The Impact of Encouraging Infants to Gesture on their Language Development

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Abstract

Infants' gestures feature prominently in early language. The observation that accomplishments in gesture presage verbal milestones prompted the question of whether encouraging infants to gesture would bring on language gains. This thesis addressed this question, remedying many of the shortfalls of previous research.

In a yearlong longitudinal study, high-SES mother-infant dyads (n = 40) were randomly allocated to one of four conditions: Symbolic Gesture training, British Sign Language (BSL) training, Verbal training and a Non-Intervention Control group. Infants' language was continually assessed between the ages of 8 to 20 months to determine the impact of encouraged gesture on language development. With the exception of a small number of boys, encouraging gesture did not affect infants' language development. However, the expressive language of boys who started the study with a low language ability was improved by gesture.

A gesture-training intervention was delivered to low-SES mothers at a Sure Start children's centre. Infants of mothers trained to gesture showed greater gains in their receptive and expressive vocabularies than infants of mothers who attended sessions aimed to improve general communication (without gesture instruction). Gesture helped reduce the discrepancy between the language abilities of infants from low and high-SES backgrounds.

Qualitative investigations revealed how encouraging mothers to use gestures with their infants led to perceived wider, non-linguistic benefits. However, a comparison of maternal and infant stress scores revealed no difference between gesturing and non-gesturing mother-infant dyads.

Infants, who because of biological and/or environmental factors have lower language abilities than their peers, stand to benefit from encouraged gesture in infancy. Through early intervention, gesture has the potential to reduce the disadvantage that children from lower-SES families face from impoverished language abilities. By changing the course of their early development, encouraged gesture could ultimately bring about lasting benefits.

Chapter 1. Literature Review

1.1. Introduction

This thesis is an evaluation of the effect of enhanced gestural communication upon infant verbal language development. This thesis examines this issue in new and important ways, exploring the effect of socio-economic status on the outcomes of enhanced gesture, and exploring and evaluating the wider non-linguistic benefits. It is pertinent to first review the literature on the role of gestures in infant language development. By understanding the relationship between speech and gesture in these early stages of language development, the potential gains of encouraging gesture can be speculated upon.

Socio-economic status (SES) has been identified to significantly impact upon the success of child's language development. Children from lower-SES backgrounds are well documented to have poorer verbal language abilities than those children from more advantaged backgrounds (e.g. Hoff, 2003). If encouraging gesture can enhance language development, then this will have significant implications for children from less advantaged backgrounds. Literature will be reviewed that has explored the impact of SES on language development, and the mechanisms by which SES impacts upon language will be discussed to determine the potential of gesture as a means to enhance the language development of infants from lower-SES backgrounds. How gestures may advance verbal gains via their influence on the child's linguistic environment will be discussed as well as the ways in which gesture is tied to speech at the biological and evolutionary level. Research that has attempted to assess the impact of encouraging infants to communicate using gestures will be evaluated. Gesturing with infants is likely to have benefits that extend beyond the verbal domain. The final section of this literature review will speculate upon the likely wider non-linguistic effects of encouraging mothers and infants to share a gestured system of communication.

1.2.1. The Emergence of Infants' Gestures and Their Relationship to Speech

Speech and gesture are inextricably linked. Children, as well as adults, gesture spontaneously as they speak, and these hand movements have been claimed to assist in various stages of speech production. Gesture has also been observed to be important when children's language skills are still in development. At each step on the path to language acquisition, language milestones are mirrored by gesture milestones, with gesture production often preceding verbal production. This section will present a review of the research that has explored how gesture develops in conjunction with speech in language development.

The first milestone in language acquisition is often considered to be when infants start to babble, usually around the age of six months. It is also around this time when infants start to make rhythmic hand movements, such as banging objects and one-handed reaching (e.g. Iverson & Fagan, 2004; Ramsay, 1984; Thelen, 1981). Iverson and Fagan (2004) examined the relationship between infant body movements and vocalisations and found that in infants aged between six and nine months, one-fifth of all rhythmic movements were co-timed with vocalisations. Furthermore, vocalisations were more likely to accompany movements of the right arm than the left arm, demonstrating the association between motor movements and the localisation of language in the left hemisphere. When infants begin to comprehend words, at around the age of eight to ten months, infants begin to produce deictic gestures, such as pointing and giving. They also engage in cultural gestural routines such as waving good-bye (Bates & Dick, 2001). Between the ages of 11 to 13 months, infants typically start to say their first words. It is also around this time that infants begin to produce gestures that are associated with specific objects, for example holding a phone to the ear. These actions have been argued to be 'gestural names' (Bates et al. 1979) because they function as labels in a similar way to words.

This closely coupled relationship between speech and gesture in the early stages of language development is consistent with the view that gesture and speech form a unified system. According to McNeill (1992) speech and gesture share the same underlying cognitive representation. As such, speech and gesture are often perceived to offer ‘different windows on a unified developmental process’ (Bates, 2003, p15). Alternatively, it is possible that the speech and gesture systems are simply developing in parallel, with no underlying shared structure (a view largely attributed with Krauss & Hadar, 1999).

However, research examining the relationship between the appearance of specific items in speech and gesture elucidates the precise relationship between the manual and verbal modalities, suggesting that speech and gesture are implicitly tied. Between the ages of 10 and 24 months, children rely extensively on gesture to refer to objects, producing significantly more items initially in gesture than speech. On average, children produced a gesture for a particular object three months before they produced the word for that object (Iverson & Goldin-Meadow, 2005). According to the ‘Gestural-Facilitation Hypothesis’, gesture allows children to communicate about a referent before they can talk, and thus serve as a ‘transitional device in early lexical development’ (Iverson & Goldin-Meadow, 2005, p.369). These findings are in line with the McNeill (1992) unified view of speech and gesture. According with this view is the argument that children hold a representation of an object or concept and this is then expressed in the modality available to them at that time, with specific items crossing modalities, making the transition from hand to mouth.

After children produce their first words, the next milestone that children achieve is the ability to combine linguistic elements. Children typically start to produce two word combinations around the age of 18 to 24 months, however, preceding this, children combine their one-word utterances with gesture to produce multi-item, multi-modal utterances. These gesture-word combinations first occur around 14 months and appear to indicate the transition between one and multiword speech (E.g. MacEachern & Haynes, 2004). If speech and gesture do form a single integrated system then it would be anticipated that there would be a direct relationship between gesture-speech combinations and the onset of two-word speech, similar to that reported at the single word level (Iverson & Goldin-Meadow, 2005). Taking a unified view of speech and gesture, the speech-gesture combination would stem from a single underlying representation that the infant intended to communicate. The combination of modalities is simply an artefact of the underlying representation being expressed through different channels, either due to a concept being more readily expressed in a visuo-spatial modality or because the child has not yet acquired that verbal label.

The alternative view is that the gesture-speech combination does not have the same underlying representation. Although they are co-expressed, they do not originate at the same level of processing. Krauss and Hadar (1999) state that "gestures originate in the process that precedes conceptualisation and construction of the preverbal message… their origin precedes the formulation of the speaker's communicative intention" (Krauss & Hadar, 1999, p103). According to this view, there would not necessarily be a direct relationship between the items that appear in gesture-speech combinations and those that appear in two-word combinations. This is because the information conveyed by gesture is said not to be relevant to the speaker's goals, but are just products of memorial representations rather than of communicative intentions. However, based on the tight coupling of speech and gesture that has been observed in the aforementioned research, it can be argued that infants' gesture-speech combinations have the communicative intent to convey those two pieces of information as a unified message.

Indeed, it has been demonstrated that specific gesture-speech combinations predict oncoming changes in children's speech (Özçalişkan & Goldin-Meadow, 2005). Gesture-speech combinations were categorised by Özçalişkan and Goldin-Meadow into three distinct types: *reinforcing* (e.g. vocalised "dog" + point at dog) *disambiguating* (e.g. "her" + point at sister) and *supplementary* (e.g. "push" + point at couch). Around half of the children studied by the authors produced gesture-speech combinations at 14 months, and by 18 months all but one of the children were combining speech and gesture. Children were found to produce particular sentence constructions in gesture and speech (e.g. reinforcing) before they produced the same constructions entirely within speech. Özçalişkan and Goldin-Meadow suggest that gesturing may ease the process of speech production, thus providing the child with extra cognitive resources that enables them to produce more complex constructions. The fact that the same constructions made the transition from being communicated in a combination of modalities to being conveyed in speech only suggests that the child is able to construct a two item message at the conceptualisation level and that speech and gesture share this same representation.

Further support for the notion that gesture is fundamentally tied to language development comes from the finding that gesture-speech combinations predict the onset of the same two elements appearing in two-word combinations. Iverson and Goldin-Meadow (2005) coded infants' speech and gesture combinations and classified them as either *complementary* (e.g. saying "flowers" + point to flowers) or *supplementary* (e.g. saying "mummy's" + point to flowers). The mean interval between the onset of supplementary gesture and word combinations and the onset of two word utterances was 2.3 months, and for complementary combinations, the interval was 4.7 months. Therefore, gesture predicts changes in language at both the lexical level (i.e. single word) and at the level of the sentence (i.e. two word combinations) (Iverson & Goldin-Meadow, 2005; Özçalişkan & Goldin-Meadow, 2005). Gesture and speech are implicitly coupled in language development, with gesture preceding verbal gains. Does this then mean that gesture is instrumental in bringing on these gains, and if so, how?

Gesture may serve a social function in language development by signalling to the child's communicative partner that they are ready for a particular kind of input, as suggested by Iverson and Goldin-Meadow (2005). In this way, the child can be thought of as directing their language-learning environment. Viewing the child in this way is key to the phenomenon that this thesis examines. By equipping infants with manual labels for items before they can talk, the infant is able to invite verbal responses from their caregiver about topics of interest to them. Therefore, not only is the infant in control of the input that they receive, but they are also receiving it at an earlier age than they would do normally. This is likely to impact upon the rate of the child's linguistic gains.

The infants' first year is punctuated by overlapping gesture and verbal milestones representing underlying linguistic advances. This close relationship between speech and gesture may suggest that infants are born 'hardwired' to gesture. These gestures appear to be intrinsic to language development and are not simply imitations of the gestures of adults. Indeed, gestures emerge even in the absence of a visual model, as congenitally blind infants have been found to gesture (Iverson, Tencer, Lany & Goldin-Meadow, 2000). Gesture therefore, is a robust feature of this stage of development. While the blind children in the Iverson et al. study gestured less than the sighted children, this lack of gesturing did not impact upon language development, as the blind children did not exhibit any delays in language learning. On the surface this finding may imply that gesture is not essential for the development of language, however the authors suggest that because blind children are not able to use gesture as a communicative tool in the same way that sighted children can, they develop alternative strategies. While the gestures of sighted children invite verbal responses from parents that may act to scaffold language development, blind children cannot make use of joint attention and so may rely more on speech to elicit communication with caregivers. Therefore, we can still assume that gestures are a part of the acquisition process, however their role is diminished (though not extinguished) when sight is impaired.

For most children, however, the process of language acquisition occurs in the context of a dynamic linguistic environment, rich with gestures as well as words. Therefore, it is important to pay attention to the nature of this gestural input and to consider how infants assimilate this information and how this impacts upon their language development. While the research described thus far has focused on the gestures that infants produce, the next section turns the focus on to the gestural input that infants receive from their parents and will consider how this contributes to infants' language acquisition.

1.2.2. What Impact Does Gestural Input Have Upon Infant Language Development?

In the same way that adults adapt their speech when talking to children – so called 'motherese' (Snow, 1977) – the same modification has been found to occur in child directed gestures – 'gesturese' (Bekken, 1989; Iverson, Capirci, Longobardi & Caselli 1999). Bekken (1989) was the first to document a difference in gesturing when adults are addressing an infant compared to an adult. When interacting with an infant, adults were found to gesture less but used more simple pointing gestures than when talking to an adult. Similarly, Iverson et al. (1999) found that adults gestured less when talking to an infant, and these gestures were 'conceptually simple', consisting of points and conventional gestures that always accompanied speech and complemented the information conveyed by speech (rather than adding additional information). This form of modified communication has been documented in American mothers (e.g. Shatz, 1982) as well as Italian mothers (Iverson et al. 1999), suggesting it may be a universal feature of the type of input that infants' receive. While it is clear that this is a robust feature of maternal communication, do these modifications serve to support infants' language development in any way?

Two main theories have been proposed to explain the function of gesture directed towards and adapted for infants: the 'Facilitative Interaction Hypothesis' and the 'Interactional Artefact Hypothesis'. According to the Facilitative Interaction Hypothesis, maternal modifications to communication serve to scaffold infants' emergent ability. This view is supported by research conducted by Brand, Baldwin and Ashburn (2002) who found that when mothers were asked to demonstrate properties of novel objects to infants, mothers spontaneously modified their gestures in ways that may assist the infants in learning about action. The mothers' gestures were of a larger scale and less complex when talking to infants compared to when performing the same task with an adult. Brand et al. suggest that these gestures facilitate attention to action and scaffold infants' processing of the concept of action. On the other hand, the Interactional Artefact Hypothesis views maternal gesture modifications simply as by-products of the semantic simplicity of child-directed interaction (O'Neill, et al. 2005; Pine, 1994).

Research has evaluated the competing theories by comparing maternal gestures in two different contexts. O'Neill, Bard, Linnell and Fluck (2005) identified and described the communicative gestures of 12 English mothers during interaction with their 20-month-old infants during a free play session and a structured counting task. According to the authors, the Facilitative Interaction Hypothesis would predict that the two contexts would elicit different gesture styles because child-directed gestures serve to facilitate infants' understanding.

Mothers were found to gesture most often to disambiguate speech, rather than to emphasise or supplement speech. The style of gesturese they observed in the sample of English mothers was comparable to that reported in Italian (Iverson et al. 1999) and American (Shatz, 1982) mothers, however there were differences in the amount of gesturing. Gesturese was found to be constant across tasks with mothers producing concrete, deictic gestures which were tied to the context and conceptually simple in both a play task and a counting task. As no difference was found across tasks, the findings lend support to an Interactional Artefact account of maternal modifications. According to this account, gesturese is simply an artefact of simplified interaction with children.

However, the extent to which the tasks were contextually different is questionable, as both the counting task and free-play task elicited interactions containing scaffolding behaviour by mothers. In the count task, mothers used gesture to identify object number relations, thus scaffolding infants' developing understanding of the one-to-one principle. In the free-play task, many mothers often paired words with gestures in activities such as book reading, therefore scaffolding infants' understanding of object-word pairing. Although differences were not observed in gesture across the two contexts, this does not mean that gestures were not acting to facilitate emergent understanding or ability. Both situations, either by design or maternal direction, contained structured tasks in which mothers communicated instructively with their infants using gesture.

Evidence demonstrates that caregivers do gesture in order to support infants' comprehension, contradicting the view that gestures are simply a by-product of simplified speech to infants. For example, Zukow-Goldring (1996) found that if an infant had initially misunderstood a caregivers' message, caregivers would then direct the infants' attention to salient features of the context by pointing, resulting in successful comprehension.

From a young age, gestures are a salient feature of the way in which infants communicate. The extent to which these gestures are a product of the gestural input that they are exposed to will go towards addressing the question of the purpose, and indeed the impact of gesturese. Infants' gestures have been demonstrated to predate and predict infants' subsequent language development (Özçalişkan & Goldin-Meadow, 2005; Iverson & Goldin-Meadow, 2005). But what drives the onset of certain types of gesturing in infants? One possibility is that changes in infants' gestures are driven by changes internal to the infants' developing cognitive system. Alternatively, it may be that changes in infant gesturing are brought about by the gestures that infants are exposed to, raising the question of whether the infant's developing linguistic competence is contingent upon their gestural environment.

One way to answer this is to examine the gestures that adults spontaneously produce when they talk to young children and consider whether these can account for changes in children's gesturing. This is what was done by Özçalişkan and Goldin-Meadow (2005), who observed forty children during the transition from one- to two-word speech. The children were recorded in their homes whilst engaged in spontaneous interaction with a caregiver at the ages 14, 18 and 22 months. The gesture production of the children and their caregivers was coded in terms of gesture type (deictic, conventional, representational) and the relation gesture held to speech (reinforcing, disambiguating, supplementary). Caregivers were found to gesture very little with just 10% of their communicative acts containing gesture.

Both caregivers and children produced all three types of gesture-speech combinations. However, children showed increases in their production of combinations over time, whereas the caregivers' production remained constant across the three time points. Children produced more supplementary gesture-speech combinations (e.g. *ride* + point at bike) than caregivers at all three-time points. Changes in the children's gesturing can therefore not be attributed to changes in the caregivers' gesturing; something else is driving the changes in infant gesture. The changing relation between speech and gesture during children's transition from one to two-word speech is therefore not a function of external input, therefore internal factors are likely to be accountable. Changes in children's gestures may reflect children's developing cognitive and communicative skills.

However, more recent research by Rowe, Özçalişkan and Goldin-Meadow (2008), found that the amount of gesture *types* produced by parents was related to the amount of gesture types that children produced. The number of gesture types refers to the number of different meanings conveyed by gesture, for example if a child pointed at a dog this would count as one gesture type (dog). Parents who produced more gesture types with their 14-month-old children had children who produced more gesture types. Furthermore, not only did the parents' gestures impact upon children's gesture production, they also related to children's subsequent language development. The children who produced more gesture meanings at 14 months had larger vocabularies at 54 months than children who produced fewer gesture types at 14 months. Therefore, parent gesture is indirectly related (through child gesture) to vocabulary development. The gestures that infants are exposed to in their early linguistic environment play an important role in scaffolding infants' verbal language development.

The rate of maternal gesturing throughout infancy has also been identified as important for children's lexical development. Namy and Nolan (2004) examined how parental verbal and gestural labelling changed over time. Across children's first year, parental rate of labelling was found to remain constant. However, gestural labelling was observed to be significantly lower when children were two years old.

It was found that children whose parents' gestural labelling remained constant across time had slightly larger increases in verbal vocabulary than those whose parents' gestures decreased by the time children were aged two. It is suggested by the authors that gestures serve an important bootstrapping function at a critical point in children's vocabulary development.

1.2.3. Social Economic Status and Infant Language Development

As described so far, gestures are a prominent feature of the infant's burgeoning language abilities and appear to be intrinsically tied to this process. The infant's linguistic environment, including the gestures that infants are exposed to, contribute significantly to language learning. This leads to the suggestion that the role of gesture could be utilised and maximised in order to enrich the infants' language learning environment to scaffold developing verbal skills.

This would be particularly beneficial for those children who are known to be at risk of communicative delay. Socio-economic status (SES) has pronounced effects on the development of children's language abilities with children from lower-SES families possessing weaker language skills than those from higher-SES backgrounds, a finding that is robust and well documented (e.g. Hoff, 2003). Research has consistently found a relation between SES and infant vocabulary. The impact on vocabulary is significant because it has wider implications for developing language skills. For example, Snow, Burns and Griffin (1998) report that deficits in vocabulary size in infancy are predictive of poor reading ability at primary school age. Children from lower-SES families build their vocabularies at slower rates than children from higher-SES families (E.g. Arriaga et al. 1998; Pan et al. 2005). By the age of three, the differences in children's language abilities are significant. Pan et al. (2005) report that children aged 32 months old from middle class backgrounds had significantly larger vocabularies than 36 month-old infants from low-income families did.

It is clear that SES is a powerful factor in determining the progress that infants make in their early language development. The next question is why does SES have such striking impacts upon infant language outcomes. Three main possibilities will be addressed here:

i. SES impacts upon the family by its association with parental mental health and limited financial resources and these account for differences in infant language.
ii. The effect of SES on language is mediated by an underlying cognitive deficit
iii. The infant's linguistic environment differs as a function of SES and this accounts for differences in language development.

Each of these arguments will be described and evaluated in turn. If SES is related to differences in the language input that children are exposed to, and it is this which accounts for the weaker language abilities of children from lower-SES backgrounds, then perhaps gesture could offer a mechanism by which the child's linguistic environment be improved.

1.2.3.1. Are Differences in Infant Language Accounted for by Either the Association Between SES and Parental Mental health or Limited Financial Resources?

Theoretical models have been proposed to explain how SES impacts infants' development. The 'Family Stress Model' states that it is the impact of SES on parental mental health which links low income with child development (e.g. Conger et al. 1992, 1993). Poverty is strongly associated with mental health problems, and stress and depression are prevalent in low-income families (Belle, 1990). There is evidence of a strong relationship between maternal mental health and children's socio-emotional development and behaviour, with affective disorders such as depression predicting adjustment problems such as disruptive behaviour (Radke-Yarrow et al. 1992). Pan et al. (2005) found that maternal depression had the effect of slowing the growth of child vocabulary production and that this effect increased as the children aged. This supports the Family Stress Model, and in particular the notion that parental mental health is a mediating factor in the relationship between socioeconomic status and language development.

Alternatively, according to the 'Investment Model' income is associated with children's development because it enables families to purchase materials, experiences and services that are beneficial to children's development and well-being' (Linver et al. 2002. p720.) However, Guo and Mullan Harris (2000) argue that this model is specified vaguely and that the resources that form the crucial part of this model are rarely sufficiently defined, measured, or incorporated into analysis. It is likely that the availability of material resources is not the only explanation of the relationship between socioeconomic status and infant development, and that low income may be related to nonmaterial family resources. Indeed, these theoretical models fail to take into consideration the infants' linguistic environment and do not account for possible differences in maternal communication.

Linver, Brooks-Gunn, and Kohen (2002) evaluated these two theories and considered a number of parental and environmental factors (as determined by the Family Stress and Investment models) as mediators for the association between income and child development, in a sample of 493 infants. Higher family income was found to be associated with a more cognitively stimulating home environment, less maternal distress and more positive parenting practices, which in turn were associated with higher child cognitive tests scores and for lower behavioural problems. Low maternal education and low maternal receptive language ability were associated with low infant cognitive development and high levels of child behaviour problems. When the variables maternal education and maternal receptive language were controlled for, the impact of parenting style and home environment persisted as strong mediators of the association between income and child development.

The authors argue that maternal characteristics as well as parenting practices and home environment are essential in determining how income is associated with children's cognitive and behavioural development. This study did not include child language development as an outcome measure, nor did it control for maternal expressive language ability. Therefore, the extent to which maternal communication quantity and quality contributed to the effects of SES on infant development cannot be established from this study. However, this study does highlight low cognitive abilities as a potential mediator between SES and language deficits. While research has found that SES has a significant impact on infant language development (e.g. Arriaga et al. 1998; Pan et al. 2005), these language deficits may be symptomatic of an underlying cognitive deficit.

1.2.3.2. Is The Effect of SES on Language Mediated By An Underlying Cognitive Deficit?

The relationship between cognitive abilities and SES was evaluated by Locke, Ginsborg and Peers (2002) who assessed the linguistic and cognitive abilities of 240 children entering nursery school in the UK (age range at testing was 3;1 – 4;8). The nursery schools were situated in areas of social and economic deprivation, as measured by the proportion of pupils receiving free school meals. The authors examined the extent to which the spoken language skills of children reared in poverty are depressed in comparison with those of the general population.

Children's receptive, expressive and overall language abilities were on average well below the level expected in the general population with over 50% of the children being identified as having potential moderate, moderate to severe, or severe language delay. The cognitive abilities of these children were comparable to those of the general population, therefore depressed cognitive abilities do not underlie the language deficiencies. By disentangling cognitive and linguistic abilities, this finding counters cognitive theories of language acquisition, which assume that linguistic development is driven by underlying cognitive development (e.g. Sinclair-de-Zwart, 1973). Therefore, without an underlying cognitive deficit explaining the language discrepancies in children from low and high-SES backgrounds, the focus turns back to an examination of the infants' linguistic environment in order to elucidate how family background influences infant language development.

1.2.3.3. Does the Infant's Linguistic Environment Differ as a Function of SES? And to What Extent Does this Account for Differences in Language Development?

According to Hoff (2003) the aspects of the language-learning environment that support vocabulary acquisition are not equally available to children across socioeconomic strata (Hoff, 2003, p.1375). Researchers have examined maternal speech to determine how this may differ according to SES. Hoff (2003) analysed the speech of 63 mothers to their infants (age range 16-31 months) in dyadic interactions, half of which were high-SES families and 30 were mid-SES families. The high-SES mothers were found to produce a higher number of utterances than mid-SES mothers, had a higher number of word tokens, a longer mean length of utterance, used more word types, and made more topic-continuing replies to their infant. These differences in maternal speech were found to fully account for differences observed between children's productive vocabulary growth in children from high-SES families and those from mid-SES families.

Similarly, a comparison of the language used at home by parents when talking to their young infants in low- and high-income families, found large differences in the amount of words spoken by parents (Hart & Risley, 1995, 1999). Children from higher income families were exposed to higher numbers of spoken words than the children from the lower income families, and this was found to impact upon children's school performance even at the age of nine. Furthermore, low-SES mothers have been documented to use language that is more controlling and less intellectually stimulating than mid-SES mothers (Lacroix et al. 2002). Hoff-Ginsberg (1998) also found that less advantaged parents tend to talk less and use fewer different words with their children, and Huttenlocher et al. (1991) found that children of parents who speak with them more show a faster growth of vocabulary over time.

Therefore, children from lower-SES families may be at risk of slower vocabulary acquisition due to exposure to less verbal input. Nittrouer and Burton (2005) propose a mechanism by which deficits in early language experience can affect later language abilities, suggesting that delays in the acquisition of speech perception strategies are related to delays in accessing phonetic structure, which appears in turn to negatively affect the ability of children to store and retrieve language in working memory. This results in children having impaired language processing skills and syntactic delay.

While it is clear that there is a strong relationship between social background and the language environment of infants, it is important to avoid the assumption that low-SES mothers are necessarily less able to contribute to their child's language development. In a sample of low-income mothers, Weizman and Snow (2001) report considerable quantitative and qualitative variation in vocabulary exposure, in terms of both the amount of lexical input and the richness of that input (as measured by the proportion of low-frequency words used) in interactions between mother and child. A strong relationship was found to exist between early exposure to more sophisticated vocabulary at home and later vocabulary performance at school, with small differences in early exposure predicting large differences in later vocabulary performance. This research elucidates the variation within a low-income group, contradicting the assumption that low-income mothers are necessarily less able to contribute to their child's vocabulary development.

While accepting that much variability does exist within SES groups, the impact of family income and education on maternal speech are strong and this difference in verbal input does account for significant differences in infants' subsequent language development. Features of the infants' linguistic environment that are known to contribute to verbal language development include the quality and quantity of both speech and gesture. Therefore, the next question is whether SES has the same impact on maternal gesture as it does on speech and does this have the same contribution to children's language?

Rowe and Goldin-Meadow (2009) examined whether gesture could account for SES related differences in children's vocabulary development. A positive relation was found between parent and child gesture, with higher-SES mothers using more gesture types with infants when infants were 14 months. The number of gesture types that children produced at 14 months was a significant predictor of children's vocabulary at 54 months. Therefore, the effect of SES on child vocabulary is mediated by children's gesture use at 14 months, which is directly related to maternal gesture use. Rowe and Goldin-Meadow (2009) suggest that future research should explore the potential of encouraging parents and children to gesture. This is precisely addressed by this thesis in an evaluation of the impact of encouraging a sample of low-SES mothers to use gestures with their infants.

