where was Mary going? Correct: to a Halloween or fancy dress party/dance	1	0	NR
2. What costume did Mary wear last year? Correct: clown	1	0	NR
3. What did Mary find out when she telephoned her friends? Correct: what they were wearing, types of costumes, that they were wearing the same things. Incorrect: They were watching "The Horror Theatre"/ watching a film	1	0	NR
4. Why did she decide to watch "The Horror Theatre"? Correct: to get ideas for/ think of/ get suggestions for a costume	1	0	NR

Mark and Stephanie were anxious to practise on their home computer. Unfortunately their father used it frequently for his insurance business, which he conducted from his home. Their mother was a lawyer, and she used it often for her work, too. Something had to be done, so Mark and Stephanie called a family meeting. Everyone sat down at the kitchen table to discuss the problem. "Stephanie and I want to negotiate some computer time," Mark said. They all discussed the problem for about an hour and finally reached an agreement. Mark and Stephanie could use it at weekends, and their parents on weekdays. Both Mark and Stephanie thought they would now do much better in school.

5. Why did their father use the computer? Correct: Answers should focus on either insurance, his work, or his business at home.	1	0	NR
6. What was their mother's job? Correct: lawyer/barrister/solicitor	1	0	NR
7. Why did Mark and Stephanie call a family meeting? Correct: Answers should focus on children's desire to get more time to use the computer.	1	0	NR
8. What was their agreement? Correct: adults on weekdays, children at weekends/take turns or variations of this	1	0	NR
Raw Score			

Paragraphs for Pupils 9-0 to 9-11 Years

Mary couldn't decide on a costume for the Halloween party. Last year, she went as a clown, and the year before that she went as a ghost. "This year, it's got to be something different," she thought to herself. Still undecided, Mary telephoned her friends to find out what they were doing. "Just as I thought, everyone is going as a clown or a ghost or a witch." Then she got an idea. "Why don't I turn on the TV tonight and watch 'The Horror Theatre'? Maybe that will help me think."

	Score		
1. Where was Mary going? Correct: to a Halloween or costume party/dance	1	0	NR
2. What costume did Mary wear last year? Correct: clown	1	0	NR
3. What did Mary find out when she telephoned her friends? Correct: what they were wearing, types of costumes, that they were wearing the same things. Incorrect: They were watching "The Horror Theatre"/ watching a film.	1	0	NR
4. Why did she decide to watch "The Horror Theatre"? Correct: to get ideas for/ think of/ get suggestions for a costume.	1	0	NR

"Freckles," Lucy called. "Here, Freckles. Where are you?" Hearing Lucy call, the brown and white springer spaniel raced homeward, knowing as always her dinner would be waiting. Just before she got to the front door, Freckles noticed something shiny in Lucy's hand. Freckles had seen that shiny thing before. She stopped suddenly just in time to escape another battle with the flea spray. Lucy shrugged her shoulders and said, "We're going to do this sooner or later, why don't you make it easier on both of us?"

5. Why did Freckles race home when she heard Lucy call? Correct: the dog was hungry, thought it was time to eat, near to dinner time Incorrect: to get flea spray	1	0	NR
6. What was Lucy trying to do ? Correct: get rid of fleas, spray Freckles, spray her	1	0	NR
7. Why did Freckles stop? Correct: Answers should focus on recognizing the can of flea spray and not liking it.	1	0	NR
8. Why did Lucy say, "Why don't you make this easier on both of us?" Correct: Answers should focus on both ideas: not liking the task and having to do it anyway	1	0	NR
Raw Score			

Paragraphs for Pupils 10-0 to 10-11 Years

Mark and Stephanie were anxious to practise on their home computer. Unfortunately their father used it frequently for his insurance business, which he conducted out of his home. Their mother was a lawyer, and she used it often for her work, too. Something had to be done, so Mark and Stephanie called a family meeting. Everyone sat down at the kitchen table to discuss the problem. "Stephanie and I want to negotiate some computer time," Mark said. They all discussed the problem for about an hour and finally reached an agreement. Mark and Stephanie could use it at weekends, and their parents on weekdays. Both Mark and Stephanie thought they would now do much better in school.

	Score		
1. Why did their father use the computer? Correct: Answers should focus on either insurance, his work, or his business at home.	1	0	NR
2. What was their mother's job? Correct: lawyer/barrister/solicitor	1	0	NR
3. Why did Mark and Stephanie call a family meeting? Correct: Answers should focus on children's desire to get more time to use the computer.	1	0	NR
4. What was their agreement? Correct: adults on weekdays, children on weekends/take turns or variations of this	1	0	NR

"Freckles," Lucy called. "Here, Freckles. Where are you?" Hearing Lucy call, the brown and white springer spaniel raced homeward, knowing as always her dinner would be waiting. Just before she got to the front door, Freckles noticed something shiny in Lucy's hand. Freckles had seen that shiny thing before. She stopped suddenly just in time to escape another battle with the flea spray. Lucy shrugged her shoulders and said, "We're going to do this sooner or later, why don't you make it easier on both of us?"

5. Why did Freckles race home when she heard Lucy call? Correct: the dog was hungry, thought it was time to eat, near to dinner time Incorrect: to get flea spray	1	0	NR
6. What was Lucy trying to do ? Correct: get rid of fleas, spray Freckles, spray her	1	0	NR
7. Why did Freckles stop? Correct: Answers should focus on recognizing the can of flea spray and not liking it.	1	0	NR
8. Why did Lucy say, "Why don't you make this easier on both of us?" Correct: Answers should focus on both ideas: not liking the task and having to do it anyway.	1	0	NR
Raw Score			

Paragraphs for Pupils 11-0 to11-11 Years

"Freckles," Lucy called. "Here, Freckles. Where are you?" Hearing Lucy call, the brown and white springer spaniel raced homeward, knowing as always her dinner would be waiting. Just before she got to the front door, Freckles noticed something shiny in Lucy's hand. Freckles had seen that shiny thing before. She stopped suddenly just in time to escape another battle with the flea spray. Lucy shrugged her shoulders and said, "We're going to do this sooner or later, why don't you make it easier on both of us?"

	Score		
1. Why did Freckles race home when she heard Lucy call? Correct: the dog was hungry, thought it was time to eat, near to dinner time Incorrect: to get flea spray	1	0	NR
2. What was Lucy trying to do ? Correct: get rid of fleas, spray Freckles, spray her	1	0	NR
3. Why did Freckles stop? Correct: Answers should focus on recognizing the can of flea spray and not liking it.	1	0	NR
4. Why did Lucy say, "Why don't you make this easier on both of us?" Correct: Answers should focus on both ideas: not liking the task and having to do it anyway.	1	0	NR

Tracey looked at the clock in nervous anticipation. It was almost time for her second period maths class to end. "I've got to really hurry. I hope there's no wait at the doctor's surgery or I'll never make it back in time for my fifth period study time. I should never have waited till today to read the homework for English," she thought to herself. The bell rang and Tracey rushed to her locker. She worked the combination several times, but the lock wouldn't open. She looked at the number on the locker and realized that she was trying to open the locker of her best friend, Mary. Tracey headed straight to her own locker. "What will I do in the seventh period if I don't have my work done?" she thought as she closed her locker door and hurried out of the building.

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5. What class did Tracey have second period? Correct: maths	1	0	NR
6. Where was Tracey in such a hurry to go? Correct: to her locker or to a doctor's appointment	1	0	NR
7. What periods did Tracey have study time? Correct: fifth	1	0	NR
8. What class did Tracey have seventh period? Correct: English	1	0	NR
Raw Score			

Paragraphs for Pupils 12-0 Years and Older

Tracey looked at the clock in nervous anticipation. It was almost time for her second period maths class to end. "I've got to really hurry. I hope there's no wait at the doctor's surgery or I'll never make it back in time for my fifth period study time. I should never have waited till today to read the homework for English," she thought to herself. The bell rang and Tracey rushed to her locker. She worked the combination several times, but the lock wouldn't open. She looked at the number on the locker and realized that she was trying to open the locker of her best friend, Mary. Tracey headed straight for her own locker. "What will I do seventh period of I don't have my work done?" she thought as she closed her locker door and hurried out of the building.

	Score		
1. What class did Tracey have second period? Correct: maths	1	0	NR
2. Where was Tracey in such a hurry to go? Correct: to her locker or to a doctor's appointment	1	0	NR
3. What period did Tracey have study time? Correct: fifth	1	0	NR
4. What class did Tracey have seventh period? Correct: English	1	0	NR

Central School was sponsoring its 10th annual computer science fair, and schools from all over the county were entered. Jamie knew that the competition was stiff. He also knew that extreme care had to be taken in category selection. One of his friends had an outstanding entry in last year's fair in the area of computer programming. He might have won if he had decided to enter his project in the graphics category rather than the programming category. Jamie had already given his own project careful consideration. He had asked several of his teachers and finally decided to enter his in a new category called artificial intelligence.