The linguistic environment that infants are exposed to impacts upon their language development and varies as a function of SES. One factor that may contribute to SES related differences in maternal speech and gesture is the type of communicative activities that mothers and infants engage in, as this is likely to contribute to the language input that infants are exposed to. Different activities that mothers share with their infant will elicit different levels of joint attention as well as varying amounts and type of verbal and gestural input. Not surprisingly, SES related differences have been reported in type of activity engagement, for example mothers with low verbal ability or education read to their children less than mothers of higher ability and education. Daily reading predicted children's subsequent linguistic and cognitive abilities at 36 months (Raikes et al. 2006). The context of book reading is likely to elicit a high amount of gesturing; therefore, it may be the rate of gesturing that mediates the relationship between book reading and language development.

Taken together, the research described identifies that it is the quality and richness of the infants' linguistic environment that mediates the relationship between SES and subsequent language proficiency. Cognitive deficits do not account for the impact of SES on language (Locke et al. 2002). Furthermore, theoretical models (the Family Stress Model, Conger et al. 1992, 1993, and the Investment Model, Linver et al. 2002), while offering plausible accounts of how social class impacts holistically upon the family environment, neglect to pay attention to the linguistic input that children are exposed to, a factor known to be of great importance for language development. The way in which mothers communicate with their infants varies as a function of social class (e.g. Hoff, 2003). Gesture has been identified as an important feature of this communication (e.g. Rowe & Goldin-Meadow, 2009) and may offer a medium by which parent-infant interaction be enhanced to benefit infants' language growth.

Psychologists have begun to explore the impact of encouraging gestured communication in pre-verbal infants. While infants are at the stage where they can only say one word, they can convey substantially more through gesture (Iverson & Goldin-Meadow, 2005; Özçalişkan & Goldin-Meadow, 2005) and do so with communicative intent (Liszkowski, 2008). This leads to the question of whether gesturing can be encouraged to allow more sophisticated gestural communication, which matches infant's mentalising abilities and surpasses their verbal skills in order to enhance infants' language development and reduce the discrepancy in the language abilities of children from different social backgrounds. Before describing research that has attempted to evaluate the impact of encouraging gesture use, the mechanisms by which gesture may exert its effects on language development will first be discussed.

1.2.4. How is Gesture Implicated in Language? An Overview of the Functional, Biological and Evolutionary Connections Between Gesture and Speech.

Gestures clearly play a critical role in language development and are an indicator of the infant's early communicative competence. There is a developmental link between stages of development observed in both modalities, speech and gesture (for a comprehensive overview see Bates & Dick, 2001), and gesture precedes and signals oncoming verbal accomplishments (e.g. Iverson & Goldin-Meadow, 2005). It is not just the gestures that infant produce, but also the gestures that infants are exposed to that have been indentified as an important feature of the child's early language environment that contribute significantly to the child's language development. Infants whose language environment is gesture-rich reap the benefits from these gestures and as a result make significant gains in their language abilities

(Namy & Nolan, 2004; Rowe et al. 2008). Furthermore, the rate of maternal gesturing has been found to be impacted by family SES. Higher-SES mothers produce more gesture types and this is positively correlated with infant gesture use, which then in turn, predicts vocabulary (Rowe & Goldin-Meadow, 2009).

So why are gestures related to word learning? The facilitative nature of gesture in language acquisition may be explained by the social role of gesture. By sharing attention on a third activity, such as a gesture, mother and infant are engaging in joint attention, or secondary intersubjectivity (Trevarthen, 1998). Joint attention is known to contribute significantly to the learning of the meanings of words (Bruner, 1978). The amount of time infants spend in joint engagement with their mothers is highly correlated with their later vocabulary (E.g. Tomasello & Todd, 1983; Smith et al. 1988) and this is because episodes of joint attention play host to verbal labelling. Gesture is likely to be implicated in word learning because by pointing to a referent, the child elicits verbal labelling from the parent (Goldin-Meadow, Goodrich, Sauer & Iverson, 2007). In this way, the child can be thought of as directing their language-learning environment, inviting appropriate verbal input for items that they possess a concept of and are interested in. This is in-line with a social-interactionist view of language acquisition, which considers adults to play an important role in the development of language with much emphasis placed on the language-learning environment, rather than innate structures (E.g. Bruner, 1983; Farrar, 1990)

In addition to inviting labelling, gesture may serve a further facilitative function by "providing children with an early way for meanings to enter their communicative repertoires" (Rowe et al. 2008, p.196). Indeed, children's gestures actually predicted what words would enter their verbal vocabulary, suggesting that at a time when children cannot yet say a specific word, they possess a concept of that referent and are able to express this using gesture (Iverson & Goldin-Meadow, 2005). Therefore, gesture is likely to advance word learning in the following way: Items first appear in gesture because this modality is more accessible, mothers translate these gestures verbally, thus scaffolding infants' emerging verbal ability. This suggests that if encouraging parents to gesture more with their infants is likely to enrich the child's language learning environment. In turn this would elicit more gesturing from infants, which has the potential to facilitate infants' language acquisition in the way described.

However, while the gestures that adults produce appear to directly impact upon infants' gestures and subsequent language growth, this is not necessarily indicative of a crucial role of parental input in language acquisition. There is evidence in children's gestures to support an inborn component to children's language, whether that language be spoken or signed. Deaf children born to hearing parents who do not, for whatever reason, expose their children to sign language, have no access to a usable language model, i.e. speech or sign. However, these children have been well documented to create their own system of effective communication, which is referred to as "homesign" (e.g. Padden & Humphries 1988; Frishberg, 1987). When analysed, these homesign systems were found to be structured in language like-ways (Goldin-Meadow, 2003). These homesign systems are not imitations of parent gestures and are similar across cultures (Goldin-Meadow, Mylander, & Franklin, 2007). Therefore, "children thus seem predisposed to impose word-level structure on their communications and will do so even when such structure is not modelled in their input" (Goldin-Meadow et al. 2007, p.132).

Because gesture has the capacity to contain grammatical like structures, this supports Chomsky's theory of language acquisition, and his notion of Universal Grammar. According to Chomsky, infants are born equipped with an innate set of principles and adjustable parameters that are common to all human languages. The presence of Universal Grammar in the brains of children is said to allow them to deduce the structure of their native languages from the linguistic environment, therefore, "Language is not learned, but grows" (Harley, 2008, p111.). The linguistic input is still important, but it is the innate structure that drives the acquisition of language.

Neurophysiological evidence demonstrates that the link between gesture and speech is not merely a surface one; rather speech and gesture may share both a biological and an evolutionary basis. Pioneering work by neurophysiologists in the last two decades have identified 'mirror neurons' in the brains of monkeys which fire both when the animal performs a particular object-related action and also when the animal observes another individual perform a similar action (for a comprehensive review refer to Rizzolatti & Craighero, 2004). In humans, the area identified to be homologous to the monkeys' mirror neuron system is found close to Broca's area, the area in the brain associated with speech. These discoveries suggest "individuals recognize actions made by others because the neural pattern elicited in their premotor areas during action observation is similar to that internally generated to produce that action" (Rizzolatti & Arbib, 1998, p.190).

Therefore, when we see a gesture being performed by another individual, the same neurons fire in our brains as if we had performed that gesture. This reciprocity of gesture has led researchers to speculate about the function of the mirror neuron system and mirror neurons have been proposed to be implicated in empathy (Wicker et al. 2003), intention understanding (Gallese & Goldman 1998), imitation and action understanding (Rizzolatti et al. 2001). Furthermore, it has been suggested that language may have evolved from the mirror neuron system. According to researchers such as Corballis (2002) language evolved from gestural communication, and this view is supported by recent mirror neuron research. Rizzolatti and Arbib (1998) propose that humans developed language as a consequence of the fact that the Broca's area of the brain was endowed with a mechanism for recognising actions made by others, the mirror neuron system. This notion is consistent with the view of Bates who argued that language developed and was overlaid on areas of the brain originally evolved to do more basic kinds of sensorimotor work (Corballis, 1999).

Therefore, a robust argument for gesture as the foundation of human language has emerged. Gesture is prominent in infant's early language acquisition and gesture takes on the form of language in the absence of a usable language model (Goldin-Meadow et al. 2007). The role of gesture in language development is therefore not entirely dependent on the input that the child receives in his or her linguistic environment, however, the child's language development can be enhanced by the gestures that they are exposed to, as demonstrated by Namy and Nolan (1999), Rowe et al. (2008) and Rowe and Goldin-Meadow (2009). This leads to the question of whether the role of gesture in language development can be maximized by encouraging gestures in early mother-infant communication.

1.2.5. The Impact of Encouraging Infants to Gesture

The impact of using gestures to communicate with children was first documented in studies of hearing children born to deaf parents, where gesture use was shown to enhance infants' language acquisition (Holmes & Holmes, 1980; Orlansky & Bonvillian, 1984; Folven, 1988). This prompted researchers to ask whether hearing children, with hearing parents, would reap similar linguistic advantages from being taught to gesture before they could speak.

When parents were trained to use gestures with their infants, the infants were found to be able to name items in gesture before the onset of speech (Goodwyn & Acredolo, 1993). On average, infants were reported to produce their first symbol in gesture at 11.94 months and their first verbal symbol appearing later at 12.64 months. Comparisons were made of the ages at which subjects reached the five gesture and five vocal symbol point, revealing only a very slight difference, with the mean age for this milestone being 13.55 months for gestures and 14.28 months for words, suggesting a limited gestural advantage. Interestingly, maternal education emerged as a key factor that contributed to whether infants displayed a gestural advantage.

Mothers of infants who showed a gestural advantage in their acquisition of symbols, had significantly higher education levels than mothers of infants who either displayed no modality advantage, or demonstrated a verbal advantage. One explanation for this is that the highly educated mothers would be more heavily invested in the study and would be more likely to model the gestures more frequently. However, parental reports of modelling frequency revealed no difference. Although, the extent that self-reported data can be relied upon is questionable. Goodwyn et al. explore another possibility, drawn from research conducted by Pederson et al. (1991) who found level of maternal education to be positively correlated with maternal sensitivity.

Specific characteristics of sensitive mothering are important to the encouragement of language development. These include features such as a mother noticing when her infant smiles and vocalises, and arranging her location so that she can perceive her infant's signals and waits for her infants' response in interactions. Goodwyn et al. suggest that these characteristics of sensitive mothering could easily contribute to more gesturing by infants. However, as described in the previous section, recent research by Rowe and Goldin-Meadow (2009) demonstrated strong links between maternal SES and rate of gesturing. While Goodwyn et al. measured the modelling of the target gestures by mothers they did not account for the overall amount of maternal gesturing, therefore it is a possibility that the more educated mothers actually produced more gestural labels overall than the less educated mothers and this directly contributed to infant gesturing.

While there appears to be a tendency for gestural symbols to appear earlier than vocal symbols, this leads to the question of whether the production of a symbol in the gestural modality predicts the production of that same symbol in the spoken form. This question was addressed by Iverson and Goldin-Meadow (2005) who found that on average, children produced a gesture for a particular object around three months before they produced the word for that object. This gestural advantage existed in the absence of gesture training, therefore what can be claimed of the advantages of encouraging symbolic gesturing in infants?

To date, there is a paucity of research that has evaluated the effect of encouraged gesturing. It has been suggested that encouraging symbolic gesturing in infants boosts verbal language development (Goodwyn et al. 2000). However, infants whose parents were encouraged to model symbolic gestures to them only scored higher than control infants on selected measures of expressive and receptive language at 15, 19 and 24 months of age, suggesting a limited benefit of gesture training. Furthermore, this study was fraught with methodological weaknesses further limiting the positive conclusion drawn. Indeed, a recent review of 17 studies into gesturing with infants questions claims for the benefits of gesturing to infants on development (Johnston, Durieux-Smith & Bloom, 2005). They point to serious and widespread shortcomings in methodology, for example none of the 17 studies had used randomized-controlled trials and many lacked adequate comparison groups, had small sample sizes and poor follow-up. Most failed to monitor whether infants used the gestures.

A rigorous scientific evaluation of the impact of gesturing with infants should address the methodological flaws of previous work. Recruitment procedures and allocation to intervention condition should be clearly reported, ideally with infants being randomly assigned to condition to provide a randomised control trial (RCT) of a gesturing intervention. The inclusion of a verbal training group is important to account for the increased focus that parents will be paying to individual words and infant language, and this group's data should be included in all analyses. Children spontaneously gesture, therefore the gestures of children in the control conditions should be taken into consideration, and compared with the gestures of children in a gesturing intervention, in order to evaluate the added benefit of encouraging gesture additive to the robust presence of gesture in children's early language. While the implementation of an RCT design will minimise potential confounding variables between groups, it would still be worthwhile to account for individual gains made by infants, as group comparisons do not fully account for the great amount of variability inherent in infant development.

The findings of Goodwyn et al. (2000) suggest a limited advantage of gesture training that do not extend beyond the infants' second year. Does this mean that if any benefits are to be had of encouraging gestured communication, that these are limited to infancy and do not extend to childhood? Acredolo & Goodwyn (2000) attempted to address this question in a study in which they followed up the infants from the longitudinal study some years later when they were in the second grade of school (when they were around seven years of age). However, the sample suffered a high attrition rate, with only 19 of the 32 gesture-trained infants and 24 of 37 control children followed up. Furthermore, the infants that had completed the verbal training intervention were not included in the follow-up study. The children were assessed using the Wechsler Intelligence Scale for Children, 3rd. ed. (WISC-III). The gesture-trained infants were found to outperform the control children on full IQ and on the verbal and performance subscales. The extent to which these differences can be attributed to the gesture intervention is highly questionable.

Though the study addresses a valuable question of the longer term, wider benefits of gesturing with infants, methodological flaws that undermine the positive conclusions drawn by the authors. The original study does not report whether infants were randomly allocated to condition, therefore the differences in the children's development cannot be attributed to the intervention children experienced, as there is no way of knowing whether the sign infants were more cognitively advantaged to start with (Johnston et al. 2005). The high attrition rate also makes any conclusions about group differences tentative at best. Furthermore, it would have been of worth to compare the effect of a gesture training and a verbal training intervention on children's development, however the VT children were not included in this study. The development of the children has not been observed from the age of two until the point of this study, when children are eight years old. Within these six years children would have undergone a large amount of changes and innumerable factors are likely to have contributed to their cognitive and linguistic growth. Assuming that differences between these two groups of children are due to a gesturing intervention they experienced in infancy is widely speculative.

1.2.6. Are There any Wider Non-Linguistic Benefits of Gesturing With Infants?

By encouraging mothers to use gestures with their pre-verbal infants this is likely to change the way that mothers both communicate with, and how they perceive their child. By sharing a manual system of communication, mothers may be in a better position to be able to share understanding with their infant, have insight into the infants' needs and feelings, and as such respond contingently. This is likely to have wider, non-linguistic benefits for mother and baby.

How a mother responds to her infant's signals and communications and her ability to interpret these signals correctly and act on them appropriately is referred to as 'maternal sensitivity'. As defined by Mary Ainsworth, the sensitive mother is able to see things from her baby's point of view. She is tuned in to receive her baby's signals: she interprets them correctly, and she responds to them promptly and appropriately (Ainsworth, 1971). It is likely that by encouraging mothers to use gestured communication with their infants, maternal sensitivity may be increased as mothers are encouraged to focus on their infants' subtle communicative attempts and to attribute meaning and intention to them and respond to them positively and contingently. This has the potential to have wider benefits for mother and baby, indeed maternal sensitivity has been demonstrated to be related to levels of infant frustration. Bell and Ainsworth (1972) found that contingent responses by mothers were associated with less infant crying in the first months of life. Furthermore, these infants subsequently produced clearer and extensive communicative acts at ages 9-12 months. Therefore, if gesturing can encourage maternal sensitivity this in turn may reduce infant frustration. This relationship is possibly mediated by more effective infant communication.

It is the appropriateness of a mother's response, over and above the response itself, that appears to be the key factor. By sharing a gestured system of communication, mothers may be in a better position to be able to share understanding with their infant, have insight into the infants' needs and feelings, and as such respond contingently. It is when mothers are not able to appropriately interpret her infants' vocalisations and behaviours to understand what her babies' needs are, that frustrations (on the part of both parent and child) are likely to arise. Gesturing with babies encourages mothers to view their young pre-verbal infants as communicative partners. As such, mothers are more likely to be willing to attribute meaning to her infant's early vocalisations and hand waves. In so doing, they utilise 'maternal mind-mindedness', defined as a mother's "proclivity to treat her infant as an individual with a mind rather than merely as a creature with needs that must be satisfied" (Meins et al. 2001. pg 638). Mind-mindedness as a construct was evolved from the original definition of maternal sensitivity (Ainsworth, 1971) and has been demonstrated to be a better predictor of infant-mother attachment security than maternal sensitivity (Meins, 1998; Meins et al. 2001). Links have been demonstrated between maternal mind-mindedness and children's later understanding of others' mental states, i.e. theory of mind. (Meins, Fernyhough, Wainwright, Gupta, Fradley & Tuckey, 2002).

Parents who gesture with their babies may develop greater maternal mind-mindedness through viewing the infant as a conscious individual with the ability to express wants, needs and desires. Better understanding of how gesturing with babies can change maternal views and experiences could lead to the use of gesture as a vehicle to support and encourage maternal mind-mindedness, the social benefits of which have been demonstrated to extend long beyond infancy (Meins et al. 2002).

Although little research has been conducted in the area of the socio-emotional consequences of encouraging gestural communication, preliminary findings are emerging to suggest that gesturing may enhance the mother-infant relationship and reduce both maternal and infant frustration. Vallotton (unpublished thesis) evaluated the impact of a gesture training intervention programme on the relationship between mother and infant. Twenty-nine families who were part of the Early Head Start programme (A US federally funded community-based program for low-income families with infants and toddlers) participated. Sixteen of the families received a symbolic gesturing intervention for seven months. The study aimed to address whether the gesturing intervention would result in changes in parent-child interactions and whether these changes would impact upon infants' social and language development and parents' stress and perceptions of their child. Parents completed the Parental Stress Index (Abidin, 1994). The PSI is a self-report questionnaire that is designed to identify dysfunctional parenting and predicts the potential for parental behavior problems and child adjustment difficulties within the family system. The PSI yields a total stress score, plus scale scores for both child and parent characteristics, which pinpoint sources of stress within the family.

The results indicated that parents who gestured with their infants were more satisfied with the relationship with their infant. Furthermore, a correlation was found between satisfaction of relationship and the number of gestures produced, therefore the positive perception of the infant relationship is directly related to gesturing. Vallotton suggests that infants' gesturing allows the mother to be able to interpret her baby better, respond better and so have warmer feelings about her baby.

Upon closer inspection, an analysis of the dyadic interaction between mothers and babies revealed that the gesturing mother-infant dyads experienced fewer episodes of distress for the child, demonstrated more appropriate maternal responses to the child's distress cues as well as a higher degree of affect attunement between mother and child. These findings suggest that gestures offer mothers insight into their infant's behaviour, and as such find it more acceptable and have a greater appreciation of the mental and relational capacities of their child. Therefore, gesturing with infants demonstrates benefits that extend beyond the verbal domain. Whether this is a robust finding and not particular to this small sample of low-income parents is open to question. The participants of the Vallotton study were already part of a community-based intervention; therefore, it is difficult to disentangle the effects of gesturing from those of the intervention in general. This thesis is able to address this issue with a sample of parents who have participated in a randomised control trial evaluating the impact of gesturing.

1.2.7. Theoretical Motivation for the Impact of Gesture on Language Learning

Why would gestures be expected to have an impact on the acquisition of language? Three main points are identified to argue why gesture (and specifically symbolic gestures rather than deictic gestures) are likely to support language learning. Firstly, infants can use gesture at a time when they cannot access the verbal modality. Secondly, representational gestures support symbolic development because they are context-free. Finally the motoric nature of gesture facilitates word learning. Each of these points will be discussed in turn.

At a time when infants are capable of symbolic representation, their articulatory and phonological skills are still maturing, yet their manual development is advanced (Acredolo & Goodwyn, 1988; Iverson & Thelen, 1999). Children typically produce their first words around the time of their first birthday (Nelson, 1973), yet in the months leading up to this milestone, infants actively communicate with their hands and indicate items with gesture (e.g. Volterra, et al. 1979). Infants begin pointing around the age of ten months (e.g. Bates, Camaioni, and Volterra, 1975) and from the age of around 12 months infants' gestures become more sophisticated and take on the form or function of items, for example pretending to drink from an empty cup (Volterra et al. 1979). Gesture offers infants an accessible way to attach labels to their developing mental representations of objects and concepts in their environment. Thus, encouraging infants to produce symbolic gestures is proposed to allow them a means to express and practice their symbolic representations in advance of vocal developments.

Symbolic gestures can communicate information about a referent independent of context, functioning as 'gestural names' (Volterra et al. 1979). As such these meaningful gestures are likely to offer infants a greater advantage over and above pointing. Deictic gestures are relevant only to concrete affiliates; mothers can only point to what is there. Whereas, symbolic gestures can represent abstract concepts in a meaningful way, as they map onto the semantic content of the accompanying word. At a time when pre-verbal infants are developing connections between mental representations and labels, the degree of similarity between the gesture and the concept may serve to reinforce the connection between the word and the referent.

The motoric nature of gesture is also likely to contribute to the benefits of gesture in word learning. Expressing a symbol in gesture may produce stronger and more robust memory traces. Children understand stories better if they physically enact them (Glenberg et al. 2004) and children's learning of new concepts has been demonstrated to be more longer lasting if they were encouraged to gesture at the point of instruction (Cook, Mitchell & Goldin-Meadow, 2008). Gestures have been suggested to "tap visual and/or proprioceptive sensory memories of an object experience" (Capone, 2007, p.741). Gesturing may enrich the infant's representation of an object or concept thus supporting symbol formation. The similarity between symbolic gestures and the referents' form or function may enrich the infants' mental representation of that referent and offer a spatio-motoric route to language learning.

1.3. Conclusion

Gestures are integral to language. Throughout language acquisition, striking parallels are observed between the hand and the mouth, with verbal milestones being mirrored in the manual modality. Children's gestures are demonstrated to both precede and predict speech (e.g. Iverson & Goldin-Meadow, 2005; Özçalişkan & Goldin-Meadow, 2005). The child's language learning process takes place in an environment laden with verbal and nonverbal information and the gestures that infants are exposed to that have been indentified as significant contributors to language development. Infants whose language environment is gesture rich reap the benefits from these gestures and as a result make significant gains in their language abilities (Namy & Nolan, 2004; Rowe et al. 2008).

It has been suggested that the role of gesture in language acquisition can be maximised to enhance language development through the encouragement of gesture in pre-verbal infants. It has been claimed that teaching pre-verbal infants simple gestures for basic objects and concepts has a positive impact on children's linguistic and cognitive skills (Goodwyn et al. 2000; Acredolo & Goodwyn, 2000). However, this and other such research is fraught with methodological weaknesses, as highlighted by a recent meta-analysis of research evaluating the effect of gesturing with infants (Johnston et al. 2005). Therefore, the evidence on whether encouraging hearing infants to communicate manually has any benefits for language development is still inconclusive and this has motivated the studies that will be presented in this thesis.

The majority of the parents in the few studies conducted to date examining the impact of teaching preverbal to communicate have been middle class, highly educated and heavily invested in the study (e.g. Goodwyn et al. 2000). This raises the question of the importance of factors including parental motivation and socio-economic status in determining the impact of gesturing interventions on language.

As the literature review has described, SES is highly related to infant language development and this relationship is mediated by the quality of the child's linguistic environment (e.g. Hoff. 2003). In particular, gesture has been identified as an important feature of the input that children receive that has the potential to boost infant's word learning capacities (Rowe & Goldin-Meadow, 2009). Preliminary research on gesturing interventions, though limited by methodological flaws, do suggest limited benefits of gesturing with infants (Goodwyn et al. 2000). This research has been conducted with middle class families, as such these infants are anticipated to be exposed to a plentiful linguistic environment anyway. For those children born into lower-SES families, a gesturing intervention is likely to have more benefit to them, as their linguistic environment has been identified to be less rich than those of children from higher-SES backgrounds.

By enhancing the early communication between mother and infant through gesture, the discrepancy between high and low income families in terms of children's language development can potentially be reduced. A further factor to be considered is that of motivation. Mothers participating in the Goodwyn et al. study for example, having committed to investing their time and efforts into in a longitudinal investigation are likely to have perhaps performed in ways that are not representative of how mothers would behave outside the setting of an experiment, and may have been subject to participant bias. Furthermore, as Goodwyn et al. do not report procedures for allocation to condition, the possibility that mothers self-selected themselves to take part in a gesturing intervention is an issue. Indeed, outside of the laboratory, many of the positive claims of Baby Sign come from parents who have purchased a commercially available programme, and as such are equally motivated to find support for the benefits of gesturing with babies.

The commercial potential of gesturing with babies is already being exploited across the globe. Referred to as 'Baby Sign', numerous courses, books and DVDs are available to parents to purchase from a number of different Baby Sign companies, including Sign with your Baby, Sing and Sign, TinyTalk, Baby Signs and Simply Signing. Extensive claims are made by such Baby Sign companies to suggest that

Baby Sign not only accelerates infant's language development but that gesturing with a baby reduces infants' frustration by giving them an effective, pre-verbal means of communicating their wishes. Preliminary findings are emerging to suggest that encouraging gestural communication between parent and infant does reduce infant stress (Vallotton, 2006).

Given the large numbers of parents who are persuaded by the claims of commercial baby sign programmes it is important to test these claims empirically. If gesturing with babies can be reliably demonstrated to reduce parental stress then it has the potential to produce profound and lasting benefits. This may provide a means for parents and health care workers to provide early support to mothers who have difficulties coping and those with 'at risk' infants.

Therefore, this programme of research will attempt to address the following questions:

1. Can encouraging preverbal hearing infants to communicate manually with gestures benefit verbal language development?

2. Is gesture training as effective when parents have not made a financial investment and the family background poorer?

3. What are the wider non-linguistic benefits of gesturing with infants?

1.4. Programme of Research

In order to address these questions, the research programme takes three complementary approaches to the studies. A longitudinal study evaluated the impact on language development of training infants to use gestures from a pre-verbal age. Measures were chosen to assess infants' developing receptive and productive vocabulary, expressive and receptive language abilities and gesture development. The longitudinal study was carefully designed to avoid the methodological weaknesses of previous research in this area. Forty mother-infant dyads were randomly allocated to one of four conditions and followed longitudinally for one year. Two gesture-training conditions and two control conditions were included. In the gesture-training conditions, parents were trained to use either a set of twenty BSL or symbolic gestures with their infants. In the Verbal Training control condition, parents were equipped with the same target words and were instructed to model these at a high frequency with their infants. The non-intervention control group received no special instruction and provided a baseline comparison. Chapter Two presents the impact of gesture training on measures of language development between the ages of 8 and 20 months. The mothers who participated in the longitudinal study are the focus of further investigation in the second chapter, where the wider linguistic and non-linguistic outcomes of gesture training are explored using qualitative and quantitative methods. The final chapter addresses the issue of socio-economic status and applies gesture training in a Sure Start children's centre setting.

Chapter 2. A Longitudinal Evaluation of the Effect of Encouraging Gesture on Infant Language Development

2.1. Introduction

The close interrelationship between speech and gesture points towards a facilitative role of encouraged gesturing in language development, yet this receives only weak support from empirical research. Research that has attempted to measure the impact of encouraging infants to gesture is undermined by widespread methodological shortcomings (Johnston, Durieux-Smith & Bloom, 2005). The study presented here aimed to address these shortcomings by conducting a methodologically rigorous longitudinal investigation. The main research question was whether exposing infants to, and encouraging them to use a target set of gestures would benefit language development. This study will contribute to existing knowledge of the role of gesture in early language development and has great implications for informing mothers of the worth of gesturing with infants. Before presenting and discussing the results, this chapter will:

- Define how the term ‘gesture’ is used and what it refers to in this study
- Discuss how encouraging gestures is anticipated to impact upon language development
- Consider the methodological issues that an evaluation of a gesture intervention must address
- Detail the selection of measures

2.1.1. Definition of Gesture

Before discussing the impact that enhanced gesturing may have on infant language development, it is important to first clarify how the term 'gesture' is being used in this study. Within the literature, the labels used for gestures are not homogeneous. The gestures that infants produce that resemble in form or function the referent have been described as representational gestures (e.g. Capirci, Iverson, Pizzuto & Volterra, 1996), characterising gestures (e.g. Goldin-Meadow & Mylander, 1990), conventional gestures (e.g. Bates et al. 1979), referential gestures (e.g. Casadio & Caselli, 1989) and symbolic gestures (Goodwyn & Acredolo, 1992). For the purpose of the present study, the term 'representational gesture' was selected to be the most appropriate description of the gestures that form the focus of this study. These gestures are "content-loaded" and denote a precise referent and their basic semantic content remains relatively stable across time (Volterra, Casselli, Capirci, Pizzuto, 2005).

Commercial Baby Sign programmes teach mothers precise representational gestures to use with their infants. These symbolically represent specific objects or concepts, such as 'milk', 'hot' and 'where'. This study aimed to address whether encouraging infants to gesture would impact upon their language development. If enhanced gesture does influence infants' language, the next question is whether this effect is particular to a certain type and form of gesture. Commercial Baby Sign teaches mothers to use a specific set of gestures that they are told will benefit their infant. Some Baby Sign classes teach gestures taken from formal sign languages, such as ASL (Sign2me®) or BSL (TinyTalk), and others teach mothers symbolic gestures that were created specifically for use with infants (e.g. Baby Signs®). Does it matter what type of gesture infants are exposed to, or, will any gesture do? The design of the present study pre-empts this question by the inclusion of two types of gesture intervention. One group of mothers were taught to use BSL[1] and another group taught to use symbolic (Baby Sign®) gestures.

How do these two types of gesture differ? BSL signs can be as arbitrary as words in language, whereas symbolic gestures possess a high level of iconicity and can be easily understood by untrained observers. Symbolic gestures represent a feature or function of the referent. Meanwhile, although some of the BSL gestures are iconic, many are also arbitrary. This raises the question of whether the similarity between the gesture and the referent facilitates the infants' mapping of the gesture to the target, or whether infants will just as readily accept an arbitrary manual label.

Werner and Kaplan (1963) and Piaget (1962) argued that the ability to learn arbitrary symbols derives from an earlier ability to learn iconic ones. However, according to Bates et al. (1979) iconicity does not influence symbol acquisition because young children are not able to apprehend the similarity between the symbol and its referent. Consistent with the latter view, research has found that infants aged 18 months will just as readily map iconic gestures to referents as they will arbitrary gestures. However, at 26 months infants will only accept iconic gestures as labels. By the time that children are four years of age, they will just as readily accept iconic and arbitrary gestures as labels (Tomasello et al. 1999; Namy & Waxman, 1998; Namy, Campbell & Tomasello, 1994). Therefore, the role of iconicity in symbol learning appears to undergo a U-shaped change between 18 months and 4 years. More recent research suggests that infants aged 14 months do not recognise iconicity (Namy, 2008). However, the infants in the Namy (2008) study did demonstrate a trend to respond to iconicity. Furthermore, while the experiments claimed to test infants' ability to recognise iconic gestures derived from actions, the trial that the 14-month old infants were exposed to had the gesture introduction phase removed. Therefore, the degree to which young infants are sensitive to iconicity is uncertain.

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[1] While BSL is a signed language, the BSL signs are described here as gestures as they are not used as part of a language but as key-word symbols.

It has been argued that if iconicity does ease the mapping process for younger infants, then the earliest signs of deaf children would be those that are iconic. However, research has suggested that this is not the case (Orlansky & Bonvillian, 1984; Morford, Singleton & Goldin-Meadow, 1995). Yet, typically developing, hearing infants produce gestures that are iconic for communicative purposes, suggesting that they are in fact able to utilise salient features of a referent and replicate these symbolically in gesture. For example, infants from 12 months of age have been documented to produce symbolic gestures such as flapping the hands by their side to represent bird (Goodwyn & Acredolo, 1993). This challenges the argument that children lack the semantic knowledge to enable them to link iconic gestures to their referents (Brown, 1977; Bates et al. 1979).

Previous studies that have examined the impact of gesture training on infant language development have not considered the form of gestures that infants are encouraged to use. The question is, is it gesturing in general that facilitates language development or do the gestures need to take a particular form in order to have an effect? If infants are sensitive to the similarity between the gestures they are exposed to and the referent, then this is likely to aid the acquisition of these gestures as labels. By comparing infants' acquisition of BSL and symbolic gestures, this study will reveal any differences in how readily infants accept these gestures as labels, and how these gestures might differentially impact upon language development.

Overall, this study will evaluate the impact that encouraging infants to use representational gestures has on language development. In order to anticipate how enhancing this type of gesture might impact upon language, the role of gestures in language development will be described and the way in which increased gesture may impact upon children's developing expressive and receptive language abilities will be discussed.

2.1.2. How is Encouraging Gesture Anticipated to Impact upon Language Development?

Infancy is a period of great change and rapid language learning. From birth, infants communicate, using their bodies and their voices to gain attention from and interact with those around them. First words typically appear between 11 and 13 months and these first words are put into early sentence like constructions between 18 and 24 months. Gestures feature prominently in these early stages of language development and have been posited to play a facilitative role in this process. For example, before children speak, they gesture and these gestures predict what words will subsequently appear in children's spoken vocabularies (Iverson & Goldin-Meadow, 2005). With gesture playing such a considerable role in early language and naturally presaging verbal milestones, this leads to the question of whether the role of gesture can be maximised to accelerate gains in vocal language development.

Infants' early language development is reflective of increases in the domains of receptive comprehension abilities, expressive communication abilities and gesture production. The potential facilitative benefit of enhanced gesturing for each of these domains of development will be discussed.

2.1.2.1.Gesture and Comprehension

Gesture serves to promote comprehension and it does so at both the intrapersonal and the interpersonal level. The ways in which observing another's gestures facilitate infant comprehension and promote learning will be described here. Furthermore, the very act of gesturing promotes understanding within the individual and this will be discussed.

The Interpersonal Role of Gesture in Comprehension

The gestures that accompany speech directed to infants are modified (O'Neill et al. 2005; Bekken, 1989). Infant-directed gestures, or 'gesturese', has been characterised to be 'conceptually simple', consisting of points and conventional gestures that reinforce the information conveyed by speech (Iverson et al. 1999). These gestures serve to direct infants' attention and assist their comprehension. Infants' understanding of simple sentences is enhanced when speech is accompanied by gesture (Morford & Goldin-Meadow, 1992). Likewise, Zukow-Goldring (1996) found that if an infant had initially misunderstood a caregiver's message, caregivers would then direct the infant's attention to salient features of the context by pointing, resulting in promoted comprehension. Beyond infancy, children's comprehension continues to be aided by the combination of modalities (McNeil, Alibali, Evans, 2000; Kelly, 2001). For example, preschool children are able to comprehend complex spoken messages when they are accompanied by reinforcing gestures (McNeil, Alibali, Evans, 2001). Gestures have been suggested by McNeil et al. (2000) to support comprehension by offering a form of external support that "scaffolds" children's comprehension of spoken language.

The benefit of multimodal communication for comprehension depends on infants' sensitivity to gestural input. This requires joint attention, the triadic coordination of attention between self, other, and some third object, event or symbol (Tomasello, 1995). Joint attention provides a rich context for language learning and unsurprisingly is an important predictor of language abilities (Achtar, 2005; Tomasello & Farar, 1986). For example, the frequency of mother-infant joint attention predicts toddlers' subsequent vocabulary (Tomasello & Todd, 1983). Yet, it is important to note that language development is not critically dependent upon joint attention, as indicated by cross-cultural studies (Ochs & Schiefflin, 1984). However, in western culture, joint attention has been identified to contribute significantly to language development, and gesture has been identified as a key mechanism by which adults elicit joint attention with their infants. From as young as nine months of age, infants are able to follow adults' pointing gestures to attend to an object (e.g. Butterworth & Jarret, 1991). The positive relationship between amount of joint attention and language development can be explained in part by gesture. In a study conducted by Rowe, Ozcaliskan & Goldin-Meadow (2008), the number of gesture types that mothers produced within episodes of joint attention when infants were 14-months of age was related to the amount of gestures that infants produced. The number of gestures infants produced significantly predicted infants' vocabulary at 54 months. Therefore, the gestures that infants are exposed to in their early linguistic environment play an important role in scaffolding infants' verbal language development.

The Intrapersonal Role of Gesture in Comprehension

In addition to observing the gestures performed by someone else, the very act of gesturing has been demonstrated to aid an individual's understanding and facilitate learning. Gesture offers children an embodied way to represent cognition. Research has found that instructing a child to enact a story enhances their understanding (Glenberg et al. 2004) and instructing children to gesture as they recall an event enhances their memory for that event (Stevanoni & Salmon, 2005). Children who imitated the gestures of a teacher were more likely to succeed after instruction (Cook & Goldin-Meadow, 2006). Therefore gesturing aids comprehension and this serves to support learning and memory. In opposition to the view that language conveys meaning by using abstract, amodal, and arbitrary symbols (i.e. words) is the view that linguistic meaning is grounded in bodily action (e.g. Barsalou, 1999; Glenberg, 1997). According to Barsolou (1999) conceptual symbols are built from perceptual symbols. Perceptual symbols are collections of neural activity based on perceptual experience, therefore a developing symbol is enriched with visual, auditory, sensory information and it is this that gives a concept meaning. Therefore, meaning is grounded in action. Gestures offer an embodied way to develop links between the external environment and conceptual symbols.

Will Gesture Promote Infants' Comprehension Abilities?

Given what we know about the benefits of gesture for infant comprehension, if we enhance the number of gestures that infants are exposed to and encourage them to use these gestures, this is likely to support infants' receptive language development. The rationale is that by training mothers to use specific gestures with their infants, this will encourage them to initiate more episodes of joint attention with their infants.

Gestures have been speculated to enhance comprehension by providing external support to reinforce communication (McNeil et al. 2000). While deictic gestures have been demonstrated to support comprehension (Zukow-Goldring, 1996) and word learning (Rowe et al. 2008), will symbolic gestures offer infants a greater advantage? Deictic gestures are relevant only to concrete affiliates; mothers can only point to what is there. Whereas, symbolic gestures can represent abstract concepts in a meaningful way, as they map onto the semantic content of the accompanying word. For example, to perform the symbolic gesture for DRINK the hand takes the form of a cup with thumb protruded. This is a body-part-as-object gesture. At a time when pre-verbal infants are developing connections between mental representations and labels, the degree of similarity between the gesture and the concept may serve to reinforce the connection between the word and the referent.

Gesture may ease the burden of word learning by offering infants an accessible way to attach labels to their developing mental representations of objects and concepts in their environment. Where the gestures are semantically relevant to the object or concept (e.g. the eat gesture is a hand to mouth action as if bringing a piece of food to the lips), performing this gesture essentially means that infants are re-enacting the encoding context and this may enhance memory for that label (Tulving & Thomson, 1973). Furthermore, because gestures are relatively easy for infants to perform, this may reduce cognitive load and free resources which can then be expended elsewhere in the infant's cognitive system (Goldin-Meadow et al. 2001). In this way, the act of gesturing may enhance learning.

Furthermore, infants who have been encouraged to gesture in infancy use these gestures to initiate joint attention with their caregiver (Moore, Acredolo & Goodwyn, 2001). Therefore, gesture gives children a means to take charge of their linguistic environment. Gestures signal to their caregiver that infants wish to be engaged with and thus are likely to elicit verbal input. Therefore, encouraging infants to gesture may enhance their receptive language abilities by increasing the amount of maternal interaction that they receive.

The present study will evaluate the impact of enhanced gesture on infants' receptive language abilities and will explore whether infants of mothers who are gesture-trained demonstrate greater receptive language development compared to infants of mothers who are not gesture-trained.

2.1.2.2. Gesture and Expressive Communication

The acquisition of receptive skills serves as precursors to expressive skills (e.g. Bates, Bretherton & Snyder, 1988). Children's expressive verbal language emerges after nonverbal communication, with infants' gestures allowing them to communicate in advance of the development of speech. The role of gesture in early expressive communication abilities will be described, and the potential impact of enhancing gestures for productive language will be discussed.

Gestures Communicate

At a time when infants' articulatory and phonological skills are still maturing, their manual development is more advanced (Acredolo & Goodwyn, 1988) and this is likely to be a result of the well-practiced movements of object exploration (Iverson & Thelen, 1999). Children typically produce their first words around the time of their first birthday (Nelson, 1973), however in the months leading up to this milestone infants have been actively communicating with their hands and indicating items by gesture (e.g. Volterra, Bates, Benigni, Bretherton, & Camaioni, 1979).

Infants begin pointing around the age of ten months (Bates, Camaioni, and Volterra, 1975) and from around the age of 12 months infants' gestures become more sophisticated and take on the form or function of items, for example pretending to drink from a cup (Volterra et al. 1979). Unlike pointing gestures, these gestures can communicate information about a referent independent of context and so function as 'gestural names' (Volterra et al. 1979). Infants' early gestures greatly expand their communicative repertoire. For example, in a sample of 315 infants, the mean number of gestures produced by 11-13 month old infants was 29 compared to a mean number of eight words (Caselli & Casadio, 1995). Similarly, Volterra and Iverson (1995) found that when they counted the number of gestures children produced, gesture doubled their productive vocabulary.

Therefore, infants' spontaneous gestures allow them, from a pre-verbal age, to communicate about a wide range of items. By encouraging infants to gesture, this may increase their communicative repertoire in two ways. Firstly, infants will acquire the target gestures and so be able to communicate about these target items using gesture in advance of speech. Secondly, infants' gestural communication may be enhanced in general, increasing the number of overall gestures that they produce thus allowing them to communicate about a wider range of referents.

Gestures Predict Word Learning

Gestures not only serve a communicative function but they also play a role in the word learning process (Iverson & Goldin-Meadow, 2005). The frequency of pointing gestures that infants produce at 12 months of age correlates with the size of their subsequent vocabulary at 20 months of age (Bates et al. 1979). Furthermore, these gestures predict what words infants will later produce. Items that are indicated by infants' gestures, i.e. what they point to, subsequently appear in their spoken vocabularies (Iverson & Goldin-Meadow, 2005). What explains this striking connection between infants' gestures and early words? One possibility, suggested by Goldin-Meadow, Goodrich, Sauer & Iverson (2007), is that this relationship between pointing and vocabulary is mediated by maternal labelling. By indicating an item with gesture, the child elicits a verbal label from their mother, which 'translates' the child's gesture. In this way, the child controls her linguistic environment, encouraging her mother to provide labels for items of interest to the infant that the child is ready to learn.

Appearing somewhat later, around the age of 12 months, infants begin to produce gestures associated with specific items. Gestural names (Bates et al. 1979) are gestures that are often performed on objects, such as holding a toy telephone to the ear or pretending to drink from a cup. Evidence that these gestures are functioning as labels comes from the fact that these gestures are positively correlated with verbal naming, and children's first words and gestures are similar in content and meaning (Bates & Dick, 2002). Therefore, the connection between gestures and words that has been observed in children's deictic gestures continues as children produce more sophisticated representational gestures that convey substantial meaning and act as manual labels.

How Might Encouraging Gesture Impact Upon Expressive Language Abilities?

Gesture is a springboard into spoken language, providing the pre-verbal infant with a means to communicate and interact with her caregivers, as well as being a device to elicit verbal translation from caregivers. The child is ready to learn language and she is able to tailor her linguistic environment with her gestures, inviting language from her caregivers that is contingent with her focus and interest to generate input that she is ripe to receive. By encouraging pre-verbal infants to learn a target set of representational gestures, this will enhance the child's gestural repertoire, allowing them to communicate precisely about referents and be readily understood by caregivers. This ability may stimulate the infants' understanding of the social functions of language, as they will be able to share their thoughts and needs and elicit action from their caregivers.

This enhanced early expressive communication is suggested to lay the foundation for the development of more advanced expressive skills, including word learning. By having a manual label for an item, this may scaffold the infants' ability to map the verbal label onto the referent, as by using this manual label the child is likely to elicit verbal labelling from his or her mother, reinforcing the child's word learning.

The motoric nature of gesture itself may contribute to language learning. Expressing a symbol in gesture may produce stronger and more robust memory traces. Children understand stories better if they physically enact them (Glenberg et al. 2004) and children's learning of new concepts has been demonstrated to be more longer lasting if they were encouraged to gesture at the point of instruction (Cook, Mitchell & Goldin-Meadow, 2008). By equipping infants with a target gesture for a particular object or concept and encouraging them to use this, the act of gesturing may strengthen the developing mental representation. Gestures have been suggested to "tap visual and/or proprioceptive sensory memories of an object experience" (Capone, 2007, p.741). Therefore, the act of gesturing may enrich the infant's representation of an object or concept thus supporting symbol formation.

The present study will evaluate the impact of encouraging pre-verbal infants to gesture on infants' communicative abilities and subsequent vocabulary at the general and specific level, addressing the following questions:

- Does encouraging infants to gesture enhance their non-verbal and verbal communicative abilities?
- Will infants who are encouraged to gesture have greater spoken vocabularies than infants who are not gesture trained when aged 12, 16 and 20 months?
- Will being able to communicate about a target set of referents using gesture accelerate the appearance of these items in infants' speech?
- Will the effects of gesture training differ depending on whether BSL or symbolic gestures are used?

2.1.2.3. Gesture Development

By encouraging infants to communicate using gesture, this could generally increase infants' gesture use. This is because from a young age, infants will learn that they can effectively communicate manually, therefore they may make more use of communicative gestures. Furthermore, because the gestures themselves are symbolic, this may encourage infants' symbolic functioning, i.e. the meaningful use of sensorimotor actions apart from their usual objective (McCune-Nicolich, 1981). As such, one might expect that because infants are well accustomed to using symbolic gestures to represent objects and concepts (such as lifting an empty hand to the mouth to represent 'drink') then they may engage in more pretend or symbolic play. Researchers have argued that both play and language development is reflective of the infants' ability to manipulate symbols (Piaget, 1962; Werner & Kaplan, 1963). Indeed, symbolic play has since been well documented to be related to early language development (e.g. Casby and Corte, 1987). Therefore, encouraging gesture may not only enhance gesture production overall, it may also impact upon infants' symbolic play development which in turn would be expected to contribute to their language development. This study will evaluate the impact of enhanced gesture on overall gesture development and use of symbolic actions and play to address the questions:

- Does gesture training result in an increase in overall gesturing at 12 months through to 20 months?
- Does gesture training increase infants' production of symbolic actions and play at 12 months through to 20 months?
- Does the amount of gestures that children produce relate to their verbal language development at 12, 16 and 20 months?

2.1.3. The Present Study

Overall, the aim of the present study was to encourage infants to communicate using gestures from a preverbal age and to evaluate the impact that this had on their subsequent language development. Previous research has begun to assess the impact that gestured communication has on infants' subsequent language development (e.g. Goodwyn et al. 2000). However, previous studies, as mentioned, have some methodological flaws. A recent review by Johnston et al. (2005) draws attention to the methodological shortcomings of research that has evaluated the impact of gesturing with infants.

Johnston et al. identified 17 studies in which outcome data had been collected from infants and children who had received gestural sign training as pre-lingual infants. Of the 17, only eight were original research studies, with seven studies being secondary analyses of the original data. For two studies it was unclear whether the research was original. Five of the studies were case studies (Holmes & Holmes, 1980; Gregory, 1994; Capirci et al. 1998; Pettito et al. 2001; Holowka et al. 2002) and as such are limited in their value for assessing the claims of gesture training as they lack a comparison control. Eleven of the studies emanated from four prospective cohort studies conducted by one of two pairs of researchers; Bonvillian and Orlansky, and Acredolo and Goodwyn. The studies reported by the Bonvillian and Orlansky research group (Bonvilillian et al. 1983a; 1983b; Folven, Bonvillian & Orlansky, 1984; Orlansky & Bonvillian, 1984; 1988) were based on convenience samples and were limited by their lack of comparison with matched or randomly selected control groups. Furthermore, the generalisability of their findings is questionable given that the infants in their studies were born to deaf parents who were fluent signers. Acredolo and Gooodwyn do not report in any procedures for recruitment or assignment to condition (Acredolo & Goodwyn, 2000; Goodwyn & Acredolo, 1993; 1998; Goodwyn et al. 2000; Moore et al. 2001).

Overall then, none of the 17 studies included in the review had used randomized-controlled trials and many lacked adequate comparison groups, had small sample sizes and poor follow-up. Most failed to monitor whether infants used the signs or the extent to which mothers understood and correctly used the signs. Furthermore, previous research has not considered the importance of the type of gesture that infants are encouraged to use. This leaves open the question of whether the form of the gesture impacts upon children accepting that gesture as a manual label and the subsequent effects that gesturing had on language development.

The present study evaluated the impact on language development of gesturing with infants in a longitudinal study that aimed to overcome the methodological shortcomings of previous research. The key methodological considerations in the design of this study will be described and discussed in turn, and will be addressed under the following headings:

- Allocation to condition
- Interventions
- Optimum age to expose infants to gesture training
- Measures

Allocation to Condition

To scientifically evaluate a gesture intervention, randomised control groups should be used to control for confounding variables, ensure equivalence of groups and to avoid selection bias. The lack of randomised control trial (RCT) studies is lamented in the review of gesture evaluations by Johnston et al. (2005). Opting to participate in a particular condition creates a bias issue, as mothers' motivation to choose a certain condition may be correlated with traits that affect the study, making the participants a non-representative sample. Furthermore, if a mother chooses one condition over another she may be motivated to prove the worth of the intervention she has chosen over the one she has dismissed. This is especially important when relying on maternal report for measures such as vocabulary.

Gender

The present study randomly allocated infants to condition, and ensured an equal number of males and females in each group to control for gender differences in language abilities. Gender has long been known to have differential effects on language, with females being advantaged over males. Girls begin talking at an earlier age than boys (Murray, Johnson & Peters, 2000) and acquire vocabulary faster (Nelson, 1973; Roulstone, Loader, & Northstone, 2002). Boys are more likely to be diagnosed as having a language delay (Stevenson & Richman, 1976) and Specific Language Impairment is more prevalent in males than females (Tomblin et al. 1997). Why are males at a disadvantage when it comes to language development?

Male brains show greater lateralization of function than do female brains (Baron-Cohen, 2003; Kolb & Wishaw, 2003). The less lateralized brain has advantages for language processing as the burden is distributed between both hemispheres. It has been suggested that right hemisphere superiority in males might be caused by foetal testosterone levels (Lutchmaya, Baron-Cohen & Raggatt, 2002a) and occur at the expense of the left hemisphere, the hemisphere of the brain largely attributed with language abilities (Geschwind & Galaburda, 1985). Indeed a link has been found between the amount of testosterone that infants are exposed to in the womb and their subsequent language abilities as infants. Lutchmaya, Baron-Cohen and Raggatt (2002) report an inverse relationship between the level of foetal testosterone and infant vocabulary at 18 and 24 months. Therefore, differences in brain development between males and females, which develop as a function of preverbal biology, can account for the superiority of females in language development.

Social differences in the way that parents interact with males and females have also been proposed to explain the relationship between gender and language. Mothers are more responsive to their daughters than to their sons (Crockenberg & Smith, 2002) and girls respond more to their mothers when their mothers speak to them than do boys (Clarke-Stewart, 1973; Gunnar & Donahue, 1980; Kleion & Durfee, 1978). Girls engage in more social referencing, using cues in mothers' and strangers' verbal and nonverbal cues to guide their behaviour, than do boys (Rosen, Adamson & Bakeman, 1992). Families spend substantially more time in literacy related activities with girls than boys (Teale, 1986). These gender differences in social interaction may be a function of the perceptions that mothers hold regarding the differing abilities of males and females, or these differences may be elicited by the superior language abilities of females. Another possibility is that girls are biologically predetermined to be more social beings than boys. Foetal testosterone has been proposed to shape the neural mechanisms underlying social development (Lutchmaya, Baron-Cohen & Raggatt, 2002b). At 12 months of age, female infants were found to engage in significantly more eye contact than male infants. The amount of eye contact was found to vary quadratically with foetal testosterone level. Therefore, it is suggested that the propensity of girls to engage in dyadic interaction may be a result of prenatal hormone exposure.

Therefore, gender differences in the language development of males and females are persistent and have a strong biological basis. It was deemed important then to control for, and to explore gender differences by ensuring an equal number of males and females in each condition.

Interventions

Previous research has not questioned whether the type of gestures that infants are exposed to bears any impact on the acquisition of these gestures by infants or on the subsequent beneficial effects. The two gesture training conditions both include representational gestures, however one condition includes gestures taken from a formal sign language (BSL condition) while the other condition (SG condition) includes symbolic gestures that have been created specifically for use with infants (Acredolo & Goodwyn, 1992). The symbolic gestures are all highly iconic, in that each gesture represents the form or function of the referent, and so the meaning of the gesture can be readily understood. Whereas the BSL gestures vary in their level of iconicity, with many of these gestures being arbitrary in their form with no obvious relation between the gesture and the referent. By including both types of gestures, the relative importance of iconicity and arbitrariness of gesture can be determined.

In the present study, mothers were trained to use a specific set of twenty target gestures in order to control for the number and properties of the gestures to which the infants would be exposed. Whereas previous research has encouraged mothers to create their own gestures (Goodwyn et al. 2000), the decision was made that to rigorously evaluate a gesture intervention, the gestures themselves should be controlled as much as possible to ensure that maternal gesture use is equivalent in number between gesture conditions and equivalent in type within conditions.