5. Who was sponsoring the science fair? Correct: Central School / school / Jamie's school	1	0	NR
6. What was the boy's name in the story? Correct: Jamie	1	0	NR
7. Why didn't his friend's project win the year before? Correct: Answers must say that either the wrong category was selected or actually name what category was chosen.	1	0	NR
8. How did Jamie decide on a category for his project? Correct: thought about it and asked his teachers, discussed/talked about it with teachers Incorrect: Just "thought about it" is wrong.	1	0	NR
Raw Score			

Appendix 7.10 IQ Analyses: Junior Categories

ANOVA

Junior Categories non-verbal test standard score according to gender

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.385E-02	1	1.385E-02	.001	.972
Within Groups	476.895	42	11.355		
Total	476.909	43			

ANOVA

Junior Categories non-verbal test standard score according to type of exposure to BSL

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.026	2	6.013	.530	.592
Within Groups	464.883	41	11.339		
Total	476.909	43			

ANOVA

Junior Categories non-verbal test standard score according to child hearing status

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.909	1	2.909	.258	.614
Within Groups	474.000	42	11.286		
Total	476.909	43			

ANOVA

Junior Categories non-verbal test standard score according to parental hearing status

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.690	1	.690	.061	.806
Within Groups	476.219	42	11.339		
Total	476.909	43			

ANOVA

Junior Categories non-verbal test standard score according to age group

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	42.400	4	10.600	.951	.445
Within Groups	434.509	39	11.141		
Total	476.909	43			

Appendix 7.11 IQ analyses: Junior Mosaics

ANOVA

Junior Mosaics non-verbal test standard score according to gender

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.257	1	.257	.026	.873
Within Groups	477.663	48	9.951		
Total	477.920	49			

ANOVA

Junior Mosaics non-verbal test standard score according to child hearing status

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21.053	1	21.053	2.212	.143
Within Groups	456.867	48	9.518		
Total	477.920	49			

ANOVA

Junior Mosaics non-verbal test standard score according to parental hearing status

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	39.446	1	39.446	4.318	.043
Within Groups	438.474	48	9.135		
Total	477.920	49			

ANOVA

Junior Mosaics non-verbal test standard score according to type of exposure to BSL

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	39.915	2	19.957	2.142	.129
Within Groups	438.005	47	9.319		
Total	477.920	49			

ANOVA

Junior Mosaics non-verbal test standard score according to age group

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	31.392	4	7.848	.791	.537
Within Groups	446.528	45	9.923		
Total	477.920	49			

Appendix 7.12 IQ analyses: Senior Categories

ANOVA

Senior Categories non-verbal test standard score according to gender

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	252.363	1	252.363	.918	.342
Within Groups	15677.738	57	275.048		
Total	15930.102	58			

ANOVA

Senior Categories non-verbal test standard score according to type of exposure to BSL

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1472.042	2	736.021	2.851	.066
Within Groups	14458.060	56	258.180		
Total	15930.102	58			

ANOVA

Senior Categories non-verbal test standard score according to child hearing status

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.025	1	4.025	.014	.905
Within Groups	15926.077	57	279.405		
Total	15930.102	58			

ANOVA

Senior Categories non-verbal test standard score according to parental hearing status

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	456.291	1	456.291	1.681	.200
Within Groups	15473.811	57	271.470		
Total	15930.102	58			

ANOVA

Senior Categories non-verbal test standard score according to age group

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3985.611	2	1992.806	9.343	.000
Within Groups	11944.490	56	213.294		
Total	15930.102	58			

Appendix 7.13 IQ analyses: Senior Mosaics

ANOVA

Senior Mosaics non-verbal test standard score according to gender

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	46.189	1	46.189	.225	.637
Within Groups	12503.557	61	204.976		
Total	12549.746	62			

ANOVA

Senior Mosaics non-verbal test standard score according to type of exposure to BSL

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	708.452	2	354.226	1.795	.175
Within Groups	11841.294	60	197.355		
Total	12549.746	62			

ANOVA

Senior Mosaics non-verbal test standard score according to child hearing status

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	55.335	1	55.335	.270	.605
Within Groups	12494.411	61	204.826		
Total	12549.746	62			

ANOVA

Senior Mosaics non-verbal test standard score according to parental hearing status

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	590.801	1	590.801	3.014	.088
Within Groups	11958.945	61	196.048		
Total	12549.746	62			

ANOVA

Senior Mosaics non-verbal test standard score according to age group

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	221.787	2	110.893	.540	.586
Within Groups	12327.959	60	205.466		
Total	12549.746	62			

Appendix 7.14: *X2* analyses according to whether or not subjects contributed data on BSL development

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Child's sex * Info on BSL development available	135	40.8%	196	59.2%	331	100.0%

Child's sex * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
Child's sex	Female	44	30	74
	Male	33	28	61
Total		77	58	135

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.392[b]	1	.531		
Continuity Correction[a]	.204	1	.652		
Likelihood Ratio	.392	1	.531		
Fisher's Exact Test				.601	.326
Linear-by-Linear Association	.389	1	.533		
N of Valid Cases	135				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 26.21.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Child deaf or hearing * Info on BSL development available	135	40.8%	196	59.2%	331	100.0%

Child deaf or hearing * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
Child deaf or hearing	Deaf	64	51	115
	Hearing	13	7	20
Total		77	58	135

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.608[b]	1	.436		
Continuity Correction[a]	.286	1	.593		
Likelihood Ratio	.618	1	.432		
Fisher's Exact Test				.474	.299
Linear-by-Linear Association	.603	1	.437		
N of Valid Cases	135				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.59.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Family deaf or hearing * Info on BSL development available	135	40.8%	196	59.2%	331	100.0%

Family deaf or hearing * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
Family deaf or hearing	At least one parent deaf BSL user	51	26	77
	Both parents hearing	26	32	58
Total		77	58	135

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.186[b]	1	.013		
Continuity Correction[a]	5.343	1	.021		
Likelihood Ratio	6.205	1	.013		
Fisher's Exact Test				.015	.010
Linear-by-Linear Association	6.140	1	.013		
N of Valid Cases	135				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 24.92.

Crosstabs

Type of exposure to British Sign Language * Info on BSL development available Crosstabulation

Count

		Info on BSL development available: yes	Info on BSL development available: no	Total
Type of exposure to British Sign Language	From birth, at least one parent BSL user	51	26	77
	Pre 3 yrs on established BSL/English programme	13	10	23
	Mainly at school, TC or BSL/English programme	13	22	35
Total		77	58	135

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.313[a]	2	.016
Likelihood Ratio	8.316	2	.016
Linear-by-Linear Association	8.251	1	.004
N of Valid Cases	135		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.88.

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Age in months when first used signs * Type of exposure to British Sign Language	77	23.3%	254	76.7%	331	100.0%

Report

Age in months when first used signs

Type of exposure to	Mean	N	Std. Deviation
From birth, at least one parent BSL user	16.92	51	10.26
Pre 3 yrs on established BSL/English programme	19.38	13	7.41
Mainly at school, TC or BSL/English programme	29.92	13	21.87
Total	19.53	77	13.28

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
final age intervals * Info on BSL development available	135	40.8%	196	59.2%	331	100.0%

final age intervals * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
final age intervals	3 - <4yrs	9	1	10
	4 - <5yrs	12	3	15
	5 - <6 yrs	10	7	17
	6 - <8yrs	13	19	32
	8 - <10 yrs	15	17	32
	10+ yrs	18	11	29
Total		77	58	135

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.850[a]	5	.025
Likelihood Ratio	13.956	5	.016
Linear-by-Linear Association	3.915	1	.048
N of Valid Cases	135		

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 4.30.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Type of exposure to British Sign Language * Info on BSL development available	135	40.8%	196	59.2%	331	100.0%

Appendix 7.15: ANOVAs on BSL development

ANOVA

Age in months when first used signs according to gender

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	646.676	1	646.676	3.799	.055
Within Groups	12766.492	75	170.220		
Total	13413.169	76			

ANOVA

Age in months when first used signs according to child hearing status

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	651.808	1	651.808	3.831	.054
Within Groups	12761.361	75	170.151		
Total	13413.169	76			

ANOVA

Age in months when first used signs according to parental hearing status

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1029.598	1	1029.598	6.236	.015
Within Groups	12383.571	75	165.114		
Total	13413.169	76			

ANOVA

Age in months when first used signs according to age group

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1414.897	5	282.979	1.675	.152
Within Groups	11998.271	71	168.990		
Total	13413.169	76			

ANOVA

Age in months when first used signs according to type of exposure to BSL

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1751.483	2	875.741	5.557	.006
Within Groups	11661.686	74	157.590		
Total	13413.169	76			

Appendix 7.16: ANOVA to explore differences in BSL mean raw scores between age groups

ANOVA
BSL receptive test, raw score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5294.304	5	1058.861	50.037	.000
Within Groups	2729.844	129	21.162		
Total	8024.148	134			

Multiple Comparisons
Dependent Variable: BSL receptive test, raw score

			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
	(I) final age intervals	(J) final age intervals				Lower Bound	Upper Bound
Tukey HSD	3 - <4yrs	4 - <5yrs	-5.40	1.88	.046	-10.75	-4.82E-02
		5 - <6 yrs	-12.20	1.83	.000	-17.42	-6.98
		6 - <8yrs	-14.26	1.67	.000	-19.01	-9.51
		8 - <10 yrs	-18.67	1.67	.000	-23.42	-13.92
		10+ yrs	-21.20	1.69	.000	-26.01	-16.39
	4 - <5yrs	3 - <4yrs	5.40	1.88	.046	4.82E-02	10.75
		5 - <6 yrs	-6.80	1.63	.000	-11.44	-2.16
		6 - <8yrs	-8.86	1.44	.000	-12.96	-4.76
		8 - <10 yrs	-13.27	1.44	.000	-17.37	-9.17
		10+ yrs	-15.80	1.46	.000	-19.97	-11.63
	5 - <6 yrs	3 - <4yrs	12.20	1.83	.000	6.98	17.42
		4 - <5yrs	6.80	1.63	.000	2.16	11.44
		6 - <8yrs	-2.06	1.38	.668	-6.00	1.87
		8 - <10 yrs	-6.47	1.38	.000	-10.40	-2.53
		10+ yrs	-9.00	1.41	.000	-13.00	-5.00
	6 - <8yrs	3 - <4yrs	14.26	1.67	.000	9.51	19.01
		4 - <5yrs	8.86	1.44	.000	4.76	12.96
		5 - <6 yrs	2.06	1.38	.668	-1.87	6.00
		8 - <10 yrs	-4.41	1.15	.002	-7.68	-1.13
		10+ yrs	-6.94	1.18	.000	-10.30	-3.58
	8 - <10 yrs	3 - <4yrs	18.67	1.67	.000	13.92	23.42
		4 - <5yrs	13.27	1.44	.000	9.17	17.37
		5 - <6 yrs	6.47	1.38	.000	2.53	10.40
		6 - <8yrs	4.41	1.15	.002	1.13	7.68
		10+ yrs	-2.53	1.18	.264	-5.89	.83
	10+ yrs	3 - <4yrs	21.20	1.69	.000	16.39	26.01
		4 - <5yrs	15.80	1.46	.000	11.63	19.97
		5 - <6 yrs	9.00	1.41	.000	5.00	13.00
		6 - <8yrs	6.94	1.18	.000	3.58	10.30
		8 - <10 yrs	2.53	1.18	.264	-.83	5.89