To account for the fact that mothers in the gesture training conditions would also be focusing special attention on their infants' language development and frequently producing the target words with the signs, a verbal training (VT) condition was also included. Mothers in this condition were given the same targets as the gesturing conditions, and modelled the words on their own without the gestures. While Goodwyn et al. (2000) included a VT group in their study, the extent to which this condition provided a reliable control is questionable, as infants were not matched, nor were they randomly allocated to condition. Furthermore, Goodwyn et al. (2000) provided the mothers in this condition a target set of words that differed to the target set of signs. Therefore, while parents in both conditions were focused on infant language, they were using different target items, rendering the two conditions incomparable. The rationale given was that the targets in each set were easiest to learn in the respective modalities. The authors later compare the acquisition of targets in the different modalities and offer this as evidence of a gestural advantage in symbol learning, despite the differences in the targets.

In the present study, a target set of items was compiled, and after random allocation, mothers received this set either as gestures or words. This allowed a direct comparison of target word acquisition by infants in the gesturing and control conditions, as well as a comparison of whether symbolic or BSL gestures were more readily acquired.

Optimum Age to Expose Infants to Gesture Training

The age at which infants were exposed to gesture was contingent upon both time constraints and a consideration of the age in infants' development when the role of gestures can be considered optimal. Within the scope of this programme of research, one year was deemed as a plausible amount of time to longitudinally follow each infant. This allowed a staggered recruitment and a manageable schedule of assessment by one researcher. A thorough review of the literature was undertaken to identify the age at which infants typically acquire gestures and the point at which infants would be likely to be able to make use of symbolic gestures and signs communicatively.

Children typically produce their first deictic gestures around the age of 10 months (Bates et al. 1975), indicating that at this age, infants have developed sufficient motor skills and cognitive abilities to be able to physically construct a point and to perform this gesture with communicative intent. From around one year of age, infants' gestures take on more meaning in their form and can represent actions and objects, for example picking up a telephone to the ear. Infants' gestures reach symbolic status around 15 months of age, for example panting to represent a dog or a fanning gesture for hot (Acredolo & Goodwyn, 1988). These gestures occur naturally, in the absence of any gesture training or enhanced gesture input. However, if infants are exposed to a gesture rich environment from an early age, can they gesture from a younger age?

This question can be addressed by considering the gesture production of hearing children born to deaf mothers, who are as such exposed to a high frequency of signing in their linguistic environment. In these cases, infant gesturing is documented to appear extremely early, for example Bonvillian, Orlansky, Novack and Folven (1983) report gestures at a mean age of 8.6 months. However, there is dispute over whether these gestures were indeed produced in a symbolic way, as they are likely to have been performed in imitation of adults' gestures. Nonetheless, it suggests that infants possess the motoric ability at this age. Gestures produced by these infants to name new instances of a concept, thus lending them symbolic status, have been documented to occur at 12 months of age (Folven & Bonvillian, 1987). Therefore, this would suggest that exposing infants to a gesture rich environment is likely to bring about infant gesturing much earlier than would be expected typically. While the initial gestures of hearing children born to deaf mothers at eight months may be imitations, these gestures achieve symbolic status around 12 months of age (Folven & Bonvillian, 1987), two months earlier than the emergence of symbolic gestures at 14 months in hearing children born to hearing mothers (Acredolo & Goodwyn, 1988).

Based on these findings and the need to assess infants well before gesture production had begun, the decision was taken for the present study to onset infants' exposure to gesture at eight months of age. Although the gesture exposure could not match that of hearing children born to deaf mothers, the typical levels of gestured input would be enhanced, and so it was deemed worthwhile to start looking at the impact of this from a young age. Because infants have been demonstrated physically to be able to gesture from eight months, this age was selected to be an appropriate time to begin a gesture intervention. Previous research has exposed infants to gesture training at a much later age. For example, , Goodwyn et al. (2000) began gesture training when infants were 11 months of age. The rationale was that in order to keep the motivation of the mothers high, they wanted a relatively short time lag between exposure to gesture and infant gesture production. However, by 11 months of age infants are typically already producing deictic gestures and may even be producing some words, therefore exposure to gestures may have less of an impact at this stage in development than it would do at a time when infants communicative skills are only just burgeoning.

Assessment Measures

To assess the impact of the interventions on infants' language development, reliable assessment measures of the infants' expressive and receptive language skills between 8 and 20 months of age were required. To measure the development of infants' vocabulary, both receptive and expressive, a parental report of vocabulary was included. Parental report has been demonstrated to be a reliable indicator of children's vocabulary (e.g. Dale, Bates, Reznick & Morisset, 1989; Mills, Coffey-Corina & Neville, 1993, 1997). The Oxford Communicative Development Inventory is a British adaptation of the widely used MacArthur Communicative Development Inventory and has been validated with a UK infant sample (Hamilton, Plunkett & Schaffer, 2000).

Since mothers in the gesture training conditions encouraged their infants to communicate with gestures, the question arises of whether this boosts the overall use of gesture by these infants. Infants in the gesture training conditions would become accustomed to using gestures to label items, and may adopt this type of labelling more frequently than infants in the control conditions. As such we would expect these infants to produce a wider range of gestures. To measure the amount of infant gesturing, a parental checklist of actions, gestures and pretend play was included. This measured a wide range of gesture behaviours including conventional gestures, indicating gestures and symbolic play and gesture. By comparing the number and type of gestures infants produced, the impact of encouraging infants to gesture on their more general gesturing could be understood. Since the differential impacts of the different types of gesture (BSL and SG) could be compared. Because the gestures that the SG infants were encouraged to use were, as a whole, more iconic than the BSL gestures, this may lead to differences in the amount of representational gestures that infants produce.

To assess whether the encouragement of gestured communication enhances language development, a focused and thorough measure of infant expressive and receptive language abilities was required. The Preschool Language Scale (PLS) -3 UK Edition was chosen as an appropriate assessment tool as it is well validated and is highly applicable for testing infants within this age range. It also includes an assessment of precursors to receptive and expressive language, crucial when evaluating the language abilities of pre-verbal infants. In this way, the PLS assesses the child's ability to attend to objects, people and the language in her environment before she can begin to comprehend language. Meanwhile the expressive communication scale examines children's social communication and vocal development as precursors to speech. The raw scores of the PLS offer a reliable measure of infants' expressive communication and auditory comprehension abilities, allowing individual infants' gains in these subscales to be measured over time, as well as a comparison across condition of infants' abilities at each age point.

Mothers were trained to use gestures or words and encouraged to use them frequently within everyday routines, however this in itself does not infer consistency in target item usage by all mothers within each condition. Therefore, a modelling interview was developed to record information regarding frequency and context of modelling. This asked mothers how often they modelled each of the target gestures and asked them to describe the typical circumstances under which they would use the gestures. Of further interest was whether mothers thought that their child understood the target items and whether the child was producing the target gesture and/or word themselves, and if so in what context. This data is important to ensure consistency between intervention conditions and within each condition on modelling frequency. This also provides a measure of when infants began to use which gestures and when.

In summary, this longitudinal study investigates whether encouraging preverbal hearing infants to communicate manually with gestures benefits language development and in doing so the following research questions were explored:

2.1.4. Research Questions

The impact of gesture training on target item acquisition

- Will there be a difference between the four conditions on infants' acquisition of the target items?
- Will infants acquire the target gestures and will they acquire more BSL or symbolic gestures?
- When infants are preverbal (10 and 12 months) will they possess more targets in gesture than words?
- Will infants who are exposed to the target words with accompanying gestures (BSL and SG group) learn the target words at a quicker rate than the infants who are exposed to the target words only (verbal training group)?

The impact of gesture training on vocabulary

- Will gesture training enhance infants' receptive and productive vocabulary? Will infants in the gesture training conditions have higher vocabularies than the control infants at 10, 12, 16 and 20 months?
- Will there be a difference in the vocabulary development of infants trained to use BSL or symbolic gestures?

The impact of gesture training on language development

- Will gesture training impact upon language development? Will infants who are gesture trained demonstrate greater receptive and expressive language abilities than infants who are not at 10, 12, 16 and 20 months?
- Will there be any difference in the effect of gesture training on language development between infants who use BSL and symbolic gestures?

The impact of gesture training on gesture development

- Will gesture training enhance infants' overall gesture production? Will infants in the gesture training conditions (BSL and SG) score higher on the gestures, action and pretend play checklist than the control infants (VT and NC) at 10, 12, 16 and 20 months?

The impact of within-child factors

- Will gender and baseline language ability affect infants' receptivity to gesture training?

2.2. Method

2.2.1. Participants

A convenience sample of forty mothers was recruited to participate in the study. Mothers answered advertisements displayed at local mother and baby groups, Internet parenting community websites, libraries and nurseries or by responding to emails sent to the University of Hertfordshire staff mailing list or National Childbirth Trust (NCT) mailing lists. Mothers were told that they would be taking part in a research project looking at baby language development, and that their baby's language would be observed and routinely assessed over the course of one year. Baby signing was not mentioned in the adverts in order to avoid parents who were motivated to take part in a signing study. Mothers were randomly allocated to condition once they responded to the adverts. Infants were aged eight months at entry into the study. Upon responding to the call for participants, mothers were preliminarily allocated to an intervention condition sequentially, i.e. the first person to respond was allocated to the BSL condition, the second to the Symbolic Gesture condition, the third to the verbal training condition and the fourth to the non-intervention control condition. This was repeated and once a condition had five males or five females, then the next participant would be allocated to the next condition in sequence that required an infant of that sex until all conditions contained ten participants.

Demographic information was obtained from the mothers from a Background Information Questionnaire (Appendix C). This yielded information about the mothers' and fathers' education and employment, hours spent at work by both parents, the number of hours that the children spend in childcare and information about siblings. The mean hours spent at work by mothers and the number of hours infants spend in childcare in all conditions are presented in the table below. To ensure that all infants would stand to receive the same amount of linguistic input from their mothers, it was important that all infants would be comparable in the amount of time that they spend with their mothers.

Table 2.1. Mean parental hours at work and hours in childcare for infants across conditions

	BSL		SG		VT		NC	
	M	*SD*	M	*SD*	M	*SD*	M	*SD*
Hours per week infant in childcare	19.00	*17.75*	9.83	*13.87*	11.80	*15.70*	13.78	*12.56*
Hours per week mother at work	18.60	*15.02*	16.56	*22.91*	14.70	*17.18*	18.89	*12.39*
Hours per week father at work	42.40	*7.43*	40.67	*7.14*	44.95	*7.03*	41.39	*7.19*

Note: BSL: British Sign Language training condition; SG: Symbolic Gesture training condition; VT: Verbal Training condition; NC: Non-intervention control condition.

There were no significant differences between groups on the number of hours spent in childcare [$F(3,35) = .80$, $p = .50$], Maternal hours at work [$F(3,36) = .30$, $p = .82$], or paternal hours at work [$F(3,35) = .70$, $p = .56$]. Infants in all conditions spent a comparable amount of time with their mothers.

Whether or not infants have siblings contributes to infant language development. If a mother has more than one infant, this decreases the amount of attention that she is able to pay each infant. It has been speculated that one of the reasons why later born infants develop language at a slower rate than firstborns is due to a greater amount of time spent with their sibling. Sibling speech to infants is “unresponsive, directive and relatively devoid of conversation-eliciting questions and turnabouts” (Barton & Tomasello, 1994, p124), features of speech which are all negatively correlated with infant language development (e.g. Tomasello & Farrar, 1986). With consideration to the intervention, having more than one infant to care for is likely to impact upon the level of attention that mothers could pay to gesture or verbal modelling. Therefore it was important that the groups were equivalent, to decrease the impact of this potential confounder. The number of infants in each condition with either a younger or an elder sibling is presented in the table below. A chi-square test indicated that there were no significant differences between the groups, χ^2 $(6, N=40) = 4.39$, $p = .62$.

Table 2.2. Total number of younger or older siblings

	BSL	SG	VT	NC	Total
No sibling	4	6	8	5	23
Younger sibling	2	1	0	2	5
Older sibling(s)	4	3	2	3	12

Another factor which significantly contributes to infant language development is parental socio-economic status (SES), which is a product of family income, occupation and education. Level of education impacts upon the quantity and quality of maternal speech and this impacts upon infants' language development (Hoff, 2003; Hart & Risley, 1995; 1999). It was important therefore to establish that the mothers in each of the four intervention conditions had an equivalent level of education, to remove this as a potential confounding variable that would impact upon infants' language abilities. Overall, the sample contained high SES mothers. All of the mothers were educated to degree level and above, with one exception (one mother in the SG group had reached A-level standard of education). A chi-square test indicated that there were no significant differences between the groups, χ^2 (3, N=40) = 3.08, p = .38. The majority of the fathers (80%) were also educated to degree level (BSL: 9 fathers degree and above, 1 A-level; SG: 7 degree level and above, 2 A-Level, 1 GCSE; VT 8 degree level and above, 2 A-Level; NC: 8 degree level and above, 1 A-Level, 1 below GCSE). A chi-square test indicated that there were no significant differences between the groups, χ^2 (9, N=40) = 7.45, p = .59. Therefore, parents were equivalent in terms of education level.

Mothers were asked whether their baby had had more than five ear infections. If so, then infants would have been excluded from the study as if their hearing was impaired in any way this would likely impact upon their language abilities. If during the course of the study children suffered more than five ear infections, they would also have been excluded. However this was not the case for any of the infants in the sample.

2.2.2. Procedure

Mother-infant dyads were randomly allocated to one of four conditions; Symbolic Gesture (SG), British Sign Language (BSL), Verbal Training (VT) and Non-Intervention Control (NC) group. Intake was staggered, taking place between January 2007 and April 2008 until each condition had ten participants with an equal number of males and females.

<u>Symbolic Gesture Condition</u>

Mothers received an initial training session at the start of the study, when their infant was eight months of age. They were individually instructed on how to perform symbolic gestures for the ten target objects. The researcher visited the mother and baby in their home and trained the mother to use the ten gestures and discussed how to incorporate them into their everyday communication with their infant. Mothers were instructed to always accompany the gesture with the word and to establish eye contact with their infant before performing the gesture. Instructions were given to model the gestures as frequently as possible. The mothers were supplied with a training pack that contained pictures of the ten gestures as well as tips on ways to use the gestures, such as incorporating them into nursery rhymes and everyday routines.

When infants were 12 months of age, mothers were given a second target set of gestures. As with the first set of gestures, the researcher visited the mother and infant in the home and instructed the mother on the new set of gestures and encouraged the mother to add these gestures to the repertoire of gestures that they were using already. Mothers were provided with a training pack that contained images of the gestures and suggestions as to how to incorporate them into everyday communication with their baby. The researcher reminded the mothers of the optimum way to perform the gestures, i.e. to always say the word alongside the gesture and to gain eye contact before performing the gestures.

BSL Condition

Mothers of the infants in the BSL condition received the same training session as mothers in the SG condition at the initial home visit, when infants were eight months of age. The only difference being that mothers were instructed to use BSL gestures. Again, the second target set of ten gestures was introduced when infants reached 12 months, which were the same targets as those given to the mothers in the SG condition.

Verbal Training Condition

To control for mothers of infants in the SG and BSL conditions focusing special attention on language, and spending more time engaged in joint attention and repeating key words frequently, a VT group was included. Mothers of infants in the VT group were encouraged to promote the acquisition of verbal labels for the target words. Mothers had an initial training session in which the researcher visited them in their homes and gave them the same set of ten target words to focus on. The researcher discussed with the mothers different ways in which these ten words could be modelled frequently, incorporating them into their everyday interactions with their baby. The second set of ten target words was then introduced when infants reached 12 months, again these target words for the same referents as the second target set of gestures.

Non-Intervention Control Condition

This group did not receive any special instruction. Infants in this group were tested at the same time points as the infants in the intervention conditions, to allow a comparison of the development of infants in the training conditions with infants who did not receive any intervention.

2.2.3. Materials

All mothers were given the same twenty target items. By doing so, each infant in the study was exposed to either the gesture and/or word for each of the same referents. This allowed a direct comparison to be made of the ease of acquiring targets in either the verbal or manual form. Mothers were given the target items in two sets, and were given the first target set when infants were eight months and the second when infants were 12 months. The targets were given in this way to make the amount of gestures that mothers were to remember manageable, so that they would feel confident using the gestures and would use them frequently.

The first target set of gestures was compiled by the researcher based on observations of the initial gestures that commercial Baby Sign instructors teach mothers, and signs that the instructors report infants readily acquire and use most. Furthermore, because the SG group were given gestures from the Baby Signs Program targets were chosen for those items that had a symbolic gesture associated with them. The second target set of gestures was compiled based on feedback from mothers who, after having used the first set of gestures for two months, were asked which additional gestures they thought would be useful to have.

Each target set contained five object concepts and five non-object concepts. The inclusion of both types was to reflect the range of symbolic gestures that infants spontaneously produce (Acredolo & Goodwyn, 1988). Infants' early lexicon development favours nouns over verbs. The majority of infants' first words are nouns and it is not until 20 -24 months that verbs make a substantial appearance in infants' vocabularies (e.g. Waxman & Lidz, 2006; Waxman et al. 2009). Therefore, by including gestures that name objects and non-object concepts, the acquisition of gestural names could be compared to determine whether infants would demonstrate a tendency to acquire one type earlier than the other.

The object concepts in Target Set One were: drink, hat, duck, flower and food. The five non-object concepts were: where, more, all-gone, hot, sleep. Target Set Two consisted of the object concepts: Biscuit, Aeroplane, Book, Shoe and Dog. The non-object concepts were: Sing, Pain, Cuddle, Dirty and Bath.

The symbolic gestures for Target Set One were taken from Acredolo and Goodwyn's book, 'Baby Signs'. The Baby Signs® Program developed by Acredolo and Goodwyn teaches babies to use simple, easy-to-do gestures for communicating with their mothers and caregivers. Because the second set of target symbolic gestures were generated by mothers, these gestures were not necessarily part of the Baby Signs® Program. As such, symbolic gestures were developed by the researcher for the referents chosen that were highly iconic and were simple actions that could be easily identified. Illustrations of the BSL gestures were kindly provided by Cath Smith who is a writer of books and resources for deaf education. Please refer to Appendices A and B for an illustration of the gestures.

2.2.4. Measures

Infants were assessed in the home at regular intervals when they were aged 8, 12, 16, and 20 months. Four month interims allowed for regular assessment so that change could be measured within the time-frame of the research programme. A variety of standardised measures of both receptive and expressive language were administered. These will be described in turn.

Oxford Communicative Development Inventory (CDI)

Mothers completed the Oxford Communicative Development Inventory (CDI), a British adaptation of the MacArthur Communicative Development Inventory (CDI) (Hamilton, Plunkett & Schaffer, 2000). This assessment tool is a checklist of words for assessing the development of receptive and productive vocabulary through parental report (see Appendix D). Mothers completed this at 8 months, 12 months, 16 months and 20 months.

Gestures, Actions and Pretend Play Checklist

This is a receptive parental checklist of infants' use of communicative gestures (e.g. conventional gestures such as waving goodbye and deictic gestures), actions (e.g. joining in with action games such as round-and-round-the-garden), as well as symbolic play (e.g. playing with doll or teddy or imitating an adult). This checklist (see Appendix E) was adapted and extended from the words and gestures section of the MacArthur CDI (Fenson et al. 1994) by Zammit and Schafer (2009). Mothers completed this at 8 months, 12 months, 16 months and 20 months.

Preschool Language Scale-3 UK Edition (PLS-3UK)

The PLS-3 (UK) uses two broad subscales (auditory comprehension and expressive communication) to assess expressive and receptive language ability in children aged between two weeks and six years (see appendix F for a sample test sheet). Infants were assessed at home using the PLS-3 (UK) at 8 months, 12 months, 16 months and 20 months. Assessment is conducted in a play context. Infants were sat on a blanket with the researcher and a variety of toys were used to complete a range of age-specific tasks. Testing time varied according to age, ranging from ten to thirty minutes.

Naturalistic Observation

Infants in the BSL training group, SG training group and VT group were filmed in a naturalistic context with their caregiver during two contexts, a free play session and during a meal or snack time. In the free play session, mothers were asked to engage in play with their infant for a ten-minute period. Mothers and infants were then filmed in a mealtime setting. This context was chosen as a number of the target concepts are relevant to meal time, i.e. food, drink, more and all-gone. Each session was filmed for a ten-minute period, resulting in 20 minutes of videotaped data for each child at the ages of 8, 10, 12, 16 and 20 months. Although it was deemed important to videotape the infants, it was beyond the scope of this PhD to analyse the interactions. The data from these sessions is therefore not included in this thesis.

Modelling Interview

A semi-structured interview was conducted with mothers in the BSL, SG and VT conditions[2]. Mothers were asked:

- How often they used the target words or gesture
- When they would typically use that word or gesture
- Whether their child understood that word or gesture (and what their child did to demonstrate understanding)
- If their child produced that word or gesture and if so, when they would typically use that word or gesture

The researcher defined what was meant by the infant understanding the word or gesture to be if the infant gave some kind of response to the target that indicated that they understood the meaning, i.e. if the child would look towards the target, become excited or appear to anticipate what is coming next. For example, the mother may produce the food gesture and the baby may stop crying and become excitable. Mothers were also asked whether their infant produced the target and if so in what context. It was established whether the infant was producing the target spontaneously or in imitation or in response to the mother. The child was only assessed to be producing the gesture if the child produced the gesture spontaneously. The interview was conducted in person during the home visits at 10, 12, 16 and 20 months[3].

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[2] The acquisition of the target items by the non-intervention control infants was ascertained from the Oxford CDI, circumventing the need to directly ask mothers about their child's understanding and production of the target words.

[3] Initially, this interview was conducted by telephone at bi-weekly intervals. However, this became difficult to maintain due to the number of participants. Furthermore, the regularity of the interviews was not consistent due to mother availability. Therefore, the interval between interviews varied within and between mothers. The decision was then made to conduct the interviews during the home visits, where they would be conducted at regular intervals and the setting would allow an in-depth discussion between the researcher and the mother to gather rich information about target modelling.

2.3. Results

Forty mother-infant dyads were assessed on four occasions (8, 12, 16 and 20 months), yielding a total of 160 data points. There are only six cases (out of 160) of missing data and no attrition. All forty mother-infant dyads completed the one-year study. The missing cases are summarised below:

- *8-month data collection point*: three cases missing due to late entry into the study. One infant was in the NC condition and two infants in the SG condition.
- *12-month data collection point*: One infant's data is missing, a participant in the BSL condition whose family was on holiday for 2 months.
- *16-month data collection point*: One infant's data is missing, a participant in the SG condition who was unavailable for a 16-month assessment.
- *20-month data collection point:* One infant's data is missing (BSL group), family unavailable for home visit due to birth of second child.

The overarching question that this study sought to answer was did gesture training benefit infants' language development? Secondary questions are concerned with whether it mattered what type of gesture infants were trained to use and whether some children benefited more from gesture training than others. The longitudinal data was analysed to address these questions. Each child had a measurement of their receptive vocabulary, productive vocabulary, auditory comprehension, expressive communication and gesture development at 8, 12, 16 and 20 months. Infants' acquisition of the target items was assessed at 10, 12, 16 and 20 months.

There were three levels of analysis. The first focussed on the target items, to determine the impact of the interventions on infants' acquisition of the target gestures and words, taking into consideration any effect of gender. Section One, therefore, establishes whether infants who were gesture trained acquired the target gestures, and, if so, whether BSL or symbolic gestures were more readily acquired.

Because all infants in the BSL, SG and VT conditions had the same target items, the acquisition of the target words by infants could be compared, allowing the impact of gesture training on target word acquisition, over and above verbal training, to be established. Section Two addresses the question of whether gesture training impacted upon infants' language development. If so, does the type of gesture matter? By comparing the development of infants' receptive and expressive language abilities, the effect of gesture training and gesture type on language could be determined. The last section examines the contribution of within-child factors on the effect of condition to identify whether some children benefited more from gesture training than others. The results are presented in the following sections:

Section 1. *Are there any differences between the four conditions in infants' acquisition of the target items?*
Section 2. *Did infants' language development differ between infants in the four conditions?*
Section 3. *Did within-child factors contribute to the effect of condition on infants' language development?*

2.3.1. Results Section One. Are There any Differences Between the Four Conditions in Infants' Acquisition of the Target Items?

This section will present an analysis of the acquisition of the target items by infants in each of the conditions. The following questions will be addressed:

- Are there any differences between the four conditions in infants' acquisition of the target items?
- Did infants acquire BSL gestures or symbolic gestures earlier?
- Did the type of gesture that mothers were trained to use impact upon their modelling frequency?
- Did infants who were gesture trained have a greater multimodal target vocabulary (speech and gesture) than control infants?
- Did infants who were gesture trained acquire more targets in gesture than speech, and at an earlier age?
- Did gesture training advance the acquisition of verbal labels?
- Was there any difference between infants' acquisition of object gestures and non-object concept gestures?

Each of these questions will be addressed by comparing overall data, and data from each age point (10, 12, 16 and 20 months). Furthermore, the gender differences in target item acquisition will be addressed in these analyses.

2.3.1.1. Did Infants More Readily Acquire BSL or Symbolic Gestures?

All infants in the gesture-training conditions acquired at least two gestures over the course of the study. At 12 months of age, the median number of target gestures produced by infants in the BSL group was 1 (minimum = 0, maximum = 4) and the median number of target gestures produced by infants in the SG group was 1.5 (minimum = 0, maximum = 5). At 16 months of age, the median number of target gestures produced by infants in the BSL group was 6 (minimum = 2, maximum = 11) and the median number of target gestures produced by infants in the SG group was

5.5 (minimum = 0, maximum = 17). At 20 months of age, the median number of target gestures produced by infants in the BSL group was 6 (minimum = 0, maximum = 14) and the median number of target gestures produced by infants in the SG group was 9.50 (minimum = 0, maximum = 17). The mean number of target gestures acquired by male and female infants in the BSL and SG conditions at each age is presented in the table below.

Table 2.3. Mean number of gestures acquired (SD) by gesture type, age and gender

		BSL		SG		Total
		N	Mean (SD)	N	Mean (SD)	
10 months	Males	5	0.00 (0.00)	5	0.20 (0.45)	0.10 (0.32)
	Females	5	0.00 (0.00)	5	0.00 (0.00)	0.00 (0.00)
	Total	**10**	**0.00 (0.00)**	**10**	**0.10 (0.32)**	**0.05 (0.22)**
12 months	Males	5	1.20 (1.30)	5	1.60 (2.08)	1.40 (1.65)
	Females	5	1.20 (1.79)	5	1.60 (1.14)	1.40 (1.43)
	Total	**10**	**1.20 (1.48)**	**10**	**1.60 (1.58)**	**1.40 (1.50)**
16 months	Males	5	5.20 (3.56)	4	8.25 (7.68)	6.56 (5.97)
	Females	4	7.50 (3.11)	5	6.00 (1.22)	6.67 (2.24)
	Total	**9**	**6.22 (3.38)**	**9**	**7.00 (4.92)**	**6.61 (4.12)**
20 months	Males	5	4.60 (3.91)	4	10.00 (7.02)	7.00 (5.85)
	Females	5	6.40 (5.02)	5	7.60 (5.32)	7.00 (4.92)
	Total	**10**	**5.50 (4.35)**	**9**	**8.67 (5.85)**	**7.00 (5.23)**

When infants were 10 and 12 months of age, target gesture production by male and female infants was very similar, as was the production of BSL and SG gestures. Differences emerge at 16 months, with infants producing slightly more symbolic gestures than BSL gestures. While in the BSL group, girls produced more gestures than boys. In the SG group, boys produced more gestures than girls. At 20 months the advantage of the SG group has increased and on average infants produce over three more symbolic gestures than BSL gestures. There is a big difference between boys in the SG and BSL group, with boys producing over double the number of gestures than BSL gestures.

A repeated-measures Analysis of Variance (ANOVA) was conducted to examine the impact of gesture type (BSL or SG) on the number of gestures infants acquired at each age of assessment. The within-subjects variable was age (10, 12, 16 and 20 months) and the between-subjects variable was gesture type (BSL and SG). Gender was included as a between-subjects variable to identify any gender differences in gesture production. The dependent variable was the total number of target gestures produced by infants at each age of assessment.

There was no significant main effect of gesture type [$F(1,13) = .88$, $p = .37$, $eta^2 = .06$, power = .14] or gender [$F(1,13) = .00$, $p = .97$, $eta^2 = .00$, power = .05]. There was no significant interaction between gesture type and gender [$F(1,13) = 1.54$, $p = .24$, $eta^2 = .11$, power = .21]. There was no significant interaction between gesture type and age [$F(3,11) = 1.21$, $p = .35$, $eta^2 = .25$, power = .24], age and gender [$F(3,11) = .10$, $p = .96$, $eta^2 = .03$, power = .06] or age, gesture type and gender [$F(3,11) = .57$, $p = .65$, $eta^2 = .14$, power = .13].

The mean scores indicate that there was a trend for infants to acquire more symbolic gestures than BSL gestures. Overall, by 20 months infants in the symbolic gesture group acquired a mean of over three gestures more than the infants in the BSL group. These differences did not reach statistical significance, which is likely due to the small sample sizes. It is important to rule out whether this difference is accounted for by the rate at which mothers modelled the target gestures. Therefore, the next analyses considered whether there were any differences in the frequency of gesture modelling by mothers in the BSL and SG conditions.

2.3.1.2. Did the Type of Gesture that Mothers were Trained to use Affect their Modelling Frequency?

Mothers were asked how often they modelled each of the target gestures. The modelling data was quantified to represent frequency using the following scores: 0 = rarely or never, 1 = a few times a week, 2 = once a day, 3 = more than once a day. For each interview, these scores were summed giving an overall modelling score. The mean modelling score by mothers of infants in the BSL and SG conditions at each age of assessment is presented in the table below. Overall, there was a trend for the mothers who were modelling symbolic gestures to model these at a greater frequency than mothers modelling BSL gestures. The rate of maternal modelling for mothers of males and females was also explored to determine whether modelling frequency differed for mothers of male and female infants.

Table 2.4. Mean rate of gesture modelling by mothers as a function of condition, age of measurement and infant gender

		BSL		SG	
		N	**Mean (SD)**	**N**	**Mean (SD)**
10 months	Males	5	13.40 (1.67)	5	20.67 (4.73)
	Females	5	17.00 (2.55)	5	14.00 (4.69)
	Total	**10**	**15.20 (2.78)**	**10**	**16.86 (5.58)**
12 months	Males	5	14.80 (2.59)	5	17.40 (7.50)
	Females	5	18.40 (3.36)	5	17.00 (6.44)
	Total	**10**	**16.60 (3.41)**	**10**	**17.20 (6.60)**
16 months	Males	5	17.80 (3.70)	4	33.25 (19.31)
	Females	4	24.40 (12.93)	5	19.60 (7.77)
	Total	**9**	**21.10 (9.62)**	**9**	**25.67 (14.89)**
20 months	Males	5	8.40 (5.13)	4	20.75 (15.90)
	Females	5	15.50 (4.80)	5	9.00 (9.25)
	Total	**10**	**11.56 (5.98)**	**9**	**14.22 (13.26)**

The mean scores indicate that there was a trend for mothers to model the symbolic gestures at a higher frequency than the BSL gestures. Within the BSL group, mothers consistently modelled the gestures at a higher rate to boys than girls. Conversely, in the SG group mothers consistently modelled the gestures more to boys than girls.

A two-way ANOVA was conducted to assess the impact of gesture type and gender on the rate of maternal modelling. The results are summarised in the table below. There was no effect of gesture type at any age. When infants were 10 months there was a significant interaction between gesture type and gender. The mean rate of modelling by mothers in the BSL condition was significantly higher if their child was female (M = 17.00, SD = 2.55) than male (M = 13.40, SD = 1.67, t(8) = -2.64, p = .03). There was no significant difference in rate of modelling by mothers in the SG condition if their child was female (M = 14.00, SD = 4.69) or male (M = 20.67, SD = 4.73, t(5) = 1.86, p = .12). For the rest of the study, mothers were equivalent in their level of modelling regardless of type of gesture or the gender of their child.

Table 2.5. Summary of ANOVA results, outcome variable rate of maternal modelling

Age	Gesture type	Gender	Gesture type * Gender
10 months	F(1,13) = 1.63, p = .25 (ns)	F(1,13) = 1.63, p = .25 (ns)	F(1,13) = 9.42, p = .01 (sig)
12 months	F(1,16) = .06, p = .81 (ns)	F(1, 16) = .69, p = .42 (ns)	F(1,16) = .69, p = .42 (ns)
16 months	F(1,14) = .42, p = .53 (ns)	F(1,15) = .42, p = .53 (ns)	F(1,15) = 3.47, p = .08 (ns)
20 months	F(1,14) = .42, p = .53 (ns)	F(1,14) = .26, p = .62 (ns)	F(1,14) = 4.34, p = .06 (ns)

2.3.1.3. Did Infants Who Were Gesture Trained Have a Greater Multimodal Target Vocabulary (Speech and Gesture) than Infants in the Control Group?

The number of target items that infants had acquired in either gesture or speech was summed to give a measure of infants' multimodal target vocabulary. Items that infants had acquired in both speech and gesture were just counted once, i.e. if a child both gestured MORE and said "more" then this was counted as one target. Therefore, for all infants, the maximum target productive vocabulary they could possess was 10 at 12 months and 20 at 16 and 20 months. The impact of condition (BSL, SG, VT, NC) on infants' multimodal vocabulary was assessed. The mean target multimodal vocabulary of infants in the four conditions is presented in the table below.

Table 2.6. Mean target multimodal vocabulary by condition, age and gender

Age	Gender	Condition			
		BSL	SG	VT	NC
12 months	Male	0.80 (1.30) n = 5	1.80 (2.49) n = 5	0.20 (0.45) n = 5	0.00 (0.00) n = 5
	Female	1.60 (1.52) n = 5	2.20 (0.84) n = 5	0.60 (0.89) n = 5	1.20 (1.10) n = 5
16 months	Male	8.20 (5.54) n = 5	10.00 (5.30) n = 4	6.00 (6.04) n = 5	2.40 (1.52) n = 5
	Female	11.40 (3.21) n = 5	8.80 (3.56) n = 5	7.20 (4.87) n = 5	6.60 (5.18) n = 5
20 months	Male	12.60 (7.40) n = 5	14.75 (5.38) n = 4	14.00 (4.85) n = 5	13.20 (4.09) n = 5
	Female	18.40 (1.67) n = 5	16.60 (1.95) n = 5	14.80 (4.02) n = 5	13.60 (4.16) n = 5

There was no significant main effect of condition [$F(3,30) = 1.82$, $p = .16$, eta 2 = .15, power = .43] or of gender [$F(1,30) = 2.50$, $p = .12$, eta 2 = .08, power = .33]. There was no significant interaction between condition and gender [$F(3,30) = .40$, $p = .76$, eta2 = .04, power = .12]. There was no significant interaction between age and gender [$F(2,30) = .82$, $p = .45$, eta2 = .03, power = .18], age and condition [$F(6,30) = 1.28$, $p = .28$, eta2 = .11, power = .46] or age, gender and condition[$F(6,30) = .86$, $p = .53$, eta2 = .08, power = .31].

However, an inspection of the means indicated that infants in the BSL and SG conditions generally appeared to score higher than infants in the VT and NC condition. Therefore, it may be that small sample sizes are masking an effect of gesture training. For that reason, the analysis was repeated with two groups, comparing those infants who were gesture trained (BSL and SG) and those who were not (VT and NC). The means and standard deviations are presented in the table below.

Table 2.7. Mean multimodal target vocabulary by intervention type, age and gender

Age	Gender	Intervention Type	
		Control	Gesture
12 months	Male	.10 (.32) n = 10	1.25 (2.19) n = 10
	Female	.90 (.99) n = 10	1.90 (1.20) n = 10
	TOTAL	.50 (.83) n = 20	1.60 (1.60) n = 20
16 months	Male	4.20 (4.57) n = 10	8.50 (5.32) n = 9
	Female	6.90 (4.75) n = 10	10.10 (3.48) n = 10
	TOTAL	5.55 (4.74) n = 20	9.58 (4.29) n = 20
20 months	Male	13.60 (4.25) n = 10	13.63 (6.72) n = 9
	Female	14.20 (3.91) n = 10	17.50 (1.96) n = 10
	TOTAL	13.90 (3.99) n = 20	15.63 (4.86) n = 19

There was a significant main effect of intervention type [$F(1,34) = 4.99$, $p = .03$, $eta^2 = .13$, power = .58]. Infants who were gesture trained had a significantly higher mean multimodal target vocabulary ($M = 8.81$, $SE = .71$) than control infants ($M = 6.65$, $SE = .66$). By being gesture trained, infants were able to express more of the target items than the control infants, as can be seen in Figure 2.1.

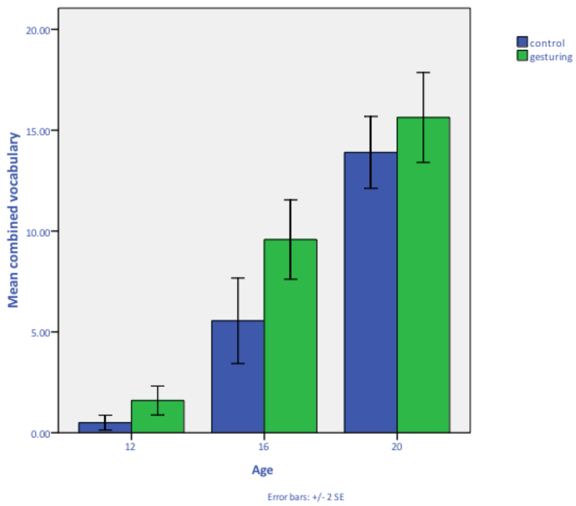

Figure 2.1. Mean number of target items acquired in either modality by gesture trained and control infants

Follow-up tests indicated that gesture-trained infants had a significantly higher multimodal vocabulary than control infants at 12 months [$t(38) = 2.73$, $p = .01$], 16 months [$t(37) = 2.78$, $p = .01$] though not at 20 months [$t(37) = 1.22$, $p = .23$].

There was no significant main effect of gender [$F(1,34) = 3.10$, $p = .09$, $eta^2 = .08$, power = .40] and there was no significant interaction between intervention type and gender [$F(1,34) = .12$, $p = .73$, $eta^2 = .00$, power = .06]. The interaction between age and intervention type approached but did not reach significance [$F(2,33) = 2.55$, $p = .09$, $eta^2 = .13$, power = .48]. There was no significant interaction between age and gender [$F(2,33) = .79$, $p = .46$, $eta^2 = .05$, power = .17] or age, gender and intervention type [$F(2,33) = 1.81$, $p = .18$, $eta^2 = .09$, power = .35].

2.3.1.4. Is There a Modality Advantage in the Acquisition of Target Labels?

The mean number of target words and gestures produced by infants in the BSL and SG conditions at each age is displayed in the figure below. This demonstrates that as expected, infants' verbal vocabulary increases over time. An interesting difference can be noted in the production of BSL and symbolic gestures, with the production of BSL gestures reaching its peak at 16 months, while the production of symbolic gestures continues to grow across time. Furthermore, at 16 months, the verbal vocabulary of the BSL infants is greater than their gesture vocabulary, while the opposite is observed for the SG infants.

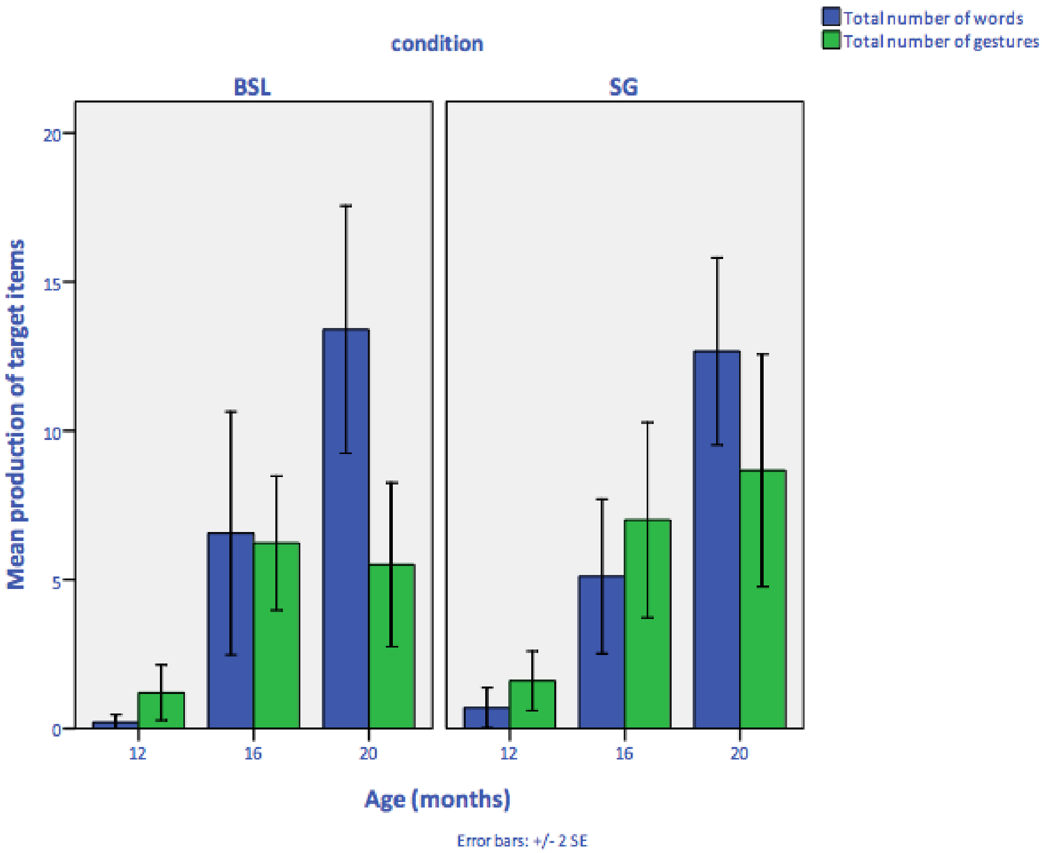

Figure 2.2. Mean number of target words and gestures produced by gesture-trained infants

A repeated-measures ANOVA was conducted to examine the impact of gesture type on the acquisition of target items in speech and gesture. The within-subjects variables were age of assessment (12, 16, 20 months) and modality of target item production (speech or gesture). The between-subjects factor was gesture type (BSL or SG) and gender. The means and standard deviations are presented in the next table.

Table 2.8. Mean targets acquired in each modality by age, condition and gender

		Target gestures		Target words	
		BSL	SG	BSL	SG
12 months	Males	1.20 (1.30) n = 5	1.67 (2.89) n = 5	0.00 (0.00) n = 5	0.67 (1.15) n = 5
	Females	1.50 (1.91) n = 5	1.60 (1.14) n = 5	0.50 (0.58) n = 5	1.00 (1.22) n = 5
16 months	Males	5.20 (3.56) n = 5	7.00 (8.89) n = 5	4.40 (5.86) n = 5	3.00 (3.00) n = 5
	Females	7.50 (3.11) n = 5	6.00 (1.22) n = 4	9.25 (6.08) n = 5	8.00 (5.96) n = 4
20 months	Males	4.60 (3.91) n = 5	11.67 (7.57) n = 5	11.60 (7.37) n = 5	9.33 (5.86) n = 5
	Females	7.50 (5.07) n = 5	7.60 (5.32) n = 4	17.25 (4.27) n = 5	14.60 (3.78) n = 4

The results of the ANOVA are summarised in the table below. There was no significant main effect of modality, gesture type (BSL or symbolic gesture) or gender. There were no significant interactions between the factors.

Table 2.9. Summary of results of 2x2x4 repeated measures ANOVA (outcome variable: target vocabulary)

Factor	ANOVA Result
Modality	$F(1,13) = 1.44$, $p = .25$, e2 = .10, power = .20
Gesture type	$F(1,13) = .02$, $p = .90$, e2 = .00, power = .05
Gender	$F(1,13) = 3.11$, $p = .10$, e2 = .19, power = .37
Modality*gesture type	$F(1,13) = 1.10$, $p = .31$, e2 = .08, power = .16
Gesture type * Gender	$F(1,13) = .79$, $p = .39$, e2 = .06, power = .13
Gender * Modality	$F(1,13) = 2.37$, $p = .15$, e2 = .15, power = .30
Modality * Gesture type * Gender	$F(1,13) = .55$, $p = .47$, e2 = .04, power = .11
Modality * Age * Gesture type	$F(2,13) = 1.57$, $p = .23$, e2 = .11, power = .30
Modality * Age * Gender	$F(2,13) = 1.27$, $p = .30$, e2 = .09, power = .25

Therefore, there was no effect of the type of gestures that infants were trained to use on differences between the number of target items acquired at each age in either speech or gesture. Furthermore, there was no relationship between gesture type and gender. However, the mean trend was for infants to produce more gestures than words therefore, the analysis was repeated but this time the sample was treated as one group of gesture-trained infants. The mean number of targets acquired in speech and gesture at each age by males and female infants who were gesture trained is presented in the table below.

Table 2.10. Mean target vocabulary of gesture-trained infants in speech and gesture by age and gender

Age	Gender	Modality	
		Speech	Gesture
12 months	Males (n = 10)	0.25 (0.71)	1.38 (1.85)
	Females (n = 10)	0.78 (0.97)	1.56 (1.42)
16 months	Males (n = 9)	3.88 (4.76)	5.88 (5.54)
	Females (n = 10)	8.56 (5.66)	6.67 (2.24)
20 months	Males (n = 9)	10.75 (6.50)	7.25 (6.20)
	Females (n = 10)	15.78 (3.99)	7.56 (4.88)

The means indicate that females consistently had a higher verbal target vocabulary than males, however there appear to be no gender differences in infants' gesture target vocabulary. The results of the ANOVA are summarised in the table below. There was no significant main effect of modality (speech or gesture) on the number of targets acquired. The impact of gender approached but did not reach significance. There was however a significant interaction between modality and age.

Table 2.11. Summary of 2x2x4 repeated measures ANOVA (outcome variable: target vocabulary)

Factor	ANOVA Result
Modality	F(1,15) = 2.13, p = .17, e2 = .12, power = .28
Gender	F(1,15) = 3.37, p = .07, e2 = .21, power = .45
Modality*Gender	F(1,14) = 1.82, p = .20, e2 = .11, power = .24
Gender*Age	F(2,14) = 1.80, p = .20, e2 = .20, power = .31
Modality*Age	F(2,14) = 7.43, p = .01. e2 = .52, power = .88
Modality*Gender*Age	F(2,14) = .66, p = .53, e2 = .09, power = .14

Figure 2.3 below represents the interaction between modality and age and demonstrates how infants' verbal vocabulary increases over time whereas infants' gesture target vocabulary appears to begin to plateau from 16 to 20 months.

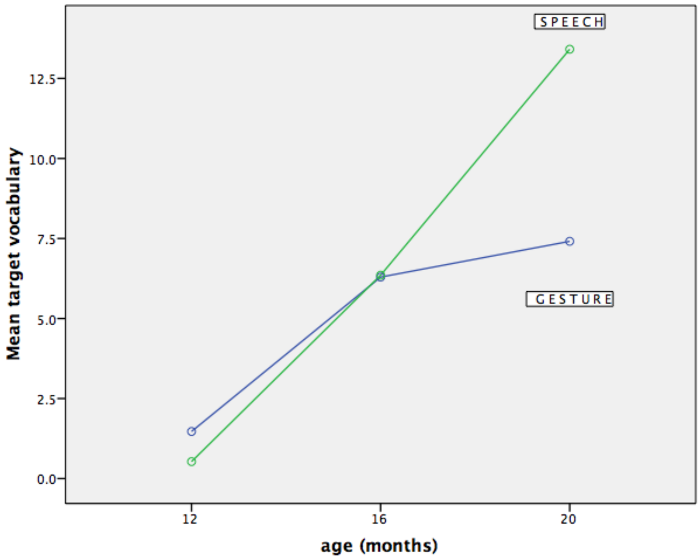

Figure 2.3. Interaction plot of target vocabulary by modality and age

Follow-up comparisons were conducted. The mean number of target gestures that gesture-trained infants had acquired at 12 months was significantly greater than the number of target words acquired, $t(19) = -2.44$, $p = .03$. Therefore, at 12 months of age a modality advantage existed for infants who have been gesture trained, acquiring significantly more target items in gesture than speech. At 16 months there was no significant difference [$t(17) = -.48$, $p = .64$] and at 20 months of age, infants produced significantly more targets as words than gestures [$t(18) = 3.53$, $p = .002$].

2.3.1.5. Does Gesture Training Advance the Acquisition of Verbal Labels?

Infants in the gesturing conditions were exposed to a high frequency of manual labelling of target items and were encouraged to acquire these gestures. Did this enhance the infants' acquisition of the verbal labels for these targets? If gesturing enhanced infants' language learning at the level of individual target words then infants in the gesture training conditions would be expected to have a greater target verbal vocabulary than the control infants. However, one by-product of gesture training is that mothers verbally label the target items at a high frequency. Therefore, if there is a significant impact of condition on target vocabulary, follow-up tests will be conducted to test whether verbal labelling (and not gesture) enhanced target word learning. If the verbal vocabulary of the gesturing infants is significantly higher than that of the VT infants then the gains in vocabulary can be attributed to gesturing. However, if there are no differences, then this would suggest there are no added benefits of gesturing over and above verbal labelling for target word learning.

A repeated-measures ANOVA was conducted. The within-subjects factor was age of assessment (12, 16 and 20 months). The between-subjects factors were condition (BSL, SG, VT and NC) and gender. The dependent variable was the number of target words produced (at each age). The means and standard deviations are presented in the table below.

Table 2.12. Mean (SD) target word vocabulary by age and condition

Infant age	Gender	Condition			
		BSL	SG	VT	NC
12 months	Males	.00 (.00) n = 5	.67 (1.15) n = 5	.20 (.45) n = 5	.00 (.00) n = 5
	Females	.50 (.58) n = 5	1.0 (1.22) 2.0 n = 5	.60 (.89) n = 5	1.20 (1.10) n = 5
16 months	Males	4.40 (5.86) n = 5	3.00 (3.00) n = 4	6.00 (6.04) n = 5	2.40 (1.52) n = 5
	Females	9.25 (6.08) n = 5	8.00 (5.96) n = 5	7.20 (4.87) n = 5	5.00 (3.74) n = 5
20 months	Males	11.60 (7.37) n = 5	9.33 (5.86) n = 4	14.00 (4.85) n = 5	13.20 (4.09) n = 5
	Females	17.25 (4.27) n = 5	14.60 (3.78) n = 5	14.80 (4.02) n = 5	13.60 (4.16) n = 5

There was no significant effect of condition on the number of target words acquired [$F(3,30) = .33$, $p = .81$, e2 = .03, power = .11]. There was however a significant main effect of gender [$F(1,30) = 4.40$, $p = .04$, e2 = .13, power = .53]. A comparison of the estimated marginal means indicate that females acquired a higher number of target words ($M = 7.53$, $SE = .69$) than males ($M = 5.40$, $SE = .75$). There was no significant interaction between condition and gender [$F(3,30) = .37$, $p = .78$, e2 = .04, power =

.11] or age and gender [F(2,30) = 1.66, p = .20, e2 = .05, power = .34]. Therefore, it would appear that the interventions did not impact upon the acquisition of target words. Despite the fact that mothers in the gesturing conditions modelled the target words alongside the gestures frequently, this did not accelerate the appearance of those words in the infants' vocabularies. Furthermore, infants whose mothers were encouraged to focus on the target words and verbalise them frequently, did not benefit from any advantage in word learning.

2.3.1.6. Was There any Difference Between Infants' Acquisition of Object Gestures and Non-Object Concept Gestures?

The number of object and non-object concept gestures acquired by infants was compared at each age. The means and standard deviations are presented in the table below. Inspecting the means, it is evident that at each age, infants acquired more object gestures than non-object concepts at each age. Paired samples t-tests were conducted to determine whether gesture-trained infants (BSL and SG combined) produced significantly more object gestures than non-object concepts. At 12 months there was no significant difference [t(19) = .62, p = .54]. At 16 months this difference bordered on significance [t(17) = 2.06, p = .06] and at 20 months there was no significant difference [t(18) = 1.66, p = .12].

Table 2.13. Mean production of object and non-object concept gestures by age and condition

	12 months		16 months		20 months	
	Object	Non-object	Object	Non-object	Object	Non-object
BSL	.80 (.92) n = 10	.40 (.70) n = 10	3.78 (2.33) n = 9	2.11 (1.62) n = 9	3.20 (3.01) n = 10	2.30 (1.77) n = 10
SG	.70 (.68) n = 10	.90 (.99) n = 10	3.44 (2.83) n = 9	3.11 (2.62) n = 9	7.11 (2.52) n = 9	5.56 (2.30) n = 9
TOTAL	.75 (.79) n = 20	.65 (.88) n = 20	3.61 (2.52) n = 18	2.61 (2.17) n = 18	3.95 (3.39) n = 19	3.05 (2.22) n = 19

Next, comparisons were conducted to determine whether infants produced more object gestures if they used BSL or symbolic gestures. The mean number of object gestures produced by infants in the BSL and SG conditions are similar at 12 and 16 months, however at 20 months infants in the SG group produced on average over double the number of object gestures than did infants in the BSL group. However, there was no significant difference between the object gesture production of infants in the BSL and SG conditions at 12 months [$t(18) = .28$, $p = .70$], 16 months [$t(16) = -.39$, $p = .70$] or 20 months [$t(17) = -1.01$, $p = .33$].

A similar pattern is evident for non-object concept gestures, with infants in the BSL and SG conditions producing a similar number at 12 and 16 months, however at 20 months infants in the SG group produced on average double the number of object gestures than did infants in the BSL group. However, there was no significant difference between the non-object concept gesture production of infants in the BSL and SG conditions at 12 months [$t(18) = -1.30$, $p = .21$], 16 months [$t(16) = .27$, $p = .79$] or 20 months [$t(17) = -1.63$, $p = .12$].