Appendix 7.17: Table of Standard Scores

BSL raw score	Age intervals: 3yrs 0mths - 3yrs 11mths	4yrs 0mths - 4yrs 11mths	5yrs 0mths - 5yrs 11mths	6yrs 0mths - 7yrs 11mths	8yrs 0mths - 9yrs 11mths	10yrs 0mths - 12yrs 11mths
36						123
35				129	119	118
34				126	116	112
33				123	112	107
32				120	109	101
31			122	117	105	95
30			120	114	102	90
29			117	111	98	84
28			114	108	95	78
27			111	105	92	73
26			108	102	88	67
25			105	99	85	61
24		121	103	96	81	56
23		119	100	93	78	
22		116	97	90	74	
21		113	95	87	71	
20		110	92	84		
19	121	108	89	81		
18	118	105	86	78		
17	115	103	83	75		
16	113	100	80	72		
15	110	97	78	69		
14	108	94	75	66		
13	105	91	73			
12	102	89				
11	100	86				
10	97	83				
9	95	80				
8	92					
7	89					
6	87					
5	84					
4	81					

Mean = 100
Standard deviation = 15

Appendix 7.18: Analysis of BSL standard scores according to child hearing status

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	163.085	1	163.085	.635	.428
Within Groups	19269.227	75	256.923		
Total	19432.312	76			

Appendix 7.19: Analysis of BSL standard scores according to child gender

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	516.314	1	516.314	2.253	.136
Within Groups	30472.767	133	229.119		
Total	30989.081	134			

Appendix 7.20: Analysis of BSL standard scores according to type of exposure to BSL

Tests of Between-Subjects Effects
Dependent Variable: BSL standard score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2020.410	2	1010.205	4.603	.012
Intercept	1078786.802	1	1078786.802	4915.650	.000
EXPBSL	2020.410	2	1010.205	4.603	.012
Error	28968.672	132	219.460		
Total	1385593.000	135			
Corrected Total	30989.081	134			

a R Squared = .065 (Adjusted R Squared = .051)

Multiple Comparisons
Dependent Variable: BSL standard score

			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
	(I) Type of exposure to British Sign Language	(J) Type of exposure to British Sign Language				Lower Bound	Upper Bound
Tukey HSD	From birth, at least one parent BSL user	Pre 3 yrs on established BSL/English programme	-7.1011	3.5202	.108	-15.3514	1.1492
		TC programme	4.9610	3.0200	.228	-2.1169	12.0390
	Pre 3 yrs on established BSL/English programme	From birth, at least one parent BSL user	7.1011	3.5202	.108	-1.1492	15.3514
		TC programme	12.0621	3.9764	.007	2.7425	21.3817
	TC programme	From birth, at least one parent BSL user	-4.9610	3.0200	.228	-12.0390	2.1169
		Pre 3 yrs on established BSL/English programme	-12.0621	3.9764	.007	-21.3817	-2.7425

Based on observed means.
* The mean difference is significant at the .05 level.

Appendix 7.21 Analyses of BSL standard scores according to type of exposure to BSL

Tests of Between-Subjects Effects
Dependent Variable: BSL standard score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2020.410	2	1010.205	4.603	.012
Intercept	1078786.802	1	1078786.802	4915.650	.000
EXPBSL	2020.410	2	1010.205	4.603	.012
Error	28968.672	132	219.460		
Total	1385593.000	135			
Corrected Total	30989.081	134			

a R Squared = .065 (Adjusted R Squared = .051)

Multiple Comparisons
Dependent Variable: BSL standard score

			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
	(I) Type of exposure to British Sign Language	(J) Type of exposure to British Sign Language				Lower Bound	Upper Bound
Tukey HSD	From birth, at least one parent BSL user	Pre 3 yrs on established BSL/English programme	-7.1011	3.5202	.108	-15.3514	1.1492
		TC programme	4.9610	3.0200	.228	-2.1169	12.0390
	Pre 3 yrs on established BSL/English programme	From birth, at least one parent BSL user	7.1011	3.5202	.108	-1.1492	15.3514
		TC programme	12.0621	3.9764	.007	2.7425	21.3817
	TC programme	From birth, at least one parent BSL user	-4.9610	3.0200	.228	-12.0390	2.1169
		Pre 3 yrs on established BSL/English programme	-12.0621	3.9764	.007	-21.3817	-2.7425

Based on observed means.
* The mean difference is significant at the .05 level.

Appendix 7.22 Analyses of TC subgroups A and B

Independent Samples Test: Comparing BSL scores of TCA vs TCB

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
BSL standard score	Equal variances assumed	4.829	.038	3.023	24	.006	16.3515	5.4098	5.1863	27.5167
	Equal variances not assumed			3.346	21.091	.003	16.3515	4.8869	6.1913	26.5117

Independent Samples Test: Comparing SON Senior Categories' scores of TCA vs TCB

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Senior Categories non-verbal test standard score	Equal variances assumed	.082	.779	.384	13	.707	3.48	9.05	-16.07	23.03
	Equal variances not assumed			.347	4.552	.744	3.48	10.02	-23.05	30.00

Appendix 7.23 Analysis of scores of children involved in pilot study compared to the rest of the sample

Independent Samples Test: Comparing Junior Categories' scores of children involved/not involved in the pilot study

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Junior Categories	Equal variances assumed	1.526	.224	2.727	42	.009	3.05	1.12	.79	5.30
	Equal variances not assumed			3.073	18.003	.007	3.05	.99	.96	5.13

Independent Samples Test: Comparing Senior Categories' scores of children involved/not involved in the pilot study

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Senior Categories	Equal variances assumed	.011	.917	.585	57	.561	3.39	5.78	-8.20	14.97
	Equal variances not assumed			.581	12.845	.572	3.39	5.83	-9.23	16.00

Independent Samples Test: Comparing BSL scores of children involved/not involved in the pilot study

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
BSL standard score	Equal variances assumed	1.418	.236	1.744	133	.084	5.7435	3.2941	-.7721	12.2591
	Equal variances not assumed			1.952	43.978	.057	5.7435	2.9425	-.1868	11.6737

Appendix 7.24 Test-retest analysis

Correlations

		BSL receptive test, raw score	BSL receptive re-test, raw score
BSL receptive test, raw score	Pearson Correlation	1.000	.868
	Sig. (2-tailed)	.	.000
	N	135	22
BSL receptive re-test, raw score	Pearson Correlation	.868	1.000
	Sig. (2-tailed)	.000	.
	N	22	22

** Correlation is significant at the 0.01 level (2-tailed).

Appendix 7.25 Correlations of CELF sub-tests completed by hearing children

. Correlations

		Linguistic Concepts spoken English test standard score	Recalling Sentences spoken English test standard score	Semantic Relationships spoken English test standard score	Oral Directions spoken English test standard score
Linguistic Concepts spoken English test standard score	Pearson Correlation	1.000	.541	.	.980
	Sig. (2-tailed)	.	.459	.	.128
	N	7	4	0	3
Recalling Sentences spoken English test standard score	Pearson Correlation	.541	1.000	.	.
	Sig. (2-tailed)	.459	.	.	.
	N	4	5	1	0
Semantic Relationships spoken English test standard score	Pearson Correlation	.	.	1.000	.756
	Sig. (2-tailed)	.	.	.	.454
	N	0	1	4	3
Oral Directions spoken English test standard score	Pearson Correlation	.980	.	.756	1.000
	Sig. (2-tailed)	.128	.	.454	.
	N	3	0	3	6

a Cannot be computed because at least one of the variables is constant.

Assessing British Sign Language Development: Receptive Skills Test

Score sheet

Child's name

Date of birth

Tester

Date of testing

Vocabulary check /22
Number of signs produced correctly

Receptive Skills Test raw score /40

Standard score

Which version of the test was used?
UK/south UK/north

Comments

Pattern of pass/fail responses

	✔	✘	
Number/ distribution			**1** LOTS APPLE
			2 CAR ROW ROW ROW
			6 ONE-TEDDY
			12 PERSON-GO-DOWN-ESCALATOR
			14 FEW-CUP
			24 QUEUE
			38 ROW-CAR-BOTTOM-LEFT
Negation			**3** ICE-CREAM NOTHING
			4 NOT-LIKE EAT
			8 HAT NOTHING
			23 NOT-SLEEP
			28 HEADPHONES NOTHING
			30 CHILD COAT RAIN NOTHING
			31 CAN'T-REACH
			33 DOG NO COLLAR EAT-BIG-BONE
			35 NOT-DROP-CUP
			36 HEARING-AID NOTHING
Noun/verb			**7** DRIVE
			19 BOY-DRINK
			26 PENCIL
Spatial verb			**5** BOOK ON
			9 BALL TABLE ON
			10 TWO-PEOPLE-MEET
			11 DOG IN
			12 PERSON-GO-DOWN-ESCALATOR
			13 CHILD LOOK-UP
			15 CAR BEHIND
			17 BOX UNDER BED
			18 BOOK-GIVE-TO-CHILD
			20 BOY HIT-GIRL FACE-HURT
			25 HOLD-UMBRELLA-OPEN-WALK
			27 POUR-WATER-OTHER-BOY HAIR-WET
			29 MOTHER LETTER GIVE
			32 CHILD BOOK-SHOW-TO-SIDE
			34 DOG-IN-FRONT
			38 ROW-CAR-BOTTOM-LEFT
			39 DOG-LIE-INSIDE-RIGHT
			40 HOUSE-TOP-RIGHT
Size and shape specifiers			**16** CURLY-HAIR
			21 PENCIL THICK
			22 THICK-STRIPES-DOWN-TROUSERS
Handling specifiers			**25** HOLD-UMBRELLA-OPEN-WALK
			35 NOT-DROP-CUP
			37 EAT-THIN-SANDWICH

How to use this score sheet

1 Use a photocopy of this score sheet.

2 Go to the back page and conduct the **vocabulary check**, filling in results and comments. *See* **Tester's manual** *page 9.*

3 Decide which version of the test is most appropriate, based on the results – UK/south or UK/north. Indicate above.

4 Run the Receptive Skills Test, marking results and comments on the centre pages of this score sheet. *See* **Tester's manual** *page 10.*

5 Transfer your findings to this page.

You will find an explanation of the aims and development of the Receptive Skills Test in the **Tester's manual**, and full instructions for use.

Assessing British Sign Language Development: Receptive Skills Test

Scoring Circle the child's response (the correct response is emboldened). When the test is over, mark **P** = pass or **F** = fail.
Important note The child should not be aware of their scores as it may influence their responses.
Repeating a test sentence Mark as a fail unless child is under 4 years or testing is disrupted.
Stopping the test After four consecutive fails, stop the test.