2.3.1.7. Summary of Findings from Section One

- There was no difference between the four conditions on their acquisition of the target words. Gesture training did not advance the acquisition of target words. Furthermore, neither did verbal training as the number of target words that infants acquired was no greater for infants in the BSL, SG and VT groups than the acquisition of those infants whose mothers did not focus on the target items at all.

- Infants acquired more symbolic gestures than BSL gestures and there was a trend for mothers to model the symbolic gestures with greater frequency than the BSL gestures, however the differences did not reach statistical significance.

- Infants who were gesture trained (BSL and SG) had a greater multimodal target vocabulary (speech and gesture) than infants in the control groups (VT and NC).

- Gesture-trained infants produced significantly more target items in gesture than speech at 12 months, indicating a modality advantage for gesture in communication. At 16 months there was no significant difference between the number of target items gesture-trained infants produced in speech and gesture and at 20 months infants produced significantly more targets verbally than manually.

- There was no effect of gender on target gesture acquisition, however females did have a higher verbal target vocabulary than males at each age. There was no difference in the rate that mothers of males and females modelled the target gestures, with one exception. At 10 months, mothers of females modelled the BSL target gestures at a higher rate than mothers of males.

- There was a trend for infants to acquire more gestures that labelled objects than non-object concepts. There was a similar production of both type of gestures by infants using BSL and SG at 12 and 16 months, however at 20 months of age infants in the SG group produced more object and non-object gestures than infants in the BSL group.

The next sections explore whether this exposure to gesture training impacted upon measures of infants' general language development.

2.3.2. Results Section Two. The Impact of Condition on Infant Language Development

Infants were assessed on their receptive and productive vocabulary, auditory comprehension, expressive communication and gesture production at 8, 12, 16 and 20 months. Two dependent variables were obtained from each language measure, a mean score and a mean rank change score. This section evaluates the impact of condition on each of these areas of development by firstly comparing infants' mean scores and then infants' mean rank change on each of the measures over time.

2.3.2.1. A Comparison of Mean Scores on the Language Measures

Initial analyses were conducted to justify the treatment of the subscales of vocabulary (receptive and productive) and language ability (auditory comprehension and expressive communication) as separate measures.

A mean productive and receptive vocabulary score was calculated for each child at each age of testing. Data was obtained by maternal report using the Oxford CDI. To determine whether vocabulary should be treated as a single variable (an additive measure of productive and receptive vocabulary) or whether productive and receptive vocabularies should be dealt with separately, correlation coefficients were calculated (see table 2.14). If productive and receptive vocabularies were highly correlated (>.80) then it would be reasonable to treat them as one variable.

Table 2.14. Spearman correlation between receptive and productive vocabularies

	8 months	12 months	16 months	20 months
Correlation coefficient	-.10 (ns)	.22 (ns)	.20 (ns)	.78**

** significant at p <.001

Receptive and productive vocabularies were highly correlated at one age point only, therefore the subsequent analyses deal with vocabulary as two separate measures; receptive and productive vocabulary.

Language ability was assessed using the Pre-school Language Scale 3-UK, which generated a score of infants' auditory comprehension and expressive communication abilities at 8, 12, 16 and 20 months. Correlation coefficients were calculated to determine whether language ability should be considered as one overall measure (an additive raw score of auditory comprehension and expressive communication) or whether the subscales should be treated separately. The table below presents the correlations between auditory comprehension and expressive communication of infants.

Table 2.15. Correlation coefficients of auditory comprehension and expressive communication

	8 months	12 months	16 months	20 months
Correlation coefficient	.10 (ns)	.39*	.60**	.70**

* significant at the .05 level
** significant at the .001 level

Although there was a significant correlation between auditory comprehension and expressive communication at selected points, none of these correlations were high enough (>.80) to warrant treating them as one variable, therefore the subsequent analyses will deal with auditory comprehension and expressive communication separately.

A series of mixed-design ANOVAs were conducted for each of the 5 language measures. The between-subjects variable for each ANOVA was condition (BSL, SG, VT, NC) and the within-subjects factor was score on the language measure at 8, 12, 16 and 20 months. The findings are summarised in the table overleaf.

Table 2.16. Mean scores on all language measures by age and condition

		Age of Assessment			
		8 months	12 months	16 months	20 months
Receptive Vocabulary	**BSL**	20.25 (16.10) n = 10	68.83 (61.48) n = 9	117.17 (28.15) n = 10	146.67 (88.98) n = 9
	SG	40.43 (79.63) n = 8	76.56 (80.22) n = 10	131.22 (73.97) n = 9	110.11 (61.73) n = 9
	VT	5.60 (5.34) n = 10	42.60 (31.57) n = 10	129.10 (56.52) n = 10	131.20 (82.21) n = 10
	NC	9.11 (8.67) n = 9	37.56 (25.24) n = 10	93.89 (33.00) n = 10	99.00 (66.33) n = 10
Productive Vocabulary	**BSL**	0 (0) n = 10	4.50 (3.02) n = 9	38.00 (56.39) n = 10	131.83 (110.72) n = 9
	SG	.71(1.89) n = 8	3.89 (4.40) n = 10	37.89 (36.94) n = 9	178.11(98.80) n = 9
	VT	.50 (1.08) n = 10	5.40 (5.93) n = 10	48.50 (42.48) n = 10	179.80 (97.89) n = 10
	NC	.22 (.67) n = 9	3.22 (4.52) n = 10	28.67 (36.88) n = 10	164.00 (75.55) n = 10
Auditory Comprehension	**BSL**	6.00 (1.26) n = 10	9.83 (1.47) n = 9	13.00 (2.28) n = 10	18.83 (3.60) n = 9
	SG	5.57 (.79) n = 8	10.33 (1.66) n = 10	14.00 (1.94) n = 9	19.44 (2.40) n = 9
	VT	6.00 (1.15) n = 10	11.20 (1.14) N = 10	14.00 (2.40) n =10	18.10 (2.88) n = 10
	NC	5.78 (.97) n = 9	9.67 (1.22) n = 10	13.11 (1.96) n = 10	19.67 (2.69) n = 10
Expressive Communication	**BSL**	6.83 (.98) n = 10	10.17 (1.83) n = 9	12.00 (1.55) n = 10	20.00 (6.03) n = 9
	SG	6.71 (.95) n = 8	10.00 (1.50) n = 10	12.44 (2.19) n = 9	19.67 (3.24) n = 9
	VT	5.50 (1.08) n = 10	13.20 (2.44) n = 10	13.20 (2.44) n = 10	17.80 (2.39) n = 10
	NC	6.44 (.73) n = 9	9.22 (1.39) n = 10	11.44 (1.59) n = 10	19.22 (3.07) n = 10
Gestures, Actions and Pretend Play	**BSL**	6.60 (4.14) n = 10	24.17 (11.36) n = 9	29.83 (6.18) n = 10	49.35 (7.77) n = 9
	SG	9.50 (6.11) n = 8	20.56 (7.18) n = 10	37.00 (12.02) n = 9	49.11 (8.46) n = 9
	VT	7.50 (4.93) n = 10	22.30 (6.20) n = 10	36.40 (11.19) n = 10	49.40 (8.29) n = 10
	NC	6.44 (4.00) n = 9	22.50 (6.36) n = 10	35.60 (7.34) n = 10	49.30 (7.67) n = 10

There was no significant effect of condition on each of the language measures. As one would expect there was a significant effect of age on each of the language measures, with infants scoring higher over time. There was no significant interaction between condition and age on any language measure. The results are summarised in the table below.

Table 2.17. Summary of results evaluating the impact of condition on language measures

Language Measure	Main effect of condition	Main effect of age	Interaction effect Condition * Age
Receptive Vocabulary	F(3,30) = .67, p = .58, eta 2 = .06, power = .18 (NS)	F(3,28) = 5.41, p = .00, eta 2 = .85, power = 1 (Sig)	F(9, 68.30) = .92, p = .51, eta2 = .09, power = .33 (NS)
Productive vocabulary	F(3,30) = .20, p = .90, eta2 = .02, power = .08 (NS)	F(3,28) = 4.23, p = .00, eta 2 = .82, power = 1 (Sig)	F(9, 68.30) = .29, p = .98, eta2 = .03, power = .12 (NS)
Auditory comprehension	F(3,28) = .20, p = .20, eta2 = .90, power = .08 (NS)	F(3, 26) = 2.32, p = .00, eta2 = .96, power = 1 (Sig)	F(9, 64.43) = .92, p = .52, eta2 = .09, power = .33 (NS)
Expressive communication	F(3,28) = .60, p = .62, eta2 = .06, power = .16 (NS)	F(3,26) = .07, p = .00, eta2 = .93, power = 1 (Sig)	F(9, 63.43) = 1.25, p = .28, eta2 = .12, power = .45 (NS)
Gestures, actions and pretend play	F(3,30) = .33, p = .81, eta 2 = .03, power = .11 (NS)	F(3,28) = 1.79, p = .00, eta 2= .95, power = 1 (Sig)	F(9, 68.30) = 1.10, p = .37, eta 2= .10, power = .40 (NS)

There was no significant main effect of condition on infants' overall score on the GAPP checklist. Further analyses were then conducted to assess the impact of condition on the development of different aspects of gesture as measured by the GAPP subscales. The GAPP checklist contains the following subscales: *Conventional gestures* (e.g. waving bye-bye, holding fingers to lips to say 'Shhh'), *Indicating gestures* (e.g. holds out an object to show you, indicating a place using hand or arm), *Games and routines* (e.g. plays pat-a-cake, joins in with round-and-round-the-garden), *Playing parents using doll or teddy* (e.g. feeds baby, puts baby to bed), *Imitating adults* (e.g. pretends to cook, to use tools) and *symbolic gestures* (e.g. holding hands wide apart to indicate big. This category does not include the target symbolic gestures).

A multivariate repeated-measures ANOVA was conducted to determine the impact of condition on the development of each of these types of gestures. The within-subjects factor was age (8, 12, 16 and 20 months) and the between-subjects factors were condition (BSL, SG, VT, NC) and gender. The dependent variables were scores on the GAPP subscales: conventional gestures, indicating gestures, games and routines, playing parents, imitating adults and symbolic gestures. The means and standard deviations are presented in the table overleaf.

There was a significant main effect of age [$F(3, 24) = 1.85$, $p = .00$, $eta^2 = .96$, power = 1] and subscale [$F(5, 22) = 2.08$, $p = .00$, $eta^2 = .98$, power = 1]. There was no significant main effect of condition, [$F(3, 26) = .16$, $p = .00$, $eta^2 = .02$, power = .08] or gender [$F(1, 26) = .62$, $p = .00$, $eta^2 = .02$, power = .12]. There was no significant interaction between condition and gender [$F(3, 26) = .18$, $p = .91$, $eta^2 = .02$, power = .08]. Therefore, an exploration of the infants' scores on the GAPP subscales did not reveal any differences between infants, regardless of condition or gender.

Table 2.18. Mean scores on GAPP subscales by age and condition

		Conventional	Indicating	Games and Routines	Playing Parents	Imitating Adults	Symbolic Gestures
8 months	BSL *(n = 10)*	3.20 (1.55)	.50 (.71)	2.10 (2.23)	.20 (.63)	.30 (.48)	.00 (.00)
	SG *(n = 9)*	2.89 (1.27)	2.00 (1.58)	2.89 (3.02)	.89 (1.54)	1.00 (1.73)	.00 (.00)
	VT *(n = 10)*	2.70 (1.77)	1.10 (.88)	1.70 (1.64)	.10 (.32)	1.60 (1.58)	.10 (.32)
	NC *(n = 10)*	2.60 (1.90)	.90 (1.20)	1.70 (1.83)	.10 (.32)	.60 (1.07)	.00 (.00)
12 months	BSL *(n = 9)*	6.67 (2.23)	3.44 (.73)	6.00 (2.78)	1.56 (1.74)	3.44 (2.51)	1.00 (2.00)
	SG *(n = 10)*	6.40 (3.27)	3.70 (.48)	5.80 (2.74)	2.50 (2.59)	5.00 (3.74)	1.10 (1.91)
	VT *(n = 10)*	7.10 (2.64)	4.00 (.00)	4.30 (2.26)	1.30 (1.70)	4.00 (2.36)	.40 (.70)
	NC *(n = 10)*	6.00 (1.56)	3.40 (.52)	6.40 (2.32)	1.20 (1.48)	4.70 (2.50)	.60 (.84)
16 months	BSL *(n = 10)*	7.90 (3.48)	3.50 (1.27)	7.70 (1.95)	3.70 (3.37)	6.90 (2.73)	2.60 (2.07)
	SG *(n = 9)*	9.33 (2.60)	3.89 (.33)	7.89 (2.52)	4.56 (3.00)	8.67 (5.29)	3.00 (3.16)
	VT *(n = 10)*	9.90 (2.02)	3.90 (.32)	7.10 (2.88)	4.70 (3.74)	9.70 (3.43)	1.60 (1.07)
	NC *(n = 10)*	8.10 (2.13)	4.00 (.00)	7.60 (2.67)	2.90 (2.77)	9.80 (3.49)	1.50 (1.35)
20 months	BSL *(n = 9)*	11.33 (2.18)	4.00 (.00)	9.11 (1.83)	7.11 (4.48)	12.44 (4.33)	3.78 (3.63)
	SG *(n = 8)*	11.25 (2.38)	3.63 (.74)	9.25 (1.28)	8.00 (2.78)	12.63 (5.76)	2.75 (1.39)
	VT *(n = 10)*	10.80 (2.10)	4.00 (.00)	8.60 (1.43)	8.00 (3.77)	14.00 (3.13)	2.90 (1.10)
	NC *(n = 9)*	11.44 (1.59)	3.56 (1.33)	8.44 (1.51)	9.11 (1.96)	14.22 (3.42)	2.33 (2.18)

2.3.2.2. Relationship Between Gesture and Verbal Language Development

While the foregoing analyses did not reveal an effect of gesture training on infants' mean scores on verbal and non-verbal language measures, the next set of analyses considers the relationship between gesture and verbal language development. Did the number of gestures (as measured by the GAPP checklist) that infants produced relate to their language abilities? Did the number of target gestures that the gesture-trained infants produced relate to their language abilities?

Correlation coefficients were computed to assess the degree of relationship between gesture (as assessed using the GAPP checklist) and measures of verbal language abilities (table 2.18).

Table 2.19. Correlation coefficients of GAPP score and language measures by age

	Receptive Vocabulary	Productive Vocabulary	Expressive Communication	Auditory Comprehension
8 months	.39*	.09	.16	-.14
12 months	.46**	.11	-.09	.08
16 months	.47**	.10	.36*	.16
20 months	.01	.07	-.19	-.21

* significant at p <.05
** significant at p <.01

Total GAPP score correlates moderately with receptive vocabulary at 8, 12 and 16 months of age. Therefore, increases in the number of gestures that infants produced was related to increases in the number of words that infants understood. This relationship disappears at 20 months, presumably because receptive vocabulary stabilises whereas the number of gestures that children produced at this age continued to increase. The number of gestures that infants produced is not related to other language measures, and so increases in gesture were not associated with gains in productive vocabulary, expressive communication or auditory communication.

Next, correlational coefficients were computed to determine the relationship between the number of target gestures that infants produced and the amount of gestures they produced overall and measures of language development (see Table 2.19). There was no significant relationship between target gesture production and language measures, therefore the number of target gestures that children produced at any age was not related to vocabulary, expressive communication or auditory comprehension. There was a large significant relationship between target gesture production and overall gesture production at 16 months. This relationship was not found at 12 or 20 months.

Table 2.20. Correlational coefficients of the number of target gestures produced and language and gesture measures by age

	GAPP	Receptive Vocabulary	Productive Vocabulary	Expressive Communication	Auditory Comprehension
12 months	.15	.45	.14	-.11	.14
16 months	.53*	.42	-.24	-.03	.20
20 months	.18	-.08	-.27	-.03	-.27

* significant at p <.05

2.3.2.3. Planned Comparisons

A series of planned comparisons were then conducted to test specific hypotheses regarding differences between the groups on measures of language. The first contrast tested the hypothesis that infants in the intervention conditions (BSL, SG, VT) would score significantly higher on language measures than the non-intervention control group. The rationale was that the encouraged attention on infants' language would result in infants in the gesture training (BSL and SG) and VT groups performing better than infants in the non-intervention control group. This would determine whether telling a mother to train her infant in some way has any effect at all on infant language development. The second contrast tested the hypothesis that the gesture-trained groups (BSL, SG) would score significantly higher on language measures than the VT group. This is because the effects of gesture training were expected to benefit language development over and above the effect of verbal training. Finally, the effect of the type of gesture that infants were exposed to and trained to use is evaluated in the third comparison. This tested whether there is any difference between the BSL and SG groups on measure of language development. The order of comparisons is demonstrated in the figure below.

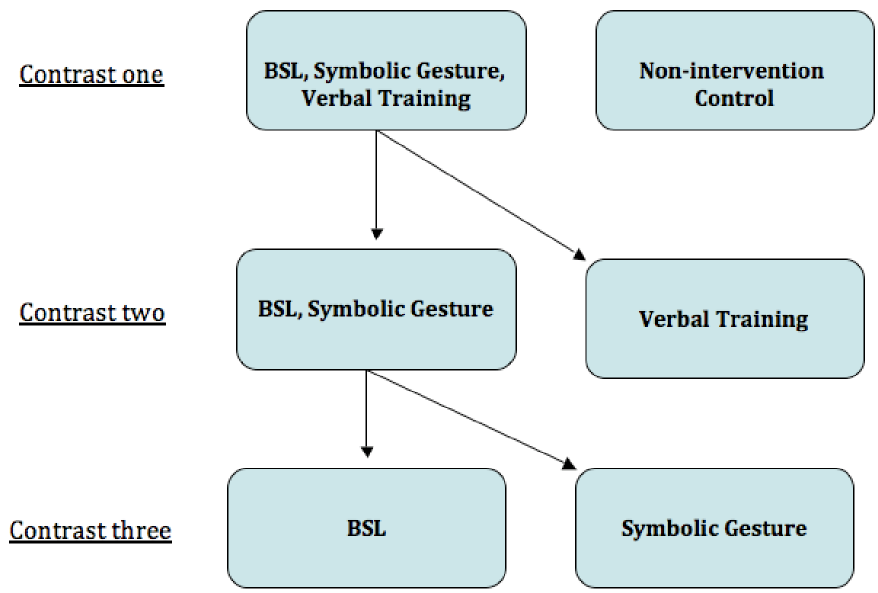

Figure 2.4. Illustration of planned comparisons

Contrast one: Intervention Vs No Intervention

The first contrast evaluated the impact of participating in a language intervention (including verbal and gesture) on infants' language development and compared the language scores of infants in the intervention groups (BSL, SG, VT) with the non-intervention control group. The means and standard deviations are presented in the table below.

Table 2.21. Mean scores (SD) on language measures of intervention groups (BSL, SG, VT) and non-intervention control by age.

	12 months		16 months		20 months	
	Intervention n = 29	Control n = 10	Intervention n = 29	Control n = 10	Intervention n = 28	Control n = 10
Receptive Vocabulary	61.12 (59.61)	40.70 (25.79	127.00 (56.74)	98.10 (33.84)	127.32 (75.27)	102.70 (63.62)
Productive Vocabulary	4.55 (4.48)	3.80 (4.64)	42.16 (42.68)	29.00 (34.79)	167.68 (99.12)	161.00 (71.86)
Gestures, Actions and Pretend Play	22.12 (7.77)	22.50 (6.36)	35.04 (10.58)	35.60 (7.34)	48.44 (8.47)	49.30 (7.67)
Auditory Comprehension	10.56 (1.47)	9.90 (1.37)	13.76 (2.17)	13.30 (1.95)	18.76 (2.85)	19.80 (2.57)
Expressive Communication	10.04 (1.40)	9.40 (1.43	12.64 (2.14)	11.80 (1.87)	19.00 (3.77)	19.40 (2.95)

An inspection of the means indicates that the infants in the intervention groups consistently scored higher than the infants in the non-intervention control group on both receptive and productive vocabulary. There appear to be no differences on the other measures between the two groups.

The results of the planned comparison for each language measure is presented in the table below. The intervention groups were not significantly different from the non-intervention control group on any measures of language at ages 12, 16 and 20 months.

Table 2.22. Results of comparison between infants in the intervention groups (BSL, SG, VT) and infants in the non-intervention control group

	Receptive Vocabulary	Productive Vocabulary	Auditory Comprehension	Expressive Communication	Gestures, Actions and Pretend Play
12 months	β = .17, *t* = 1.03, *p* .31	β = .07, t = .43, p = .67	β = .15, *t* = .94, *p* .35	β = .20, *t* = 1.21, *p* .24	β = -.05, *t* = -.28, *p* .78
16 months	β = .27, t = 1.63, p = .11	β = .16, t = .93, p = .36	β = .10, t = .57, p = .58	β = .17, t = .99, p = .33	β = .00, t = .00, p = 1.00
20 months	β = .10, t = .59, p = .56	β = .10, t = .57, p = .57	β = -.12, t = -.71, p = .48	β = .00, t = .01, p = .99	β -.04, t = -.21, p = .84

Contrast Two: Gesture Training Vs Verbal Training

The second contrast evaluated the impact of type of intervention (verbal training or gesture training) on infants' language development. This was conducted to determine whether encouraging mothers to model the target items in gesture and speech would have greater benefits than focusing on verbal modelling alone. The mean language scores of infant who were gesture trained (BSL and SG groups) were compared with those of the infants in the VT condition. The means and standard deviations are presented in Table 2.23.

Table 2.23. Mean language scores (SD) of gesture trained and verbal trained infants by age

	12 months		16 months		20 months	
	Gesture n = 19	Verbal n = 10	Gesture n = 19	Verbal n = 10	Gesture n = 18	Verbal n = 10
Receptive Vocabulary	73.47 (71.01)	42.60 (31.57)	125.60 (58.83)	129.10 (56.52)	124.73 (73.13)	131.20 (82.21)
Productive Vocabulary	4.13 (3.80)	5.40 (5.93)	37.93 (43.76)	48.50 (42.48)	159.60 (102.50)	179.80 (97.89)
Gestures, Actions and Pretend Play	22.00 (8.88)	22.50 (6.20)	34.13 (10.46)	36.40 (11.19)	47.80 (8.82)	49.40 (8.29)
Auditory Comprehension	10.13 (1.55)	11.20 (1.14)	13.60 (2.06)	14.00 (2.40)	19.20 (2.83)	18.10 (2.88)
Expressive Communication	10.07 (1.58)	10.00 (1.15)	12.27 (1.91)	13.20 (2.44)	19.80 (4.36)	17.80 (2.39)

The receptive vocabulary of infants in the gesture training groups (BSL and SG) is greater than that of infants in the VT group at 12 months, however at 16 and 20 months infants in both groups have similar scores. The productive vocabulary of infants in the VT group is larger than that of infants in the gesture group and the magnitude of difference increases over time, with a difference of one at 12 months, ten at 16 months and 20 at 20 months. Infants do not appear to differ on any other measures, with the exception that at 20 months infants in the gesture group score higher than infants in the VT group in expressive communication. Given the small range of scores on this measure, a difference of two is a considerable difference.

The results of the planned comparison are summarised in Table 2.24. Overall, there was no significant impact of type of intervention on infants' language development. There was one exception, with infants in the VT condition scoring significantly higher in auditory comprehension at 12 months. However, overall the findings suggest that there is no added benefit of encouraging mothers to gesture in addition to verbal modeling.

Table 2.24. Summary of findings of planned comparison of gesture-trained infants and verbal trained infants on measures of language

	Receptive Vocabulary	Productive Vocabulary	Auditory Comprehension	Expressive Communication	Gestures, Actions and Pretend Play
12 months	β = .21, t = 1.31, p .20	β = -.12, t = -.73, p .47	β = .15, t = .94, p .04	β = .02, t =.09, p .93	β = -.05, t = -.28, p .78
16 months	β = .03, t = .17, p .87	β = -.08, t = -.50, p .62	β = -.08, t = -.44, p .66	β = -.20, t =-1.21, p .24	β = -.05, t = -.31, p .76
20 months	β = -.11, t = -.63, p .54	β = .01, t = .07, p .95	β = .22, t = 1.32, p .19	β = .28, t =1.68, p .10	β = -.06, t = -.33, p .74

Contrast Three: BSL Vs SG

The last set of comparisons evaluated the impact of the type of gesture to which infants were exposed and encouraged to use. The language scores of infants in the BSL and SG conditions were compared. The means and standard deviations are presented in Table 2.25.

Table 2.25. Mean scores (SD) on language measures of infants in the BSL and SG groups by age

	12 months		16 months		20 months	
	BSL n = 9	SG n = 10	BSL n = 10	SG n = 9	BSL n = 9	SG n = 9
Receptive Vocabulary	68.83 (61.48)	76.56 (80.22)	117.17 (28.15)	131.22 (73.97)	146.67 (88.98)	110.11 (61.73)
Productive Vocabulary	4.50 (3.02)	3.89 (4.40)	38.00 (56.39)	37.89 (36.94)	131.83 (110.72)	178.11 (98.80)
Gestures, Actions and Pretend Play	24.17 (11.36)	20.56 (7.18)	29.83 (6.18)	37.00 (12.02)	49.35 (7.77)	49.11 (8.46)
Auditory Comprehension	9.83 (1.47)	10.33 (1.66)	13.00 (2.28)	14.00 (1.94)	18.83 (3.60)	19.44 (2.40)
Expressive Communication	10.17 (1.83)	10.00 (1.50)	12.00 (1.55)	12.44 (2.19)	20.00 (6.03)	19.67 (3.24)

Infants in the BSL and SG groups had similar mean scores on the language measures. However, differences are apparent in vocabulary at 20 months. While infants in the BSL group have a higher receptive vocabulary than infants in the SG group, infants in the SG group have a higher productive vocabulary. Therefore, while infants in the BSL group may be judged as understanding more words than infants in the SG group, they were actually saying less.

The results of the planned comparison (table 2.26) suggest that the type of gesture that infants were encouraged to use did not differentially impact upon their language development.

Table 2.26. Summary of planned comparison 3

	Receptive Vocabulary	Productive Vocabulary	Auditory Comprehension	Expressive Communication	Gestures, Actions and Pretend Play
12 months	β = -.00, *t* = -.02, *p* .98	β = -.03, *t* = -.19, *p* .85	β = -.10, *t* = -.64, *p* .53	β = -.03, *t* =-.15, *p* .88	β = .15, *t* = .90, *p* .38
16 months	β = .02, *t* = .12, *p* .90	β = .05, *t* = .27, *p* .79	β = -.12, *t* = -.72, *p* .48	β = -.08, *t* =-.45, *p* .66	β = -.13, *t* = -.80, *p* .43
20 months	β = .03, *t* = .15, *p* .88	β = .03, *t* = .19, *p* .85	β = .03, *t* = .17, *p* .87	β = .11, *t* =.64, *p* .52	β = -.07, *t* = -.42, *p* .68

2.3.2.4. Did Infants' Language Development Differ Between Infants in the Four Conditions? A Comparison of Mean Rank Change on the Language Measures

The data analyses to this point have considered infants' mean scores on the language measures. Infant data, by its very nature is high in variation and this variance can mask mean differences between groups on measures of language development. Therefore, the dependent variable in the following analyses is mean rank change. This considers each individual's position relative to all others within the sample. By ranking the data, infants' scores on language measures is replaced by each infant's relative position within the sample. Ranking infants' scores on the language measures at 8 months provides an indication of where infants' initial ability ranks in comparison to the whole sample. Infants' scores on each of the language measures were ranked at the start and at the end of the study. From these it was possible to compute a measure of individual change in rank relative to the sample across the study. The lowest score was given a rank of one, therefore the lowest rank score indicates the infant within the sample with the lowest ability on that measure, and the highest rank the infant with the highest score. Mean rank change was calculated by subtracting mean rank at 8 months from mean rank at 20 months[4]. Positive mean rank change scores indicate gain in rank within the sample whereas a negative mean rank score indicates a decrease in rank.