	Target	Response	P	F	Comments
P1	CHILD EAT	1 **2** 3			
P2	MOTHER READ	**1** 2 3			
P3	TEDDY SMALL	1 2 **3** 4			
1	LOTS APPLE	1 **2** 3 4			
2	CAR ROW ROW ROW	1 2 **3** 4			
3	ICE-CREAM NOTHING	1 2 **3**			
4	NOT-LIKE EAT	**1** 2 3 4			
5	BOOK ON	1 **2** 3			
6	ONE-TEDDY	**1** 2 3			
7	DRIVE	1 **2** 3 4			
8	HAT NOTHING	1 2 **3** 4			
9	BALL TABLE ON	**1** 2 3 4			
10	TWO-PEOPLE-MEET	1 2 3 **4**			
11	DOG IN	1 2 **3**			
12	PERSON-GO-DOWN-ESCALATOR	1 **2** 3 4			
13	CHILD LOOK-UP	1 2 3 **4**			
14	FEW-CUP	1 2 **3**			
15	CAR BEHIND	**1** 2 3 4			
16	CURLY-HAIR	1 2 **3** 4			
17	BOX UNDER BED	1 **2**			

Appendix 8.1

	Target	Response	P	F	Comments
18	BOOK-GIVE-TO-CHILD	1 2 3 **4**			
19	BOY-DRINK	**1** 2 3 4			
20	BOY HIT-GIRL FACE-HURT	**1** 2 3 4			
21	PENCIL THICK	1 **2** 3 4			
22	THICK-STRIPES-DOWN-TROUSERS	**1** 2 3 4			
23	NOT-SLEEP	**1** 2 3			
24	QUEUE	1 **2** 3 4			
25	HOLD-UMBRELLA-OPEN-WALK	1 2 3 **4**			
26	PENCIL	1 2 **3** 4			
27	POUR-WATER-OTHER-BOY HAIR-WET	1 2 3 **4**			
28	HEADPHONES NOTHING	1 **2** 3			
29	MOTHER LETTER GIVE	1 2 3 **4**			
30	CHILD COAT RAIN NOTHING	1 **2** 3 4			
31	CAN'T-REACH	1 **2** 3			
32	CHILD BOOK-SHOW-TO-SIDE	1 2 3 **4**			
33	DOG NO COLLAR EAT-BIG-BONE	**1** 2 3 4			
34	DOG-IN-FRONT	1 2 **3** 4			
35	NOT-DROP-CUP	1 **2** 3 4			
36	HEARING-AID NOTHING	1 **2** 3 4			
37	EAT-THIN-SANDWICH	1 **2** 3 4			
38	ROW-CAR-BOTTOM-LEFT	**1** 2 3 4			
39	DOG-LIE-INSIDE-RIGHT	**1** 2 3 4			
40	HOUSE-TOP-RIGHT	1 2 3 **4**			

Assessing British Sign Language Development: Vocabulary check

Vocabulary	Child's sign: UK/south = 1 UK/north = 2 Other = O Wrong = ✗ Didn't know = ?						Can the child recognise the test sign? Yes = ✔ No = ✗		
	1	2	O	✗	?	Comments	✔	✗	Comments
1 APPLE									
2 BALL									
3 BED									
4 BOOK									
5 BOX									
6 BOY*									
7 CHILD*									
8 CAR									
9 COAT									
10 CUP									
11 DOG+									
12 COLLAR+									
13 HAT									
14 HEADPHONES									
15 HEARING-AID									
16 ICE-CREAM									
17 LETTER									
18 MOTHER									
19 PENCIL									
20 TABLE									
21 TEDDY									
22 UMBRELLA									
Number of signs produced correctly									

* BOY and CHILD are produced using the same picture

\+ DOG and COLLAR are produced using the same picture

Which version of the Receptive Skills Test is most suitable for this child?

UK/south UK/north

Keeping in touch with our study

The authors would be pleased to receive copies of completed children's score sheets for future research purposes – including further development of the standardisation of this test. All information will be treated in strict confidence. *Please fill in a questionnaire and attach it to each score sheet.*

In return for your completed score sheets and questionnaires your name will be added to the project database. This means that you will automatically receive updated versions of the standardisation tables, which will be revised when sufficient numbers of children are added to the sample. Please send score sheets and questionnaires to:

Rosalind Herman
Department of Language and Communication Science
City University
Northampton Square London EC1V 0HB

Thank you

Appendix 8.2

Assessing British Sign Language Development: Receptive Skills Test

Questionnaire

to accompany copies of completed scoresheets returned to the authors

The authors are continuing their work on the study which produced the Receptive Skills Test. It will enrich the study to receive copies of completed children's score sheets for future research purposes – including further development of the standardisation of this test.

All information will be treated in strictest confidence.

In return for completed score sheets and questionnaires your name will be added to the project database. This means that you will automatically receive updated versions of the standardisation tables, which will be revised when sufficient numbers of children are added to the sample.

Please fill in a questionnaire to accompany each score sheet.

Please send score sheets and questionnaires to:

Rosalind Herman
Department of Language and
Communication Science
City University
Northampton Square
London
EC1V 0HB

Thank you

Please fill in a photocopy of this questionnaire and attach it to each score sheet you return.

Child's name or initials

Date of birth

Gender Male Female

Postcode *Child's home address*

Tester *Initials only*

Date of testing

Where was the test carried out?

Home Nursery Other

Please describe if 'other'

Did you adapt the recommended test procedure? *If yes, please describe – live presentation/child tested over several sessions, etc*

Is the child deaf or hearing?

Are there deaf family members?
If so, which?

What language(s) are used at home?

What language(s) are used at nursery/school?

At what age did the child use her/his first signs?

Results of recent psychological assessment
If an intelligence test was used, please provide the name of the test, the standard score and the test date

If no recent test results are available, please give an impression of the child's general developmental abilities (excluding language) in relation to their age

Below average Average Above average

Is this your view, as tester, or is it another person's view – if so who?

We would welcome any other observations you might want to make about the Receptive Skills Test *Please use the back of this sheet if you need more room*

Thank you for taking time to fill in this questionnaire and respond *Now attach the questionnaire to a copy of the relevant score sheet and return*

Appendix 8.3a

	childage	agegrp	sex	chearing	fhearing	school	tester	loc	drel	specinfo	iq	bsldev	bslrec	standard	nostand	bslrat	readage
1	96	5.00	2	1	2	1	JS	7	7	.	2	.	21	71.00		.	.
2	91	4.00	2	1	1	1	JS	2	.	.	3	.	30	114.00		.	.
3	102	5.00	2	1	2	1	JS	2	7	.	3	.	32	109.00		.	104.00
4	96	5.00	2	1	2	1	JS	6	7	.	2	.	24	81.00		.	.
5	112	5.00	2	1	2	1	JS	2	7	3.00	2	.	28	95.00		.	.
6	120	6.00	2	1	2	1	JS	2	7	.	2	.	26	67.00		.	.
7	114	5.00	1	1	2	1	JS	2	7	.	2	.	32	109.00		.	.
8	140	6.00	1	1	1	1	JS	6	7	.	2	.	32	101.00		.	94.00
9	112	5.00	1	1	1	1	JS	2	6	.	3	.	30	102.00		.	.
10	144	6.00	2	1	2	1	SS	3	7	.	1	.	26	67.00		.	.
11	123	6.00	2	1	1	1	JS	1	7	.	2	.	32	101.00		.	94.00
12	120	6.00	2	1	2	1	JS	2	.	.	2	.	24	56.00		.	.
13	110	5.00	2	1	2	1	SS	2	7	.	2	.	30	102.00		.	84.00
14	87	4.00	2	1	1	1	JS	6	6	.	2	.	15	69.00		.	.
15	60	3.00	1	1	2	1	JS	2	7	.	3	.	24	103.00		.	.
16	131	6.00	1	1	1	1	JS	2	6	.	3	.	34	116.00		.	96.00
17	60	3.00	2	1	1	1	JS	2	7	.	3	.	20	92.00		.	.
18	150	7.00	2	1	2	1	JS	11	.	.	1	.	26	67.00		.	.
19	132	6.00	2	1	2	1	JS	3	.	.	1	.	18	.	<56	.	.
20	144	6.00	1	1	1	1	JS	2	6	.	2	.	32	101.00		.	99.00
21	131	6.00	1	1	2	1	JS	2	7	.	3	.	35	118.00		.	97.00
22	120	6.00	2	1	2	1	JS	9	7	.	1	.	27	73.00		.	.
23	122	6.00	1	1	1	1	JS	6	6	.	3	.	35	118.00		.	105.00
24	126	6.00	2	1	2	1	JS	2	1	.	2	.	25	61.00		.	.
25	122	6.00	1	1	2	1	JS	3	7	.	2	.	30	90.00		.	.

Appendix 8.3a Details of subjects in data collectted through extended use of the BSL test.sav

	childage	agegrp	sex	chearing	fhearing	school	tester	loc	drel	specinfo	iq	bsldev	bslrec	standard	nostand	bslrat	readage
51	124	6.00	2	1	2	.	JSH	1	7	.	.	48	29	84.00		.	.
52	126	6.00	2	1	2	.	DD	1	7	4.00	1	.	11	.	<56	.	.
53	65	3.00	2	1	1	.	GS	.	.	.	.	.	34	128.00		.	.
54	97	5.00	1	1	2	.	DM	5	7	14.00	1	36	20	69.00		.	.
55	66	3.00	1	1	2	.	DM	5	1	.	2	30	21	95.00		.	.
56	74	4.00	2	1	2	.	DM	5	1	.	2	36	16	72.00		.	.
57	73	4.00	2	1	2	.	DM	5	7	.	2	36	22	90.00		.	.
58	64	3.00	2	1	2	.	DM	5	7	.	2	24	21	95.00		.	.
59	81	4.00	2	1	2	.	DM	5	7	15.00	1	.	17	75.00		.	.
60	90	4.00	2	1	2	.	AD	2	7	8.00	1	.	15	69.00		.	.
61	143	6.00	2	1	2	.	AD	2	7	8.00	1	.	22	52.00		.	.
62	63	3.00	2	1	1	.	AD	2	7	14.00	1	.	8	.	<73	.	.
63	144	6.00	2	1	2	.	RH	1	1	.	2	36	32	101.00		.	.
64	143	6.00	2	1	2	.	RH	1	7	.	2	.	35	118.00		.	.
65	64	3.00	2	1	2	.	RH	1	7	14.00	2	48	3	73.00		.	.
66	141	6.00	2	1	2	.	RH	1	7	.	2	.	28	78.00		.	.
67	129	6.00	1	1	1	.	RH	1	7	.	2	48	34	112.00		.	.
68	151	7.00	2	1	2	.	RH	1	.	2.00	1	.	32	101.00		.	.
69	137	6.00	1	1	1	.	JAW	.	1	.	2	.	18	.	<56	.	.
70	104	5.00	1	1	2	.	JAW	.	7	14.00	2	18	34	116.00		.	.
71	108	5.00	1	1	.	6	TP	.	.	.	.	.	22	74.00		.	.
72	102	5.00	1	1	.	6	TP	.	.	.	.	.	21	71.00		.	.
73	99	5.00	1	1	.	6	TP	.	.	.	.	.	26	88.00		.	.
74	99	5.00	1	1	.	6	TP	.	.	.	.	.	29	99.00		.	.
75	98	5.00	1	1	.	6	TP	.	.	.	.	.	29	99.00		.	.

Appendix 8.3a Details of subjects in data collectted through extended use of the BSL test.sav

	childage	agegrp	sex	chearing	fhearing	school	tester	loc	drel	specinfo	iq	bsldev	bslrec	standard	nostand	bslrat	readage
76	89	4.00	1	1	.	6	TP	.	.	.	.	.	24	96.00		.	.
77	86	4.00	1	1	.	6	TP	.	.	.	.	.	25	99.00		.	.
78	86	4.00	1	1	.	6	TP	.	.	.	.	.	24	96.00		.	.
79	85	4.00	2	1	.	6	TP	.	.	.	.	.	16	72.00		.	.
80	84	4.00	1	1	.	6	TP	.	.	.	.	.	14	66.00		.	.
81	83	4.00	2	1	.	6	TP	.	.	.	.	.	21	87.00		.	.
82	64	3.00	2	1	.	6	TP	.	.	.	.	.	26	108.00		.	.
83	62	3.00	2	1	.	6	TP	.	.	.	.	.	22	97.00		.	.
84	60	3.00	1	1	.	6	TP	.	.	.	.	.	14	75.00		.	.
85	58	2.00	2	1	.	6	TP	.	.	.	.	.	23	119.00		.	.
86	82	4.00	2	1	.	7	TP	.	.	.	.	.	26	102.00		.	.
87	78	4.00	2	1	.	7	TP	.	.	.	.	.	18	78.00		.	.
88	96	5.00	1	1	.	7	TP	.	.	.	.	.	30	102.00		.	.
89	62	3.00	2	1	.	7	TP	.	.	.	.	.	24	103.00		.	.
90	69	3.00	1	1	.	7	TP	.	.	.	.	.	17	83.00		.	.
91	95	4.00	2	1	.	7	TP	.	.	.	.	.	21	87.00		.	.
92	92	4.00	2	1	.	7	TP	.	.	.	.	.	20	84.00		.	.
93	89	4.00	1	1	.	7	TP	.	.	.	.	.	27	105.00		.	.
94	54	2.00	2	1	.	2	TP	12	.	.	.	.	9	80.00		.	.
95	76	4.00	1	1	.	2	TP	12	1	.	.	.	24	96.00		.	.
96	104	5.00	1	1	.	2	TP	12	.	.	.	.	30	102.00		.	.
97	111	5.00	2	1	1	2	TP	12	1	.	.	.	22	74.00		.	.
98	76	4.00	2	1	1	2	TP	12	1	.	.	.	18	78.00		.	.
99	118	5.00	2	1	.	2	TP	12	.	.	.	.	26	88.00		.	.
100	93	4.00	2	1	.	2	TP	12	.	.	.	.	29	111.00		.	.

Appendix 8.3a Details of subjects in data collectted through extended use of the BSL test.sav

	childage	agegrp	sex	chearing	fhearing	school	tester	loc	drel	specinfo	iq	bsldev	bslrec	standard	nostand	bslrat	readage
101	74	4.00	1	1	.	2	TP	1	.	.	.	.	17	75.00		.	.
102	91	4.00	1	1	.	2	TP	1	.	.	.	.	27	105.00		.	.
103	95	4.00	1	1	.	2	TP	1	.	.	.	.	15	69.00		.	.
104	74	4.00	1	1	.	2	TP	1	.	.	.	.	21	87.00		.	.
105	75	4.00	1	1	.	2	TP	1	.	.	.	.	20	84.00		.	.
106	88	4.00	1	1	2	2	ALJ	5	7	2.00	1	.	13	64.00		.	.
107	73	4.00	1	1	1	2	ALJ	5	7	.	2	.	17	75.00		.	.
108	76	4.00	2	1	2	2	ALJ	5	7	.	2	.	16	72.00		.	.
109	77	4.00	1	1	2	2	ALJ	5	7	.	.	.	28	108.00		.	.
110	76	4.00	2	1	2	2	ALJ	5	7	.	1	.	3	.	<66	.	.
111	95	4.00	2	1	2	2	ALJ	5	7	.	.	.	27	105.00		.	.
112	57	2.00	2	1	2	2	ALJ	5	7	3.00	2	.	9	80.00		.	.
113	70	4.00	2	1	2	2	ALJ	5	5	.	2	.	9	.	<73	.	.
114	63	3.00	2	1	2	2	ALJ	5	1	.	2	.	6	.	<73	.	.
115	40	2.00	2	1	2	2	ALJ	5	7	.	1	.	1	72.00		.	.
116	58	2.00	1	1	2	2	ALJ	5	7	.	2	.	1	.	<80	.	.
117	68	3.00	1	1	2	2	ALJ	5	7	.	2	.	30	120.00		.	.
118	75	4.00	1	1	2	2	ALJ	5	7	.	2	.	30	114.00		.	.
119	65	3.00	2	1	2	2	ALJ	12	7	17.00	.	.	9	61.00		.	.
120	62	3.00	2	1	2	2	ALJ	12	7	18.00	.	.	1	.	<73	.	.
121	65	3.00	2	1	1	2	ALJ	12	6	19.00	2	.	20	92.00		.	.
122	74	4.00	1	1	2	2	ALJ	12	7	.	.	.	22	90.00		.	.
123	105	5.00	1	1	1	2	ALJ	12	4	.	.	.	30	102.00		.	.
124	99	5.00	1	1	2	2	ALJ	12	7	.	.	.	27	92.00		.	.
125	101	5.00	1	1	2	2	ALJ	12	7	.	.	.	29	98.00		.	.

Appendix 8.3a Details of subjects in data collectted through extended use of the BSL test.sav

	childage	agegrp	sex	chearing	fhearing	school	tester	loc	drel	specinfo	iq	bsldev	bslrec	standard	nostand	bslrat	readage
126	100	5.00	1	1	2	2	ALJ	12	7	.	.	.	32	109.00		.	.
127	105	5.00	1	1	2	2	ALJ	12	1	17.00	.	.	30	102.00		.	.
128	130	6.00	1	1	2	2	ALJ	12	7	.	.	.	37	126.00		.	.
129	156	7.00	1	1	2	3	ALJ	9	7	.	.	.	30	90.00		.	.
130	134	6.00	1	1	2	3	ALJ	9	7	.	.	.	16	.	<56	.	.
131	136	6.00	2	1	2	3	ALJ	9	7	.	.	.	27	73.00		.	.
132	137	6.00	2	1	2	3	ALJ	9	7	.	.	.	27	73.00		.	.
133	122	6.00	2	1	2	3	ALJ	9	7	.	.	.	25	61.00		.	.
134	118	5.00	1	1	2	3	ALJ	9	7	.	.	.	21	71.00		.	.
135	112	5.00	1	1	2	3	ALJ	9	7	.	.	.	21	71.00		.	.
136	111	5.00	1	1	2	3	ALJ	9	7	3.00	.	.	33	112.00		.	.
137	92	4.00	2	1	2	3	ALJ	9	7	.	.	.	16	72.00		.	.
138	95	4.00	1	1	2	3	ALJ	9	7	.	.	.	13	63.00		.	.
139	87	4.00	2	1	2	3	ALJ	9	7	.	.	.	22	90.00		.	.
140	89	4.00	1	1	2	3	ALJ	9	7	.	.	.	14	66.00		.	.
141	82	4.00	1	1	2	3	ALJ	9	7	.	.	.	21	87.00		.	.
142	69	3.00	2	1	2	3	ALJ	9	7	14.00	.	.	1	.	<73	.	.
143	140	6.00	1	1	2	2	DB	2	1	.	3	.	34	116.00		3.00	.
144	132	6.00	2	1	2	2	DB	2	7	.	3	60	32	101.00		2.00	.
145	124	6.00	1	1	1	2	DB	2	1	.	3	.	35	118.00		3.00	.
146	139	6.00	1	1	2	2	DB	2	7	.	1	60	25	61.00		1.00	.
147	137	6.00	2	1	2	2	DB	2	1	.	2	.	31	95.00		2.00	.
148	132	6.00	1	1	2	2	DB	2	1	.	3	.	30	90.00		2.00	.
149	122	6.00	2	1	1	2	DB	2	1	.	3	.	34	116.00		3.00	.
150	124	6.00	1	1	2	2	DB	2	1	.	3	.	33	112.00		3.00	.

Appendix 8.3a Details of subjects in data collectted through extended use of the BSL test.sav

	childage	agegrp	sex	chearing	fhearing	school	tester	loc	drel	specinfo	iq	bsldev	bslrec	standard	nostand	bslrat	readage
151	135	6.00	2	1	2	2	DB	2	7	.	2	60	27	73.00		2.00	.
152	126	6.00	1	1	1	2	DB	2	1	.	3	.	38	131.00		3.00	.
153	139	6.00	1	1	2	2	DB	2	1	.	1	36	31	95.00		1.00	.
154	124	6.00	2	1	1	2	DB	2	1	.	3	.	33	112.00		3.00	.
155	133	6.00	2	1	2	2	DB	2	5	.	2	.	31	95.00		3.00	.
156	74	4.00	1	1	2	3	BG	.	7	.	1	36	7	.	<66	1.00	.
157	59	2.00	2	1	2	3	BG	.	7	.	2	36	15	97.00		2.00	.
158	61	3.00	2	1	2	3	BG	.	7	.	2	24	9	61.00		1.00	.
159	177	7.00	2	1	2	3	BG	.	7	.	2	.	33	.	off	2.00	.
160	169	7.00	2	1	2	3	BG	.	7	.	2	.	30	.	off	.	.
161	77	4.00	2	1	2	3	BG	.	7	8.00	2	36	8	.	<66	1.00	.
162	111	5.00	1	1	2	3	BG	.	7	.	2	36	23	71.00		1.00	.
163	116	5.00	2	1	2	3	BG	.	7	14.00	1	36	7	71.00		1.00	.
164	103	5.00	1	1	1	2	EH	1	7	.	2	.	27	123.00		2.00	.
165	142	6.00	2	1	2	2	EH	1	1	.	2	60	32	101.00		2.00	.
166	87	4.00	2	1	1	2	ML	11	6	.	2	9	30	114.00		.	.
167	87	4.00	2	1	1	2	ML	11	6	.	2	9	24	96.00		.	.
168	93	4.00	2	1	1	2	ML	11	1	.	1	.	18	78.00		.	.
169	92	4.00	2	1	2	2	ML	11	7	.	1	.	21	87.00		.	.
170	115	5.00	2	1	2	2	ML	11	1	.	1	.	26	88.00		.	.
171	121	6.00	1	1	1	2	ML	11	7	.	2	.	28	78.00		.	.
172	119	5.00	1	1	2	2	ML	11	7	.	2	.	27	92.00		.	.
173	111	5.00	1	1	2	2	ML	11	7	.	1	.	19	65.00		.	.
174	102	5.00	1	1	1	2	ML	11	6	.	3	.	29	98.00		.	.
175	116	5.00	1	1	2	2	ML	11	1	.	1	.	21	71.00		.	.