In this section, mean rank change was compared across conditions to identify in which condition infants were most likely to improve their mean ranking. Analyses were conducted for each measure of language; receptive vocabulary, expressive vocabulary, auditory comprehension, expressive communication and gesture development.

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[4] With the exception of productive vocabulary, for which the baseline was 12 months because scores at 8 months were negligible and so not appropriate to use as an indicator of early ability.

Initial analyses were conducted to explore the distribution of mean rank change scores and to allow the identification of any individual infants in each condition that made great gains or losses in their mean rank which may skew the data. Box-plot analyses were conducted for each measure, presented below.

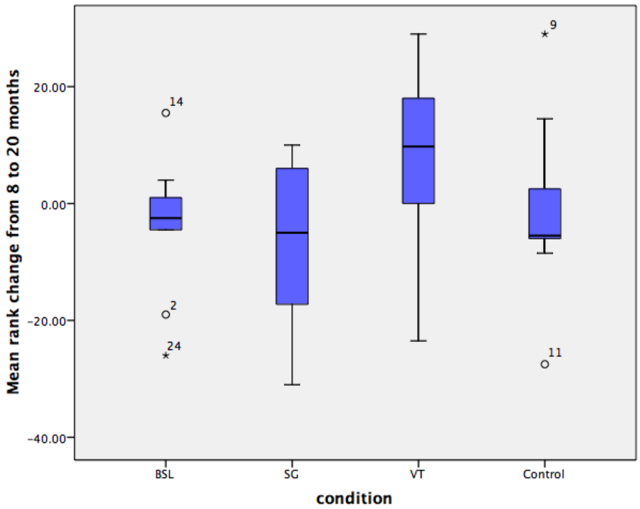

Figure 2.5. Distribution of mean rank change scores for receptive vocabulary by condition

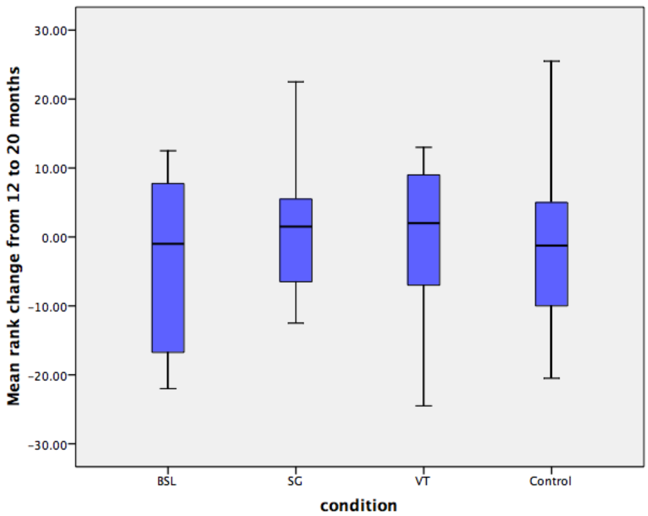

Figure 2.6. Distribution of mean rank change scores of productive vocabulary by condition

An inspection of the distribution of receptive vocabulary rank change scores indicate that the median rank change in the BSL, SG and control condition is close to zero, however the median rank change for the VT group is higher suggesting that these infants tended to improve in their mean rank. A number of outliers are indentified in the BSL and control groups. These cases were not immediately removed from the sample. However, if significant differences were found in the subsequent analyses of rank change by condition, then these cases would then be removed and the analyses repeated without these cases. An inspection of the box-plot for productive vocabulary reveals that the median score for all groups is close to zero, therefore no significant difference between the groups is anticipated as all groups made little change in the their mean rank. No outliers are identified.

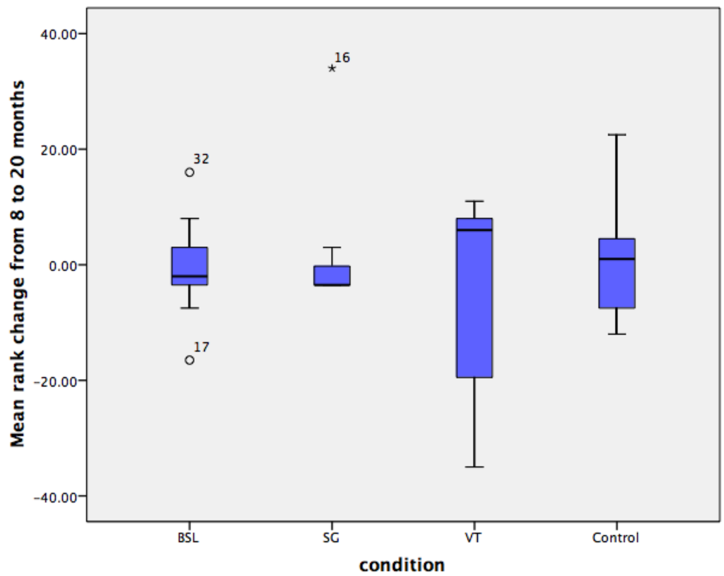

Figure 2.7. Distribution of rank change scores on auditory comprehension

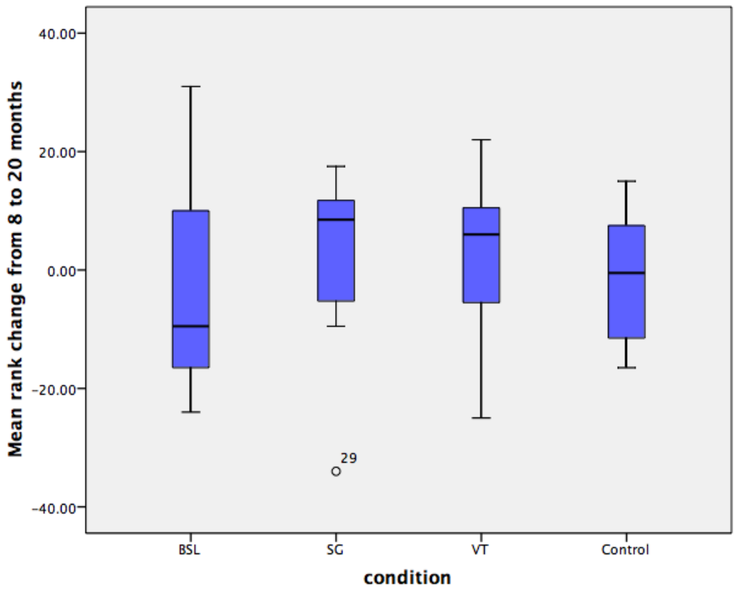

Figure 2.8. Distribution of expressive communication rank change scores by condition

An inspection of the language ability plots (Figures 2.7, 2.8) indicate a difference in the distribution of scores on auditory comprehension and expressive communication. The median rank change on auditory comprehension is close to zero for all four groups, however the median rank change on expressive communication varies by group. The BSL group has a negative median rank, the SG and VT have a positive median rank and the control group has a median close to zero. There were three outliers on auditory comprehension and one outlier for expressive communication. These cases were not removed, however, if significant effects were to emerge in subsequent analyses, then these cases would be removed to determine whether they were skewing the data.

The distribution of GAPP rank change scores indicates that there are no outliers and that each condition had a similar distribution of scores.

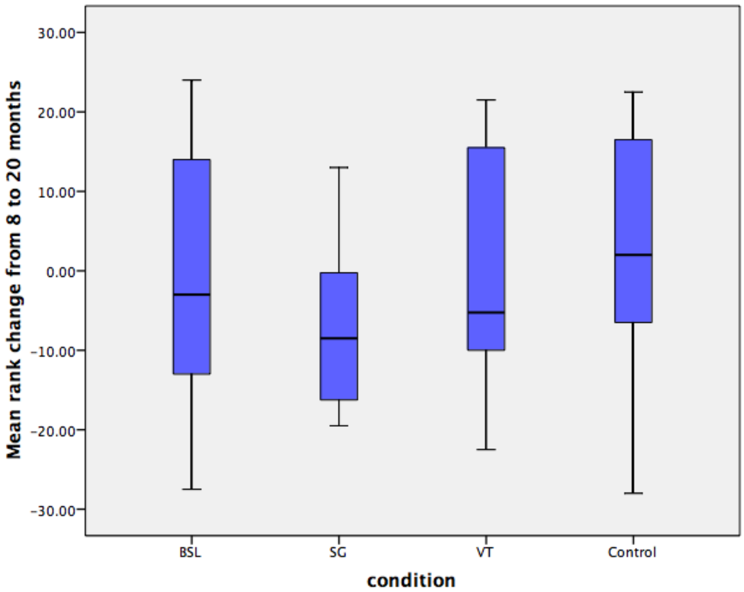

Figure 2.9. Distribution of GAPP rank change scores

The mean rank change of infants in the four conditions is presented in Table 2.27 for each of the language measures.

Table 2.27. Mean rank change by language measure and condition

	BSL n = 9	SG n = 7	VT n = 10	NC n = 9
Receptive Vocabulary	-6.13 (10.60)	-6.93 (16.30)	8.15 (15.75)	-.83 (15.72)
Productive Vocabulary	-3.69 (13.46)	1.21 (11.99)	-.50 (13.18)	2.00 (12.35)
Auditory Comprehension	-1.50 (9.32)	2.79 (13.98)	-4.70 (17.40)	1.67 (11.26)
Expressive Communication	-5.25 (18.39)	.71 (17.89)	3.00 (13.69)	-1.11 (10.82)
Gestures, Actions and Pretend Play	1.69 (17.34)	-6.86 (12.02)	.50 (15.22)	3.00 (16.27)

A one-way Multivariate Analysis of Variance (MANOVA) was conducted to determine the effect of condition on the mean rank change in the language measures. No significant differences were found among the four conditions on the dependent measures, $F(15, 72.18) = 1.01$, $p = .45$, $eta^2 = .16$, power = .54. Therefore, infants did not change in their mean rank within the sample as a function of the condition they experienced.

2.3.2.5. *Interim Summary of Findings*

All of the infants who were exposed to gesture modelling acquired between two and seventeen target gestures, with no significant difference in the number of gestures acquired by male and female infants. There was a trend for infants to acquire more symbolic gestures than BSL gestures. Being able to gesture greatly enhanced infants' target item vocabulary. Access to both the manual and verbal modalities meant that gesture-trained infants could communicate about more target items than control infants. Indeed, when aged 16 months the target vocabulary of gesture-trained infants doubled that of control infants. Gesture also meant that infants could communicate at a much younger age. At 12 months, gesture-trained infants could communicate about a significantly greater number of targets than they could verbalise. Did the acquisition of a manual label for a target mean that infants acquired the verbal labels earlier? No it did not, in fact there was no difference between any of the infants in the acquisition of target words at any age. Therefore, regardless of being exposed to enhanced modelling of target words (as were the infants in the VT condition) all infants acquired an equivalent number of the target words at each age.

Did gesture training impact upon infants' language development? No effect of gesture training was found on the development of infants' receptive and productive vocabulary, auditory comprehension, expressive communication or gesture production. Further analyses indicated that there was no overall effect of intervention on infants language development; infants who participated in the BSL, SG and VT conditions were equivalent in their language development to the non-intervention control infants. There was no effect of gesture training; infants who participated in the BSL, and SG conditions were equivalent in their language development to the VT infants. There was no effect of gesture type on language development; infants who were taught BSL gestures were equivalent in their language development infants instructed to use symbolic gestures. Furthermore, infants' mean rank change on the language measures from baseline to 20 months did not change significantly as a function of condition. These findings appear to suggest that, although infants may acquire gestures from a pre-verbal age and these gestures greatly enhance their target communicative repertoire, gesturing does not have any effect of the development of infants' language abilities.

2.3.3. Results: Section Three. What Contribution did Within-Child Factors have on the Effect of Condition on Infants' Language Development?

All of the foregoing analyses have focused on group differences and some assume that all infants start the same. However, even at eight months of age, some infants are more able than others. This next section considers within child factors and how these may relate to infants' receptivity to gesture. The analyses presented here focus on individual change and the contribution of intervention, gender and initial ability to this change over time. Gender contributes significantly to individual ability; language performance is generally better among females than males (e.g. Bornstein et al. 2000) and girls are known to start talking earlier than their male peers (Murray, Johnson & Peters, 1990). Therefore, gender differences are likely in infants' language ability and this may result in differences to infants' receptivity to gesture.

The analyses are presented in two sections. The first considers the contribution of the within child factors of gender and ability to infants' mean scores on the language measures. The second set of analyses focus on mean rank change on each of the language measures.

2.3.3.1. What Contribution Did Within-Child Factors have on the Effect of Condition on Infants' Language Development? A Comparison of Mean Scores.

Receptive Vocabulary

Infants' receptive vocabulary score at eight months was used as an indicator of their initial ability. The mean score of the sample was 17.32 (SD = 36.80) and the median score was 7. There was a wide range of scores, the minimum was 0 and the maximum was 220. Infants were categorised as low or high-ability depending on whether their mean receptive vocabulary score at eight months was higher or lower than the median score of 7. The mean receptive vocabulary score at eight months for low-ability infants (N = 20) was 3.20 (SD = 2.48) and the mean score of high-ability infants was 33.94 (SD = 49.98), a significant difference, $t(35) = -2.75$, $p = .01$. This confirms that low and high scorers were two distinct groups. The mean receptive vocabulary of infants in the four conditions at each age is presented in the table below by gender and ability.

Table 2.28. Mean receptive vocabulary score by condition, age, ability and gender

Group	Age (months)	Baseline Receptive Vocabulary			
		Low		High	
		Male	Female	Male	Female
BSL		*n = 0*	*n = 2*	*n =4*	*n = 2*
	8	-	3.50 (4.95)	23.75 (7.93)	36.00 (28.28)
	12	-	16.00 (14.14)	83.75 (72.78)	78.00 (36.77)
	16	-	75.00 (15.56)	127.50 (28.63)	153.50 (65.76)
	20	-	41.00 (53.74)	167.25(105.04)	89.50 (60.10)
SG		*n = 1*	*n = 2*	*n = 2*	*n = 2*
	8	6.00 (-)	5.00 (1.41)	18.50 (14.85)	115.00(148.49)
	12	11.00 (-)	42.50 (9.19)	97.50 (48.79)	140.00(169.71)
	16	29.00 (-)	100.00 (41.01)	162.50 (82.73)	159.50(125.16)
	20	151.00 (-)	126.00 (3.66)	50.00 (63.64)	63.50 (14.85)
VT		*n = 5*	*n = 3*	*n = 0*	*n = 2*
	8	2.60 (1.67)	4.33 (.58)	-	15.00 (4.24)
	12	33.20 (13.26)	21.33 (10.12)	-	98.00 (11.31)
	16	140.80 (55.76)	79.33 (38.55)	-	174.50 (33.23)
	20	156.20 (78.30)	88.33 (67.93)	-	133.00(135.76)
NC		*n = 3*	*n = 2*	*n = 2*	*n = 2*
	8	8.33 (3.51)	2.50 (3.54)	14.50 (4.95)	19.00 (9.90)
	12	28.33 (15.01)	30.00 (9.90)	31.50 (20.51)	65.00 (46.67)
	16	80.00 (38.74)	103.50 (3.54)	86.50 (55.86)	112.50 (31.82)
	20	89.00 (99.87)	112.00 (86.27)	130.50 (34.65)	69.50 (47.38)

A mixed-design ANOVA was conducted to explore the impact of condition and within-child factors on infants' receptive vocabulary development. The repeated measures factor was age of assessment (4 levels: 8, 12, 16, 20 months). The between-subjects factors were gender, condition (BSL, SG, VT, NC) and ability (low, high). The dependent variable was receptive vocabulary mean score at each age of assessment. The findings are summarised in the table below. There was no significant main effect of condition or gender on infants' receptive vocabulary, however there was a significant effect of ability.

Table 2.29. Summary of 4x2x2 mixed ANOVA outcome variable: receptive vocabulary (significant effects in bold)

Between-Subjects Main Effects and Interactions	ANOVA Result
Condition	F(3,20) = .70, p = .57, e2 = .10, power = .17
Gender	F(1,20) = .00, p = .98, e2 = .00, power = .05
Ability	**F(1,20) = 4.87, p = .04, e2 = .20, power = .56**
Condition * Gender * Ability	F(1,20) = .14, p = .71, e2 = .01, power = .06
Condition * Gender	F(3,20) = .76, p = .53, e2 = .10, power = .18
Condition * Ability	F(3,20) = .41, p = .75, e2 = .06, power = .12
Gender * Ability	F(1,20) = .01, P = .93, e2 = 0 , power = .05
Age	**F(3,18) = 6.27, p = .00, e2 = .91, power = 1**
Age* Condition	F(9, 43.96) = 1.27, p = .28, e2 = .17, power = .43
Age * Gender	F(3,18) = .78, p = .52, e2 = .12, power = .18
Age * Ability	**F(3,18) = 4.20, p = .02, e2 = .41, power = .77**
Age * Condition * Ability	F(9, 43.96) = 1.37, p = .23, e2 = .18, p = .46
Age * Gender * Ability	F(3,18) = 1.49, p = .25, e2 = .20, power = .33
Age * Condition * gender	F(9, 43.96) = 1.03, p = .43, e2 = .14, power = .35
Age * Condition * Gender * Ability	F(3,18) = 2.05, p = .14, e2 = .25, power = .44

Four independent-samples t-test were conducted to follow up the significant interaction between age and ability. Familywise error rate was controlled for across these tests using the Bonferonni approach, as such alpha was set at .0125. Differences in mean receptive vocabulary between low and high-ability infants were significant at 12 months only (see table below).

Table 2.30. Comparison of receptive vocabulary scores of low and high-ability infants at each age of assessment

Age (months)	Mean Score		Comparison
	Low (n = 18)	High (n = 16)	
8	3.20 (2.48)	33.94 (49.98)	t(16.07) = -2.53, p = .02 (ns)
12	26.89 (13.73)	85.59 (63.59)	t(17.34) = -3.73, p = .00*
16	99.95 (46.21)	144.35 (60.12)	t(34) = -2.50, p = .02 (ns)
20	112.11 (70.36)	108.81 (78.95)	t(34) = .13, p = .90 (ns)

* significant at p < .0125

Productive Vocabulary

The mean productive vocabulary score of the whole sample when infants were 12 months was 4.36 (SD = 4.47). The median score was 3 and the minimum score was 0 and the maximum 20. A categorical variable was created from infants' productive vocabulary at 12 months[5]. A median split was used, with infants scoring less than the median receptive vocabulary score at 12 months (median = 3) being labelled as 'low-ability' and those that had a higher score were labelled 'high-ability'. The mean productive vocabulary of low scoring infants (N = 22) was 1.27 (SD = 1.03) and high scoring infants (N = 17) had a mean score of 8.35 (SD = 4.00), a significant difference [t(37) = 7.99, p = .00] confirming that these two groups as distinct. The mean productive vocabularies of infants in each condition who were low and high-ability, male and female is presented in the table below, by age.

Table 2.31. Mean productive vocabulary by condition, age and ability

Group	Age (months)	Low Ability		High Ability	
		Male	Female	Male	Female
BSL		*n = 3*	*n = 0*	*n = 1*	*n = 4*
	12	2.00 (1.00)	-	8.00 (-)	5.25 (1.89)
	16	7.33 (6.11)	-	151.00 (-)	50.00 (44.05)
	20	61.67 (55.14)	-	327.00 (-)	223.75(101.78)
SG		*n = 2*	*n = 2*	*n = 1*	*n = 2*
	12	.50 (.71)	1.50 (.71)	9.00 (-)	10.00(0.00)
	16	14.50 (7.78)	20.00 (5.66)	38.00 (-)	90.50 (57.28)
	20	130.00(137.18)	163.50 (6.36)	256.00 (-)	277.50(129.40)
VT		*n = 2*	*n = 2*	*n = 3*	*n = 3*
	12	0.00(0.00)	1.00(0.00)	11.00(7.81)	6.33(.58)
	16	10.00(12.73)	22.50(17.68)	60.33(36.07)	79.67(52.50)
	20	96.50(61.59)	174.50(13.44)	194.00(114.53)	224.67(133.16)
NC		*n = 5*	*n = 3*	*n = 0*	*n = 1*
	12	1.40(.89)	2.33(1.15)	-	15.00(-)
	16	16.80(10.18)	16.33(3.79)	-	125.00(-)
	20	148.60(75.27)	152.00(65.64)	-	277.00(-)

A mixed-design ANOVA was conducted to assess the impact of condition and within-child factors on infants' productive vocabulary development. The repeated-

[5] This age was chosen over 8 months as infants' productive vocabularies at 8 months was minimal and would not give a good indication of baseline ability.

measures factor was age of assessment (12, 16, 20 months). The between-subjects factors were gender, condition (BSL, SG, VT, NC) and ability (low, high). The dependent variable was productive vocabulary mean score at each age of assessment. The findings are summarised in Table 2.32.

Table 2.32. Summary of results of 4x2x2 ANOVA, outcome variable: productive vocabulary (significant effects in bold)

Between-Subjects Main Effects and Interactions	ANOVA Result
Condition	F(3,23) = .13, p = .94, e2 = .02, power = .07
Gender	F(1,23) = .04, p = .85, e2 = .00, power = .05
Ability	**F(1,23) = 18.97, p = .00, e2 = .45, power = .99**
Condition * Gender * Ability	F(1,23) = .16, p = .69, e2 = .01, power = .07
Condition * Gender	F(3,23) = 1.17, p = .34, e2 = .13, power = .27
Condition * Ability	F(3,23) = 1.04, p = .39, e2 = .12, power = .24
Gender * Ability	F(1,23) = .00, p = .99, e2 = .00, power = .05
Age	**F(2,22) = 5.73, p = .00, e2 = .84, power = 1**
Age* Condition	F(6,44) = .21, p = .97, e2 = .03, power = .10
Age * Gender	F(2,22) = .52, p = .60, e2 = .05, power = .12
Age * Ability	**F(2,22) = 1.17, p = 0.00, e2 = .52, power = .99**
Age * Condition * Ability	F(6,44) = 1.46, p = .21, e2 = .17, power = .52
Age * Gender * Ability	F(2,22) = 1.44, p = .26, e2 = .12, power = .27
Age * Condition * gender	F(6,44) = 2.05, p = .08, e2 = .22, power = .68
Age * Condition * Gender * Ability	F(2,22) = .25, p = .79, e2 = .02, power = .08

There was a significant main effect of age and ability, and the interaction between these factors was significant. Four independent-samples t-test were conducted to follow up the significant interaction between age and ability. Familywise error rate was controlled for across these tests using the Bonferonni approach, as such alpha was set at .02. Differences in mean productive vocabulary between low and high-ability infants was significant at 12, 16 and 20 months (Table 2.33). High-ability infants scored consistently higher than low-ability infants at 16 and 20 months. This demonstrates that productive vocabulary at 12 months is a strong indicator of infants' subsequent vocabulary development.

Table 2.33. Summary of post-hoc comparisons of mean productive vocabulary of low and high-ability infants

Age (months)	Mean Productive Vocabulary Score		Comparison
	Low (n = 19)	High (n = 15)	
12	1.27 (1.03)	8.35 (4.00)	t(17.65) = -7.12, p = .00*
16	16.64 (9.25)	71.69 (46.35)	t(15.87) = -4.68, p = .00*
20	129.43 (65.98)	231.25 (96.48)	t(25.20) = -3.63, p = .00*

* significant at p <.02 level

Auditory Comprehension

At 8 months, the mean auditory comprehension score of the sample as a whole was 5.86 (SD = 1.03). The median score was 6 and the minimum score was 4 and the maximum was 8. A median split was applied to the sample, and infants who scored lower than 6 were categorised as 'low-ability' and those who scored higher were categorised as 'high-ability'. The mean auditory comprehension score of the low-ability infants (N = 29) at 8 months was 5.45 (.69) and high-ability infants (N = 8) had a mean score of 7.38 (SD = .52), a significant difference [t(35) = -7.36, p = .00]. The mean auditory comprehension score of infants in the four conditions at each age, by ability and gender is presented in Table 2.3.4.

Table 2.34. Mean auditory comprehension scores by condition, age, ability and gender

Group	Age (months)	Low Ability		High Ability	
		Male	Female	Male	Female
		n = 3	*n = 1*	*n = 1*	*n = 1*
BSL	8	5.00 (.00)	6.00 (-)	8.00 (-)	7.00 (-)
	12	9.00 (1.00)	12.00 (-)	11.00 (-)	9.00 (-)
	16	12.00 (2.65)	12.00 (-)	15.00 (-)	15.00 (-)
	20	17.33 (2.31)	16.00 (-)	25.00 (-)	20.00 (-)
SG		*n = 3*	*n = 4*	*n = 0*	*n = 0*
	8	5.67 (.58)	5.50 (1.00)	-	-
	12	10.33 (1.15)	11.00 (2.00)	-	-
	16	12.33 (1.53)	14.25 (1.71)	-	-
	20	18.33 (2.08)	20.25 (2.50)		
VT		*n = 3*	*n = 4*	*n = 0*	*n = 1*
	8	5.67 (.58)	5.25 (.96)	7.50 (.71)	7.00 (-)
	12	10.33 (1.15)	11.50 (1.29)	12.00 (.00)	11.00 (-)
	16	15.00 (2.65)	15.00 (2.00)	11.00(.00)	13.00 (-)
	20	18.33 (3.06)	19.50 (2.38)	14.50 (2.12)	19.00 (-)
NC		*n = 3*	*n = 4*	*n = 2*	*n = 0*
	8	5.67 (.58)	5.25 (.96)	7.00 (.00)	-
	12	10.00 (1.00)	10.25 (.50)	8.00 (1.41)	-
	16	13.00 (2.00)	13.25 (2.22)	13.00 (2.83)	-
	20	18.00 (1.00)	19.75 (3.10)	19.75 (3.10)	-

A mixed-design ANOVA evaluated the impact of condition and within child factors on infants' auditory comprehension development. The within-subjects factor was age of assessment (8,12, 16 and 20 months). The between-subjects factors were condition (BSL, SG, VT, NC), gender and ability (low, high). The results of the ANOVA are summarised in Table 2.35.