Appendix 8.3a Details of subjects in data collectted through extended use of the BSL test.sav

	childage	agegrp	sex	chearing	fhearing	school	tester	loc	drel	specinfo	iq	bsldev	bslrec	standard	nostand	bslrat	readage
176	130	6.00	2	1	2	2	ML	11	7	.	1	.	27	73.00		.	.
177	118	5.00	1	1	2	2	ML	11	1	.	2	.	34	116.00		.	.
178	131	6.00	2	1	2	2	ML	11	7	.	1	.	28	78.00		.	.
179	124	6.00	1	1	2	2	ML	11	7	.	2	.	27	73.00		.	.
180	117	5.00	1	1	2	2	ML	11	7	.	2	.	35	119.00		.	.
181	112	5.00	2	1	2	2	ML	11	7	.	3	.	30	102.00		.	.

Appendix 8.3b: Key to table of subject details

Variable name	Label	Values
childage	Child's age in months at time of testing	None
agegrp	Age groups	1= 3 < 4 yrs 2=4 < 5 yrs 3=5 < 6 yrs 4=6 < 8 yrs 5=8 < 10 yrs 6=10+ yrs
sex	Child's gender	1=female 2=male
chearing	Child's hearing status	1=deaf 2=hearing
fhearing	Parental hearing status	1=at least one deaf parent 2=hearing
school	Type of school attended	1.=Residential school for the deaf 2=Day school for the deaf 3= Hearing impaired unit 4=Resourced mainstream 5=Mainstream
tester	Initials of tester	None
location	Family geographic location	1=North 2=East Midlands 3=East Anglia 4=South East 5=South West 6=West Midlands 7=North West 8=Scotland 9=Wales 10=Northern Ireland 11=Yorks & Humber 12=London
deafrel	Deaf relatives	1=older sibling(s) 2=younger sibling(s) 3=older and younger sibling(s) 4=twin 5=other relative other than parent 6=sibling(s) and other relative(s) 7=no deaf relatives
specinfo	Special information provided	1=cochlear implant user 2=additional needs (unspecified) 3=ushers 5=dyslexia 7=behavioural difficulties 8=cerebral palsy 9=charge syndrome 15=mild microcephaly and physical difficulties
iq	Estimate of non-verbal abilities	1=low 2=within the average range 3=above average
bsldev	Age in months when first BSL signs produced	None
bslrec	BSL raw score	None
standard	BSL standard score	None
nostand	Standard score not computed	None
bslrating	Tester's rating of child's BSL	None
readage	Reading age in months	None

8.4: X^2 analyses on subjects with and without reported information on BSL development

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Child's sex * Info on BSL development available	135	40.8%	196	59.2%	331	100.0%

Child's sex * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
Child's sex	Female	44	30	74
	Male	33	28	61
Total		77	58	135

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.392[b]	1	.531		
Continuity Correction[a]	.204	1	.652		
Likelihood Ratio	.392	1	.531		
Fisher's Exact Test				.601	.326
Linear-by-Linear Association	.389	1	.533		
N of Valid Cases	135				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 26.21.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Child deaf or hearing * Info on BSL development available	135	40.8%	196	59.2%	331	100.0%

Child deaf or hearing * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
Child deaf or hearing	Deaf	64	51	115
	Hearing	13	7	20
Total		77	58	135

8.4: X^2 analyses on subjects with and without reported information on BSL development

Appendix 8.4

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.608[b]	1	.436		
Continuity Correction[a]	.286	1	.593		
Likelihood Ratio	.618	1	.432		
Fisher's Exact Test				.474	.299
Linear-by-Linear Association	.603	1	.437		
N of Valid Cases	135				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.59.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Family deaf or hearing * Info on BSL development available	135	40.8%	196	59.2%	331	100.0%

Family deaf or hearing * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
Family deaf or hearing	At least one parent deaf BSL user	51	26	77
	Both parents hearing	26	32	58
Total		77	58	135

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.186[b]	1	.013		
Continuity Correction[a]	5.343	1	.021		
Likelihood Ratio	6.205	1	.013		
Fisher's Exact Test				.015	.010
Linear-by-Linear Association	6.140	1	.013		
N of Valid Cases	135				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 24.92.

Crosstabs

8.4: X^2 analyses on subjects with and without reported information on BSL development

Case Processing Summary

Appendix 8.4

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
final age intervals * Info on BSL development available	135	40.8%	196	59.2%	331	100.0%

final age intervals * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
final age intervals	3 - <4yrs	9	1	10
	4 - <5yrs	12	3	15
	5 - <6 yrs	10	7	17
	6 - <8yrs	13	19	32
	8 - <10 yrs	15	17	32
	10+ yrs	18	11	29
Total		77	58	135

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.850[a]	5	.025
Likelihood Ratio	13.956	5	.016
Linear-by-Linear Association	3.915	1	.048
N of Valid Cases	135		

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 4.30.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Type of exposure to British Sign Language * Info on BSL development available	135	40.8%	196	59.2%	331	100.0%

Type of exposure to British Sign Language * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
Type of exposure to British Sign Language	From birth, at least one parent BSL user	51	26	77
	Pre 3 yrs on established BSL/English programme	13	10	23
	Mainly at school, TC or BSL/English programme	13	22	35
Total		77	58	135

8.4: X^2 analyses on subjects with and without reported information on BSL development

Appendix 8.4

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.313[a]	2	.016
Likelihood Ratio	8.316	2	.016
Linear-by-Linear Association	8.251	1	.004
N of Valid Cases	135		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.88.

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Age in months when first used signs * Type of exposure to British Sign Language	77	23.3%	254	76.7%	331	100.0%

Report

Age in months when first used signs

Type of exposure to	Mean	N	Std. Deviation
From birth, at least one parent BSL user	16.92	51	10.26
Pre 3 yrs on established BSL/English programme	19.38	13	7.41
Mainly at school, TC or BSL/English programme	29.92	13	21.87
Total	19.53	77	13.28

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Age in months when first used signs * Child's sex	34	18.8%	147	81.2%	181	100.0%

Report

Age in months when first used signs

Child's sex	Mean	N	Std. Deviation
Female	39.60	15	14.13
Male	36.00	19	16.70
Total	37.59	34	15.50

Oneway

ANOVA

Age in months when first used signs

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	108.635	1	108.635	.445	.510
Within Groups	7815.600	32	244.238		
Total	7924.235	33			

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Age in months when first used signs * Family deaf or hearing	34	18.8%	147	81.2%	181	100.0%

Report

Age in months when first used signs

Family deaf or hearing	Mean	N	Std. Deviation
At least one parent deaf BSL user	27.60	5	19.60
Both parents hearing	39.31	29	14.40
Total	37.59	34	15.50

Oneway

8.5: Analyses of children's BSL development

ANOVA

Age in months when first used signs

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	584.828	1	584.828	2.550	.120
Within Groups	7339.407	32	229.356		
Total	7924.235	33			

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Age in months when first used signs * final age intervals	34	18.8%	147	81.2%	181	100.0%

Report

Age in months when first used signs

final age intervals	Mean	N	Std. Deviation
3 - <4yrs	24.00	1	.
4 - <5yrs	28.00	3	9.17
5 - <6 yrs	31.50	4	11.36
6 - <8yrs	32.00	9	17.17
8 - <10 yrs	38.67	9	15.33
10+ yrs	51.00	8	10.64
Total	37.59	34	15.50

Oneway

Warnings

Post hoc tests are not performed for Age in months when first used signs because at least one group has fewer than two cases.

ANOVA

Age in months when first used signs

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2339.235	5	467.847	2.346	.067
Within Groups	5585.000	28	199.464		
Total	7924.235	33			

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Age in months when first used signs * iq within +/- 1 SD of norm on test or estimate, or below or above average	33	18.2%	148	81.8%	181	100.0%

Report

Age in months when first used signs

iq within +/- 1 SD of norm	Mean	N	Std. Deviation
low	40.29	7	14.99
average	36.00	22	15.90
high	39.00	4	18.65
Total	37.27	33	15.63

Oneway

ANOVA

Age in months when first used signs

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	111.117	2	55.558	.216	.807
Within Groups	7701.429	30	256.714		
Total	7812.545	32			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Age in months when first used signs
Tukey HSD

(I) iq within +/- 1 SD of norm on test or estimate, or below or above average	(J) iq within +/- 1 SD of norm on test or estimate, or below or above average	Mean Difference (I-J)	Std. Error	Sig.
low	average	4.29	6.95	.812
	high	1.29	10.04	.991
average	low	-4.29	6.95	.812
	high	-3.00	8.71	.937
high	low	-1.29	10.04	.991
	average	3.00	8.71	.937

Multiple Comparisons

Dependent Variable: Age in months when first used signs
Tukey HSD

(I) iq within +/- 1 SD of norm on test or estimate, or below or above average	(J) iq within +/- 1 SD of norm on test or estimate, or below or above average	95% Confidence Interval	
		Lower Bound	Upper Bound
low	average	-12.86	21.43
	high	-23.47	26.04
average	low	-21.43	12.86
	high	-24.47	18.47
high	low	-26.04	23.47
	average	-18.47	24.47

8.6: Analyses of differences in BSL raw scores between age groups

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL receptive test, raw score * final age intervals	181	100.0%	0	.0%	181	100.0%

Report

BSL receptive test, raw score

final age intervals	Mean	N	Std. Deviation
3 - <4yrs	5.00	1	.
4 - <5yrs	9.88	8	7.95
5 - <6 yrs	15.37	19	9.32
6 - <8yrs	19.47	49	6.46
8 - <10 yrs	26.43	44	5.86
10+ yrs	29.02	60	6.16
Total	23.39	181	8.76

Oneway

ANOVA

BSL receptive test, raw score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5741.716	4	1435.429	32.525	.000
Within Groups	7723.279	175	44.133		
Total	13464.994	179			

Post Hoc Tests

8.6: Analyses of differences in BSL raw scores between age groups

Multiple Comparisons

Dependent Variable: BSL receptive test, raw score
Tukey HSD

(I) final age intervals	(J) final age intervals	Mean Difference (I-J)	Std. Error	Sig.
4 - <5yrs	5 - <6 yrs	-5.49	2.80	.285
	6 - <8yrs	-9.59*	2.53	.001
	8 - <10 yrs	-16.56*	2.55	.000
	10+ yrs	-19.14*	2.50	.000
5 - <6 yrs	4 - <5yrs	5.49	2.80	.285
	6 - <8yrs	-4.10	1.80	.150
	8 - <10 yrs	-11.06*	1.82	.000
	10+ yrs	-13.65*	1.75	.000
6 - <8yrs	4 - <5yrs	9.59*	2.53	.001
	5 - <6 yrs	4.10	1.80	.150
	8 - <10 yrs	-6.96*	1.38	.000
	10+ yrs	-9.55*	1.28	.000
8 - <10 yrs	4 - <5yrs	16.56*	2.55	.000
	5 - <6 yrs	11.06*	1.82	.000
	6 - <8yrs	6.96*	1.38	.000
	10+ yrs	-2.58	1.32	.286
10+ yrs	4 - <5yrs	19.14*	2.50	.000
	5 - <6 yrs	13.65*	1.75	.000
	6 - <8yrs	9.55*	1.28	.000
	8 - <10 yrs	2.58	1.32	.286

8.6: Analyses of differences in BSL raw scores between age groups

Multiple Comparisons

Dependent Variable: BSL receptive test, raw score
Tukey HSD

(I) final age intervals	(J) final age intervals	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
4 - <5yrs	5 - <6 yrs	-13.13	2.14
	6 - <8yrs	-16.50	-2.68
	8 - <10 yrs	-23.52	-9.59
	10+ yrs	-25.96	-12.32
5 - <6 yrs	4 - <5yrs	-2.14	13.13
	6 - <8yrs	-9.00	.80
	8 - <10 yrs	-16.04	-6.09
	10+ yrs	-18.42	-8.88
6 - <8yrs	4 - <5yrs	2.68	16.50
	5 - <6 yrs	-.80	9.00
	8 - <10 yrs	-10.73	-3.20
	10+ yrs	-13.04	-6.06
8 - <10 yrs	4 - <5yrs	9.59	23.52
	5 - <6 yrs	6.09	16.04
	6 - <8yrs	3.20	10.73
	10+ yrs	-6.18	1.01
10+ yrs	4 - <5yrs	12.32	25.96
	5 - <6 yrs	8.88	18.42
	6 - <8yrs	6.06	13.04
	8 - <10 yrs	-1.01	6.18

*. The mean difference is significant at the .05 level.

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * final age intervals	162	89.5%	19	10.5%	181	100.0%

Report

BSL standard score

final age intervals	Mean	N	Std. Deviation
3 - <4yrs	84.0000	1	.
4 - <5yrs	91.8333	6	17.6796
5 - <6 yrs	89.1333	15	18.5313
6 - <8yrs	86.5227	44	15.6361
8 - <10 yrs	92.4884	43	17.5056
10+ yrs	92.4340	53	21.6702
Total	90.4630	162	18.5362

Oneway

8.6: Analyses of differences in BSL raw scores between age groups

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1144.971	5	228.994	.659	.655
Within Groups	54173.307	156	347.265		
Total	55318.278	161			

8.7: Analyses of BSL test scores according to gender

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * Child's sex	162	89.5%	19	10.5%	181	100.0%

Report

BSL standard score

Child's sex	Mean	N	Std. Deviation
Female	94.0000	83	18.9762
Male	86.7468	79	17.4168
Total	90.4630	162	18.5362

T-Test

Group Statistics

	Child's sex	N	Mean	Std. Deviation	Std. Error Mean
BSL standard score	Female	83	94.0000	18.9762	2.0829
	Male	79	86.7468	17.4168	1.9595

Independent Samples Test

		Levene's Test for Equality of Variances	
		F	Sig.
BSL standard score	Equal variances assumed	.509	.476
	Equal variances not assumed		

8.7: Analyses of BSL test scores according to gender

Independent Samples Test

		t-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
BSL standard score	Equal variances assumed	2.531	160	.012	7.2532
	Equal variances not assumed	2.536	159.793	.012	7.2532

Independent Samples Test

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
BSL standard score	Equal variances assumed	2.8659	1.5934	12.9130
	Equal variances not assumed	2.8598	1.6053	12.9010

8.8: Analyses of BSL scores according to parental hearing status

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * Family deaf or hearing	129	71.3%	52	28.7%	181	100.0%

Report

BSL standard score

Family deaf or hearing	Mean	N	Std. Deviation
At least one parent deaf BSL user	102.9697	33	17.3358
Both parents hearing	86.1458	96	18.6079
Total	90.4496	129	19.6576

Oneway

Warnings

Post hoc tests are not performed for BSL standard score because there are fewer than three groups.

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6950.994	1	6950.994	20.766	.000
Within Groups	42510.928	127	334.732		
Total	49461.922	128			

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * Family deaf or hearing	80	90.9%	8	9.1%	88	100.0%

Report

BSL standard score

Family deaf or hearing	Mean	N	Std. Deviation
At least one parent deaf BSL user	105.4815	27	15.8899
Both parents hearing	91.4151	53	18.2677
Total	96.1625	80	18.6428

8.8: Analyses of BSL scores according to parental hearing status

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3539.279	1	3539.279	11.542	.001
Within Groups	23917.609	78	306.636		
Total	27456.887	79			

Appendix 8.9 Analyses of test validity: a) Correlation of BSL test scores with reading scores; b) Correlation of BSL test scores with tester ratings of children's BSL

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * iq within +/- 1 SD of norm on test or estimate, or below or above average	102	56.7%	78	43.3%	180	100.0%

Report

BSL standard score

iq within +/- 1 SD of norm	Mean	N	Std. Deviation
low	73.4348	23	11.9386
average	90.8545	55	18.7206
high	108.8333	24	11.3852
Total	91.1569	102	19.8433

Oneway

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	14727.668	2	7363.834	29.112	.000
Within Groups	25041.822	99	252.948		
Total	39769.490	101			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: BSL standard score
Tukey HSD

(I) iq within +/- 1 SD of norm on test or estimate, or below or above average	(J) iq within +/- 1 SD of norm on test or estimate, or below or above average	Mean Difference (I-J)	Std. Error	Sig.
low	average	-17.4198*	3.9493	.000
	high	-35.3986*	4.6408	.000
average	low	17.4198*	3.9493	.000
	high	-17.9788*	3.8908	.000
high	low	35.3986*	4.6408	.000
	average	17.9788*	3.8908	.000

Appendix 8.9

Multiple Comparisons

Dependent Variable: BSL standard score
Tukey HSD

(I) iq within +/- 1 SD of norm on test or estimate, or below or above average	(J) iq within +/- 1 SD of norm on test or estimate, or below or above average	95% Confidence Interval	
		Lower Bound	Upper Bound
low	average	-26.8170	-8.0225
	high	-46.4413	-24.3558
average	low	8.0225	26.8170
	high	-27.2370	-8.7206
high	low	24.3558	46.4413
	average	8.7206	27.2370

*. The mean difference is significant at the .05 level.

Correlations

Correlations

		BSL standard score	reading age in months
BSL standard score	Pearson Correlation	1.000	.700*
	Sig. (2-tailed)	.	.017
	N	162	11
reading age in months	Pearson Correlation	.700*	1.000
	Sig. (2-tailed)	.017	.
	N	11	11

*. Correlation is significant at the 0.05 level (2-tailed).

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * testers' bsl ratings	19	10.1%	169	89.9%	188	100.0%

Report

BSL standard score

testers' bsl ratings	Mean	N	Std. Deviation
below	71.8000	5	13.8996
average	97.1429	7	14.9268
above	114.2857	7	10.6570
Total	96.7895	19	21.1570

Oneway

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5266.072	2	2633.036	15.094	.000
Within Groups	2791.086	16	174.443		
Total	8057.158	18			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: BSL standard score
Tukey HSD

(I) testers' bsl ratings	(J) testers' bsl ratings	Mean Difference (I-J)	Std. Error	Sig.
average	below	-25.3429*	7.7336	.012
	above	-42.4857*	7.7336	.000
below	average	25.3429*	7.7336	.012
	above	-17.1429	7.0598	.067
above	average	42.4857*	7.7336	.000
	below	17.1429	7.0598	.067

Multiple Comparisons

Dependent Variable: BSL standard score
Tukey HSD

		95% Confidence Interval	
(I) testers' bsl ratings	(J) testers' bsl ratings	Lower Bound	Upper Bound
average	below	-45.2983	-5.3874
	above	-62.4411	-22.5303
below	average	5.3874	45.2983
	above	-35.3596	1.0739
above	average	22.5303	62.4411
	below	-1.0739	35.3596

*. The mean difference is significant at the .05 level.

8.10 Summary of X^2 analyses comparing new sample with standardization sample

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
child part of original standardisation study or new data * Child's sex	316	100.0%	0	.0%	316	100.0%

child part of original standardisation study or new data * Child's sex Crosstabulation

Count

		Child's sex		Total
		Female	Male	
child part of original standardisation study or new data	standardisation study	74	61	135
	new data	89	92	181
Total		163	153	316

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.986[b]	1	.321	.363	.190	
Continuity Correction[a]	.773	1	.379			
Likelihood Ratio	.987	1	.320	.363	.190	
Fisher's Exact Test				.363	.190	
Linear-by-Linear Association	.983[c]	1	.321	.363	.190	.055
N of Valid Cases	316					

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 65.36.

c. The standardized statistic is .991.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
child part of original standardisation study or new data * Family deaf or hearing	283	89.6%	33	10.4%	316	100.0%

8.10 Summary of X^2 analyses comparing new sample with standardization sample

child part of original standardisation study or new data * Family deaf or hearing Crosstabulation

Count

		Family deaf or hearing		Total
		At least one parent deaf BSL user	Both parents hearing	
child part of original standardisation study or new data	standardisation study	82	53	135
	new data	35	113	148
Total		117	166	283

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	40.054[b]	1	.000	.000	.000	
Continuity Correction[a]	38.540	1	.000			
Likelihood Ratio	41.012	1	.000	.000	.000	
Fisher's Exact Test				.000	.000	
Linear-by-Linear Association	39.913[c]	1	.000	.000	.000	.000
N of Valid Cases	283					

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 55.81.

c. The standardized statistic is 6.318.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
child part of original standardisation study or new data * iq within +/- 1 SD of norm on test or estimate, or below or above average	248	78.5%	68	21.5%	316	100.0%

child part of original standardisation study or new data * iq within +/- 1 SD of norm on test or estimate, or below or above average Crosstabulation

Count

		iq within +/- 1 SD of norm on test or estimate, or below or above average			Total
		low	average	high	
child part of original standardisation study or new data	standardisation study	3	126		129
	new data	31	63	25	119
Total		34	189	25	248

8.10 Summary of X^2 analyses comparing new sample with standardization sample

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	68.767[a]	2	.000	.000		
Likelihood Ratio	82.502	2	.000	.000		
Fisher's Exact Test	77.641			.000		
Linear-by-Linear Association	.192[b]	1	.661	.697	.379	.094
N of Valid Cases	248					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.00.

b. The standardized statistic is -.439.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
child part of original standardisation study or new data * final age intervals	316	100.0%	0	.0%	316	100.0%

child part of original standardisation study or new data * final age intervals Crosstabulation

Count

		final age intervals				
		3 - <4yrs	4 - <5yrs	5 - <6 yrs	6 - <8yrs	8 - <10 yrs
child part of original standardisation study or new data	standardisation study	10	15	17	33	33
	new data	1	8	19	49	44
Total		11	23	36	82	77

child part of original standardisation study or new data * final age intervals Crosstabulation

Count

		final age	Total
		10+ yrs	
child part of original standardisation study or new data	standardisation study	27	135
	new data	60	181
Total		87	316

8.10 Summary of X^2 analyses comparing new sample with standardization sample

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	20.555[a]	5	.001	.001		
Likelihood Ratio	21.658	5	.001	.001		
Fisher's Exact Test	20.585			.001		
Linear-by-Linear Association	15.882[b]	1	.000	.000	.000	.000
N of Valid Cases	316					

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 4.70.

b. The standardized statistic is 3.985.

8.11 Analysis of age when BSL signs first produced between samples

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Age in months when first used signs * child part of original standardisation study or new data	117	36.2%	206	63.8%	323	100.0%

Report

Age in months when first used signs

child part of original	Mean	N	Std. Deviation
standardisation study	19.53	77	13.28
new data	37.95	40	15.74
Total	25.83	117	16.61

Oneway

ANOVA

Age in months when first used signs

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7689.154	1	7689.154	39.279	.000
Within Groups	21337.404	109	195.756		
Total	29026.559	110			

8.12 Analysis of mean BSL standard scores between samples

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * child part of original standardisation study or new data	297	94.0%	19	6.0%	316	100.0%

Report

BSL standard score

child part of original	Mean	N	Std. Deviation
standardisation study	100.1704	135	15.2073
new data	90.4630	162	18.5362
Total	94.8754	297	17.7488

Oneway

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6939.031	1	6939.031	23.718	.000
Within Groups	86307.359	295	292.567		
Total	93246.391	296			

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * child part of original standardisation study or new data	206	96.3%	8	3.7%	214	100.0%

Report

BSL standard score

child part of original	Mean	N	Std. Deviation
standardisation study	100.9683	126	14.7214
new data	96.1625	80	18.6428
Total	99.1019	206	16.4801

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1130.099	1	1130.099	4.226	.041
Within Groups	54546.761	204	267.386		
Total	55676.859	205			

Appendix 8.13

8.13 Analysis of the effect of gender on BSL standard scores between samples

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Child's sex * Info on BSL development available	181	100.0%	0	.0%	181	100.0%

Child's sex * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
Child's sex	Female	15	74	89
	Male	19	73	92
Total		34	147	181

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.428[b]	1	.513		
Continuity Correction[a]	.215	1	.643		
Likelihood Ratio	.429	1	.513		
Fisher's Exact Test				.571	.322
Linear-by-Linear Association	.425	1	.514		
N of Valid Cases	181				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 16.72.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Family deaf or hearing * Info on BSL development available	148	81.8%	33	18.2%	181	100.0%

Family deaf or hearing * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
Family deaf or hearing	At least one parent deaf BSL user	5	30	35
	Both parents hearing	29	84	113
Total		34	114	148

8.13 Analysis of the effect of gender on BSL standard scores between samples

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.955[b]	1	.162		
Continuity Correction[a]	1.365	1	.243		
Likelihood Ratio	2.112	1	.146		
Fisher's Exact Test				.249	.119
Linear-by-Linear Association	1.942	1	.163		
N of Valid Cases	148				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.04.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
final age intervals * Info on BSL development available	181	100.0%	0	.0%	181	100.0%

final age intervals * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
final age intervals	3 - <4yrs	1		1
	4 - <5yrs	3	5	8
	5 - <6 yrs	4	15	19
	6 - <8yrs	9	40	49
	8 - <10 yrs	9	35	44
	10+ yrs	8	52	60
Total		34	147	181

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	7.479[a]	5	.187	.199		
Likelihood Ratio	6.291	5	.279	.312		
Fisher's Exact Test	6.784			.218		
Linear-by-Linear Association	3.463[b]	1	.063	.067	.039	.011
N of Valid Cases	181					

a. 4 cells (33.3%) have expected count less than 5. The minimum expected count is .19.

b. The standardized statistic is 1.861.

Crosstabs

8.13 Analysis of the effect of gender on BSL standard scores between samples

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
iq within +/- 1 SD of norm on test or estimate, or below or above average * Info on BSL development available	118	65.6%	62	34.4%	180	100.0%

iq within +/- 1 SD of norm on test or estimate, or below or above average * Info on BSL development available Crosstabulation

Count

		Info on BSL development available		Total
		yes	no	
iq within +/- 1 SD of norm on test or estimate, or below or above average	low	7	24	31
	average	21	41	62
	high	4	21	25
Total		32	86	118

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	3.317[a]	2	.190	.190		
Likelihood Ratio	3.444	2	.179	.182		
Fisher's Exact Test	3.132			.198		
Linear-by-Linear Association	.170[b]	1	.680	.765	.397	.110
N of Valid Cases	118					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.78.

b. The standardized statistic is .412.

Appendix 8.14

8.14 Analysis of BSL standard scores according to parental status between samples

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * Family deaf or hearing	264	83.5%	52	16.5%	316	100.0%

Report

BSL standard score

Family deaf or hearing	Mean	N	Std. Deviation
At least one parent deaf BSL user	101.4783	115	16.1503
Both parents hearing	90.7450	149	18.2831
Total	95.4205	264	18.1548

Oneway

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7477.325	1	7477.325	24.733	.000
Within Groups	79207.004	262	302.317		
Total	86684.330	263			

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * Family deaf or hearing	206	96.3%	8	3.7%	214	100.0%

Report

BSL standard score

Family deaf or hearing	Mean	N	Std. Deviation
At least one parent deaf BSL user	102.6117	103	15.6532
Both parents hearing	95.5922	103	16.6117
Total	99.1019	206	16.4801

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2537.519	1	2537.519	9.741	.002
Within Groups	53139.340	204	260.487		
Total	55676.859	205			

8.15 Comparison of children from deaf and hearing families across samples

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
child part of original standardisation study or new data	1.00	standardisati on study	135
	2.00	new data	129
Family deaf or hearing	1	At least one parent deaf BSL user	115
	2	Both parents hearing	149

Tests of Between-Subjects Effects

Dependent Variable: BSL standard score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	13288.923[a]	3	4429.641	15.692	.000
Intercept	2108789.926	1	2108789.926	7470.296	.000
NEWSUBJ	1636.355	1	1636.355	5.797	.017
FHEARING	4833.255	1	4833.255	17.122	.000
NEWSUBJ * FHEARING	3143.361	1	3143.361	11.135	.001
Error	73395.407	260	282.290		
Total	2490421.000	264			
Corrected Total	86684.330	263			

a. R Squared = .153 (Adjusted R Squared = .144)

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
child part of original standardisation study or new data	1.00	standardisati on study	126
	2.00	new data	80
Family deaf or hearing	1	At least one parent deaf BSL user	103
	2	Both parents hearing	103

Tests of Between-Subjects Effects

Dependent Variable: BSL standard score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4743.915[a]	3	1581.305	6.271	.000
Intercept	1783113.359	1	1783113.359	7071.826	.000
NEWSUBJ	249.669	1	249.669	.990	.321
FHEARING	2745.953	1	2745.953	10.890	.001
NEWSUBJ * FHEARING	1752.774	1	1752.774	6.952	.009
Error	50932.944	202	252.143		
Total	2078843.000	206			
Corrected Total	55676.859	205			

a. R Squared = .085 (Adjusted R Squared = .072)

8.16 Effect of gender across samples

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * Child's sex	297	94.0%	19	6.0%	316	100.0%

Report

BSL standard score

Child's sex	Mean	N	Std. Deviation
Female	97.7452	157	17.5933
Male	91.6571	140	17.4277
Total	94.8754	297	17.7488

Oneway

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2743.039	1	2743.039	8.941	.003
Within Groups	90503.352	295	306.791		
Total	93246.391	296			

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BSL standard score * Child's sex	206	96.3%	8	3.7%	214	100.0%

Report

BSL standard score

Child's sex	Mean	N	Std. Deviation
Female	102.2818	110	16.2735
Male	95.4583	96	16.0341
Total	99.1019	206	16.4801

ANOVA

BSL standard score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2386.762	1	2386.762	9.137	.003
Within Groups	53290.097	204	261.226		
Total	55676.859	205			