Table 2.35. Summary of 4x2x2 mixed ANOVA results, outcome variable: Auditory comprehension (Significant effects in bold)

Between-Subjects Main Effects and Interactions	ANOVA Result
Condition	F(3,19) = .27, p = .85, e2 = .04, power = .09
Gender	F(1, 19) = .23, p = .64, e2 = .01, power = .07
Ability	F(1, 19) = 2.32, p = .14, e2 = .11, power = .30
Condition * Gender * Ability	F(1,19) = 1.96, p = .18, e2 = .09, power = .27
Condition * Gender	F(3,19) = .62, p = .61, e2 = .09, power = .16
Condition * Ability	**F(2,19) = 3.60, p = .05, e2 = .28, power = .59**
Gender * Ability	F(1,19) = .60, p = .45, e2 = .09, power = .27
Age	**F(3,17) = 1.81, p = .00, e2 = .97, power = 1**
Age* Condition	F(9, 41.52) = 1.48, p = .19, e2 = .20, power = .49
Age * Gender	F(3,17) = .48, p = .70, e2 = .08, power = .13
Age * Ability	**F(3,17) = 4.17, p = .02, e2 = .42, power = .76**
Age * Condition * Ability	**F(6, 34) = 2.34, p = .05, e2 = .29, power = .73**
Age * Gender * Ability	F(3,17) = 1.10, p = .38, e2 = .16, power = .24
Age * Condition * gender	F(9, 41.52) = .72, p = .69, e2 = .11, power = .24
Age * Condition * Gender * Ability	F(3,17) = .25, p = .86, e2 = .04, power = .09

There was a significant three-way interaction between age, condition and ability. The two-way interactions between age and ability was significant as was the interaction between condition and ability. This indicates that the difference between low and high-ability infants varied depending on the age of assessment, and that the relationship between ability and auditory comprehension score varies as a function of condition. To interpret the significant three-way interaction, the two-way interaction between age and ability was examined for each condition

There was a significant difference between low and high-ability infants in their auditory comprehension scores 8 months of age. At 12, 16 and 20 months of age there were no significant differences between low and high-ability infants (see table below).

Table 2.36. Comparison of mean auditory comprehension scores of low and high-ability infants by age

Age (months)	Mean Auditory Comprehension Score		Comparison
	Low	High	
8	5.45 (.69)	7.38 (5.18)	t(35) = -7.36, p = .00*
12	10.39 (1.40)	10.00 (1.77)	t(34) = .66, p = .51 (ns)
16	13.59 (2.11)	13.00 (2.00)	t(32) = .67, p = .51 (ns)
20	18.93 (2.34)	20.00 (4.07	t(33) = -.96, p = .35 (ns)

* significant at p <0.0125

Because the three-way interaction was significant, the relationship between ability and age was examined by condition. Independent samples t-tests were conducted to evaluate the effect of ability (low, high) on auditory comprehension at 8,12, 16 and 20 months. Alpha was set at 0.0125. For infants in the BSL condition, there was a significant difference between low and high-ability infants at 8 months only. Comparisons were not conducted for the SG group as this group did not contain any high-ability infants. In the VT group, there was a significant difference between low and high-ability infants at 8 months only. In the NC group there was a significant difference between the low and high-ability infants at 8 and 12 months.

Expressive Communication

The mean expressive communication score at 8 months was 6.22 (SD = 1.13) and the median score at 8 months was 6. The minimum score was 4 and the maximum was 8. Infants who scored less than 6 were categorised as 'low-ability' and those who scored above 6 were categorised as 'high-ability'. The mean expressive communication score of low-ability infants (N=20) at 8 months was 5.35 (SD = .75) and the mean score of high-ability infants (N = 17) was 7.24 (SD = .44), a significant difference [t(35) = -9.17, p = .00]. Therefore, these two groups are distinct.

A mixed-design ANOVA was conducted to evaluate the impact of condition and within child factors on infants' expressive communication development. Infants' mean expressive communication scores are presented in the table below by condition, ability and gender.

Table 2.37. Mean expressive communication scores by condition, age, ability and gender

Group	Age (months)	Low Ability		High Ability	
		Male	Female	Male	Female
BSL		*n = 2*	*n = 0*	*n = 3*	*n = 2*
	8	5.00 (-)	-	7.00(.00)	7.50(.71)
	12	12.00 (-)	-	9.00(1.73)	11.00(1.41)
	16	14.00(-)	-	11.00(0.00)	12.50(2.12)
	20	29.00(-)	-	16.00(2.00)	21.50(6.36)
SG		*n = 1*	*n = 3*	*n = 2*	*n = 1*
	8	6.00(-)	6.00(0.00)	7.50(.71)	8.00(-)
	12	11.00(-)	10.33(.58)	11.00(0.00)	7.00(-)
	16	11.00(0.00)	13.67 (3.06)	11.56 (.71)	11.00 (-)
	20	20.00(-)	21.00(1.00)	16.00(4.24)	25.00(-)
VT		*n = 5*	*n = 4*	*n = 0*	*n = 1*
	8	5.60 (.55)	4.75 (.50)	-	8.00 (-)
	12	10.20 (.84)	9.75 (1.71)	-	10.00 (-)
	16	13.20 (2.59)	13.75 (2.63)	-	11.00 (-)
	20	17.20 (2.95)	18.75 (1.89)	-	17.00 (-)
NC		*n = 2*	*n = 2*	*n = 3*	*n = 2*
	8	5.50(.71)	6.00(0.00)	7.00(0.00)	7.00(0.00)
	12	8.00(1.41)	9.50(.71)	8.67 (1.15)	11.00 (0.00)
	16	11.00 (0.00)	13.00 (2.83)	11.33 (1.53)	10.50 (.71)
	20	15.50 (.71)	20.50 (.71)	21.33 (3.51)	18.50 (2.12)

There was no significant effect of condition or ability on expressive communication, however there was a significant main effect of gender and age. There was a significant four-way interaction between gender, condition, ability and age. In order to interpret this interaction, the lower order interactions were examined. There was a significant three-way interaction between age, condition and ability and a significant two-way interaction between age and ability. This indicates that the interaction between age and ability is different depending on condition. At the next level, the interaction between age, condition and ability is different for males and females.

Table 2.38. Summary of ANOVA results, outcome variable: Expressive Communication

Between-Subjects Main Effects and Interactions	ANOVA Result
Condition	F(3,18) = 2.72, p = .08, e2 = .31, power = .56
Gender	**F(1,18) = 5.15, p = .04, e2 = .22, power = .58**
Ability	F(1,18) = 1.97, p = .18, e2 = .01, power = .27
Condition * Gender * Ability	F(1,18) = 1.31, p = .27, e2 = .07, power = .19
Condition * Gender	F(3,18) = .91, p = .46, e2 = .13, power = .21
Condition * Ability	**F(3,18) = 3.25, p = .05, e2 = .35, power = .65**
Gender * Ability	F(1,18) = .60, p = .45, e2 = .03, power = .11
Age	**F(3,16) = 1.83, p = .00, e2 = .97, power = 1**
Age* Condition	F(9,39.09) = 1.89, p = .08, e2 = .25, power = .61
Age * Gender	F(3,16) = 2.62, p = .09, e2 = .33, power = .53
Age * Ability	**F(3,16) = 8.78, p = .00, e2 = .62, power = .98**
Age * Condition * Ability	**F(9,39.09) = 2.17, p = .05, e2 = .28, power = .68**
Age * Gender * Ability	F(3,16) = .69, p = .57, e2 = .12, power = .16
Age * Condition * gender	F(9, 39.09) = 1.55, p = .17, e2 = .22, power = .51
Age * Condition * Gender * Ability	**F(3,16) = .57, p = .03, e2 = .43, power = .74**

The interaction between age and ability was examined by comparing the mean expressive communication scores by low and high-ability infants at each age of assessment. The findings are presented in Table 2.39.

Table 2.39. Interaction between age and ability on expressive communication scores

Age (months)	Mean Expressive Communication Score		Comparison
	Low	High	
8	5.30 (.75)	7.24 (.44)	t(31.39) = -9.55, p = .00*
12	9.84 (1.34)	9.88 (1.50)	t(34) = -.09, p = .93 (ns)
16	12.95 (2.21)	11.29 (1.07)	t(29.97) = 2.91, p = .01*
20	19.21 (3.39)	19.56 (4.37)	t(33) = -.27, p = .79 (ns)

* significant at p <.0125

The effect of ability was only significant at ages 8 and 16 months. This relationship was then examined by condition to explore the three-way interaction between age condition and ability. Comparisons were not conducted for the VT condition as there were no high-ability males. As previously established, there was a significant difference between low and high-ability infants at 8 months for infants in the BSL, SG and NC conditions, but not at any other age. The three-way interaction therefore is likely to reflect the fact that there were no high-ability males in the VT condition. Therefore the four-way interaction was not explored.

Table 2.40. Comparison of expressive communication scores of low and high-ability infants by condition and age

Age (months)	BSL	SG	NC
8	t(8) = -9.33, p = .00 *	t(6) = -5.20, p = .00*	t(7) = -5.69, p = .00*
12	t(7) = .00, p = 1 (ns)	t(6) = .48, p = .65 (ns)	t(7) = -.90, p = .40 (ns)
16	t(6) = 1.14, p = .30 (ns)	t(5) = .98, p = .37 (ns)	t(7) = .93, p = .38 (ns)
20	t(7) = 1.10, p = .31 (ns)	t(5) = .59, p = .58 (ns)	t(7) = -1.08, p = .32 (ns)

Gesture, Actions and Pretend Play

At 8 months, infants' mean GAPP score was 7.43 (SD = 4.75) and the median score was 6. The minimum score was 0 and the maximum was 18. The sample was split based on median GAPP score at 8 months. Those that scored lower than the median score of 6 were classified as 'low' GAPP scorers and those with a higher score as 'high' GAPP scorers. An independent samples t-test confirmed that the mean score of low scorers (N = 21, M = 4.14, SD = 1.65) was significantly lower than high scorers [n = 16, M = 11.75, SD = 3.94, t(19.03) = -7.25, p = .00].

A mixed design ANOVA was conducted to explore the impact of condition and within child factors (ability and gender) on infants' gesture development. The means and standard deviations are presented in Table 2.41.

Table 2.41. Mean GAPP score (SD) by condition, ability, gender and age

Group	Age (months)	Low Ability		High Ability	
		Male	Female	Male	Female
BSL		*n = 2*	*n = 4*	*n = 2*	*n = 0*
	8	5.00 (.00)	4.50 (1.29)	13.50 (4.95)	-
	12	21.00 (4.24)	19.00 (5.10)	30.00 (22.63)	-
	16	27.50 (7.78)	32.25 (1.89)	30.50 (10.61)	-
	20	43.00 (19.80)	52.75 (9.81)	46.50 (6.36)	-
SG		*n = 1*	*n = 1*	*n = 2*	*n = 3*
	8	6.00 (-)	5.00 (-)	12.50 (6.36)	13.00 (5.57)
	12	25.00 (-)	18.00 (-)	21.00 (16.97)	23.33 (1.53)
	16	52.00 (-)	29.00 (-)	32.50 (13.44)	40.67 (6.51)
	20	57.00 (-)	37.00 (-)	46.50 (13.44)	50.33 (3.21)
VT		*n = 3*	*n = 3*	*n = 2*	*n = 2*
	8	5.67 (.58)	3.00 (2.65)	12.50 (4.95)	12.00 (4.24)
	12	22.67 (4.51)	21.67 (9.02)	20.50 (6.36)	24.50 (9.19)
	16	38.00 (4.36)	39.33 (15.53)	30.00 (9.90)	36.00(19.80)
	20	52.67 (7.57)	46.67 (14.05)	46.50 (2.12)	51.50 (4.95)
NC		*n = 3*	*n = 2*	*n = 2*	*n = 2*
	8	3.00 (1.00)	4.00 (1.41)	11.50 (2.12)	9.00 (2.83)
	12	23.00 (11.14)	22.50 (.71)	20.50 (.71)	21.00 (8.49)
	16	38.33 (4.93)	38.00 (7.07)	27.50 (10.61)	39.00 (8.49)
	20	52.67 (1.15)	43.50 (4.95)	42.50 (10.61)	55.50 (10.61)

The results of the ANOVA are summarised in Table 2.42. The only significant effect was that of age. The mean difference between infants' GAPP score between 8 and 12 months (mean difference 14.23, SE = 1.42) was significant (p = .00), as was the difference between 12 and 16 months (mean difference 13.13, SE = 1.33, p = .00) and 16 and 20 months (mean difference 12.93, SE = 1.73, p = .00).

Table 2.42. Summary of 4x2x2 ANOVA, outcome variable GAPP (significant effect in bold)

Between-Subjects Main Effects and Interactions	ANOVA Result
Condition	F(3,19) = .05, p = .99, e2 = .01, power = .06
Gender	F(1,19) = .10, p = .76, e2 = .01, power = .06
Ability	F(1,19) = .99, p = .33, e2 = .05, power = .16
Condition * Gender * Ability	F(2,19) = .36, p = .70, e2 = .04, power = 10
Condition * Gender	F(3,19) = .77, p = .52, e2 = .11, power = .18
Condition * Ability	F(3,19) = .74, p = .54, e2 = .10, power = .18
Gender * Ability	F(1,19) = 3.79, p = .07, e2 = 17, power = .46
Age	**F(3,17) = 1.78, p = .00, e2 = .97, power = 1**
Age* Condition	F(9, 41.52) = .66, p = .74, e2 = .10, power = .22
Age * Gender	F(3,17) = .42, p = .74, e2 = .07, power = .12
Age * Ability	F(3,17) = 2.59, p = .09, e2 = .31, power = .53
Age * Condition * Ability	F(9, 41.52) = .28, p = .98, e2 = .05, power = .11
Age * Gender * Ability	F(3,17) = 2.19, p = .13, e2 = .28, power = .46
Age * Condition * gender	F(9, 41.52) = .66, p = .74, e2 = .10, power = .22
Age * Condition * Gender * Ability	F(6,34) = .51, p = .80, e2 = .08, power = .18

The interaction between gender and ability approached significance (p = .07) therefore the means were inspected to determine what pattern this revealed. The mean gain in GAPP score was calculated by subtracting infants' GAPP score at 8 months fro their score at 20 months. The mean gain for low and high ability boys and girls are presented in the following table.

Table 2.43. Mean gain in GAPP score (SD) by gender and ability

	Male	Female
Low ability	46.33 (9.47) n = 9	43.50 (10.16) n = 10
High ability	32.56 (7.21) n = 9	40.57 (7.18) n = 7

Females made a similar gain in their GAPP score, regardless of whether they had a low or high baseline GAPP score [t(15) = .65, p = .52]. However, boys who had a low baseline GAPP score made significantly more gains in their GAPP score than boys who began with a high baseline [t(16) = 3.47, p = .00). The higher gain made by lower ability infants served to bring their GAPP score to an equivalent level to the score of the high ability infants at 20 months. The mean GAPP score of low ability infants at 20 months was 51.00 (SD = 9.29) and the mean GAPP score of high ability infants at 20 months was 44.44 (SD = 7.43), a non-significant difference [t(16) = 1.65, p = .12].

2.3.3.2. What Contribution do Within-Child Factors have on the Effect of Condition on Infants' Language Development? A Comparison of Mean Rank Change.

The dependent variable in the following analyses is mean rank change. By ranking the data, infants' scores on language measures is replaced by each infant's relative position within the sample. In this section, the impact of condition and within-child factors on mean rank change is explored. Analyses were conducted for each measure of language; receptive vocabulary, expressive vocabulary, auditory comprehension, expressive communication and gesture development.

Receptive Vocabulary

Mean rank change in receptive vocabulary was calculated by subtracting infants' rank at 8 months from their rank at 20 months. The mean rank change of infants as a factor of gender, condition and initial ability is presented in the table below.

Table 2.44. Mean rank change (SD) in receptive vocabulary rank by condition, gender and ability

Condition	Low Ability		High Ability	
	Male	Female	Male	Female
BSL	15.50 (-) n=1	-3.50 (1.41) n = 2	-4.13 (10.27) n=4	-12.75 (18.74) n = 2
SG	9.50 (-) n = 1	6.25 (5.30) n = 2	-18.00 (18.38) n = 2	-17.25 (12.37) n = 2
VT	17.00 (9.92) n = 5	3.17 (13.53) n = 3	-	-6.50 (24.04) n = 2
NC	3.83 (10.07) n = 3	11.75 (24.40) n = 2	3.83 (10.07) n = 3	-18.00 (13.43) n = 2

A General Linear Model (GLM) was conducted with the between-subjects factors: gender, condition (BSL, SG, VT, NC) and ability (low, high). The dependent variable was mean change in receptive vocabulary rank. There were no significant main effects of condition or gender, however there was a significant main effect of ability (results summarised in the table below). Low-ability infants had a mean rank change of 7.94 (SE = 3.47) and high-ability infants a mean rank change of -1.14 (SE = 3.42). Therefore, infants who had a high receptive score at 8 months made little change in their mean rank over time, whereas low scorers at 8 months made a significant gain in their mean ranking. There were no significant interactions between the factors. The results of the ANOVA are summarised in the table below.

Table 2.45. Results of 2x2x4 ANOVA, outcome variable: Receptive vocabulary mean rank change (significant effects in bold)

Factor or Interaction	Test of Between Subject Effect
Condition	$F(3,20) = .48$, $p = .70$, $eta^2 = .07$, power = .13
Gender	$F(1,20) = 2.55$, $p = .13$, $eta^2 = .11$, power = .33
Ability	**$F(1,20) = 10.91$,$p = .00$, $eta^2 = .35$, power = .88**
Gender * Ability	$F(1,20) = .06$, $p = .81$, $eta^2 = .00$, power = .06
Gender * condition	$F(3,20) = .49$, $p = .69$, $eta^2 = .07$, power = .13
Condition * Ability	$F(3, 20) = .40$, $p = .75$, $eta^2 = .06$, power = .12
Gender * Condition * Ability	$F(3,20) = .87$, $p = .43$, $eta^2 = .08$, power = .18

Productive Vocabulary

A GLM was conducted and the factors were condition (BSL, SG, VT, NC), gender (male, female) and ability (productive vocabulary ability at eight months categorised as low or high). The dependent variable was mean difference in productive vocabulary rank from 12 to 20 months. The means and standard deviations are presented in the following table.

Table 2.46. Mean rank change in productive vocabulary by ability, condition and gender

Condition	Low Ability		High Ability	
	Male	Female	Male	Female
BSL	-10.50 (11.30) n = 3	-	5.00 (-) n = 1	-.75 (15.96) n = 4
SG	6.67 (15.28) n = 3	2.00 (7.76) n = 3	-6.50 (-) n = 1	-5.50 (9.90) n = 2
VT	6.75 (8.84) n = 2	11.00 (2.83) n = 2	-10.50 (12.62) n = 3	-3.00 (15.32) n = 3
NC	4.40 (13.38) n = 5	1.00 (14.00) n = 3	-	-13.75 (9.55) n = 2

There was no significant main effect of condition, gender or ability. There was no significant interaction between the factors. The results of the ANOVA are summarised in the table below. These findings indicate that infants' productive vocabulary rank score remains constant and is not influenced by the condition that they experience, their level of initial ability, gender or any combination of these factors.

Table 2.47. Results of 2x2x4 ANOVA, outcome variable: productive vocabulary mean rank change.

Factor or Interaction	Test of Between Subject Effect
Condition	$F(3,23) = .24$, $p = .87$, $e^2 = .32$, power = .34
Gender	$F(1,23) = .03$, $p = .88$, $e^2 = .00$, power = .05
Ability	$F(1,23) = 1.80$, $p = .19$, $e^2 = .07$, power = .25
Gender * Ability	$F(1,13) = .13$, $p = .73$, e2 = .01, power = .06
Gender * condition	$F(3,13) = .30$, $p = .83$, e2 = .04, power = .10
Condition * Ability	$F(3,13) = 1.16$, $p = .35$, e2 = .13, power = .27
Gender * Condition * Ability	$F(1,23) = .009$, $p = .92$, e2 = .00, power = .05

Auditory Comprehension

A GLM was conducted, with the between-subjects factors: condition (BSL, SG, VT, NC), gender (male, female) and ability (auditory comprehension ability at 8 months categorised as low or high). The dependent variable was mean rank change in auditory comprehension from 8 to 20 months. The means and standard deviations are presented in the table below.

Table 2.48. Mean rank change in auditory comprehension by condition, gender and ability

Condition	Low Ability		High Ability	
	Male	Female	Male	Female
BSL	8.00 (-) n = 1	-2.25 (7.42) n = 2	2.75 (9.21) n = 4	-9.25 (10.25) n = 2
SG	-3.50 (-) n = 1	-3.50 (0.00) n =2	-.25 (4.60) n = 2	15.25 (26.52) n = 2
VT	-12.80 (20.43) n = 5	8.83 (1.89) n = 3	-	-4.75 (13.08) n = 2
NC	-3.67 (4.75) n = 3	1.25 (18.74) n = 2	-1.75 (8.13) n = 2	13.50 (12.73) n = 2

The results of the ANOVA are summarised Table 2.48. There was no significant main effect of condition, ability or gender on infants change in mean rank from 8 to 20 months. There was no significant interaction between the factors. Therefore, infants auditory comprehension rank in the sample remained constant throughout the study and was not affected by the condition that infants experienced, their gender, baseline ability or any combination of these factors.

Table 2.49. Summary of 4x2x2 ANOVA results, outcome variable: auditory comprehension

Factor or Interaction	Test of Between Subject Effect
Condition	F(3,20) = .63, p = .61, e2 = .09, power = .16
Gender	F(1,20) = 1.72, p = .20, e2 = .08, power = .24
Ability	F(1,20) = .00, p = .99, e2 =.00, power = .05
Gender * Ability	F(1,20) = .49, p = .49, e2 = .02, power = .10
Gender * condition	F(3,20) = 1.84, p = .17, e2 = .22, power = .40
Condition * Ability	F(3,20) = 1.26, p = .32, e2 = 16, power = .28
Gender * Condition * Ability	F(2,20) = .19, p = .83, e2 = .02, power = .08

Expressive Communication

Infants were ranked in their expressive communication ability at 8 and 20 months. Mean rank change was calculated by subtracting rank at 8 months from rank at 20 months. A GLM was conducted with the between-subjects factors being condition (BSL, SG, VT, NC) gender (male, female) and ability (expressive communication ability at 8 months categorised as low or high). The dependent variable was mean rank difference in expressive communication from 8 to 20 months (means and standard deviations are presented below).

Table 2.50. Mean change in rank in expressive communication scores by condition, ability and gender

Condition	Low Ability		High Ability	
	Male	Female	Male	Female
BSL	26.50 (6.36) n = 2	-	-19.17 (5.62) n = 3	-3.88 (11.59) n = 4
SG	8.50 (-) n = 1	13.67 (4.65) n = 3	-21.75 (17.32) n = 2	-1.00 (-) n = 1
VT	1.20 (8.07) n = 5	12.25 (9.72) n = 4	-	-25.00 (-) n = 1
NC	-6.00 (7.77) n = 2	11.75 (4.60) n = 2	-.67 (10.87) n = 3	-9.75 (9.55) n = 2

There was a significant main effect of condition[6], gender and ability on infants change in mean rank in their expressive communication scores (Table 2.50).

[6] The effect of condition was still significant when the outlier score (low score of -34.00 of male high-ability infant in SG condition) was removed. Therefore this case was kept in the sample for the analysis.

Table 2.51. Summary of 4x2x2 ANOVA, outcome variable: Expressive communication (Significant effects in bold)

Factor or Interaction	Test of Between-Subject Effect
Condition	**$F(3,21) = 3.86$, $p = .02$, $e^2 = .36$, power = .74**
Gender	**$F(1, 21) = 9.15$, $p = .01$, $e^2 = .30$, power = .82**
Ability	**$F(1,21) = 42.84$, $p = .00$, $e^2 = .67$, power = 1**
Gender * Ability	$F(1,21) = .32$, $p = .58$, $e^2 = .02$, power = .08
Gender * condition	$F(3,21) = .64$, $p = .60$, $e^2 = .08$, power = .16
Condition * Ability	**$F(3,21) = 5.05$, $p = .01$, $e^2 = .42$, power = .86**
Gender * Condition * Ability	**$F(1,21) = 4.49$, $p = .05$, $e^2 = .18$, power = .53**

Infants in the BSL condition had a mean rank change of 1.15 (SE = 3.21), infants in the SG a mean rank change of -.15 (SE = 3.90). Infants in the VT group had a mean rank change of -3.85 (SE = 3.72) and those in the non-intervention control group a mean rank change of -1.17 (SE = 3.14). Follow-up tests were conducted to evaluate pairwise differences among the means. Bonferroni multiple comparison tests indicated that there were no significant differences between the conditions ($p = 1$ for all comparisons).

There was a significant main effect of gender. The mean rank change of male infants was -1.62 (SE = 2.43) and the mean rank change of females was -.28 (SE = 2.59). Therefore, overall females' mean rank in expressive communication remained stable from 8 to 20 months, whereas males as a whole decreased slightly in mean rank.

The impact of ability on mean rank change was significant. Infants who scored lower than the median expressive communication score at 8 months ('low-ability') had a mean rank change of 9.70 (SE = 2.40) while high-ability infants had a mean rank change of -1.16 (SE = 2.62).

There was a significant three-way interaction between condition, gender and ability. To explore the relationship between these factors, the means plots were inspected. Separate plots are presented below for males and females

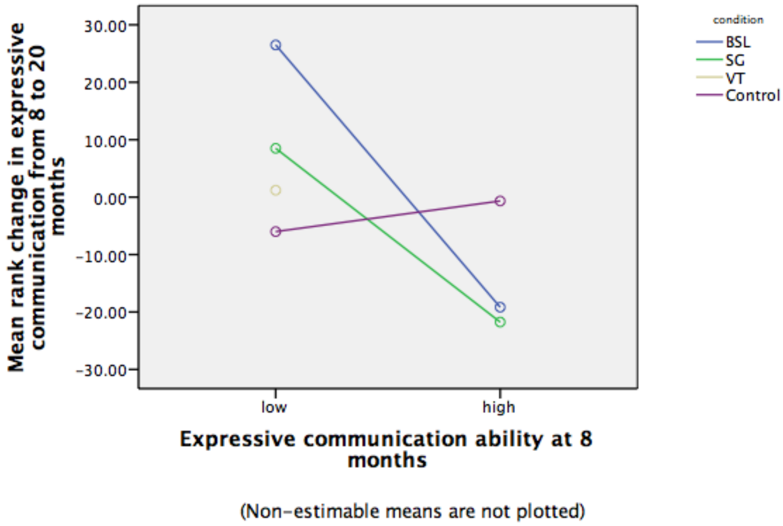

Figure 2.10. Interaction plot of the relationship between ability and condition on male infants' expressive communication score

The intervention condition that infants received had a different effect on boys depending on their expressive communication ability at eight months. An inspection of the means plot indicates that, regardless of ability (high or low), if boys were in the control condition, their expressive communication mean rank position within the sample changed very little. Gesture training however appeared to have had pronounced effects on male infants. Low-ability boys who were gesture trained made considerable gains in their mean rank, with infants in the BSL group making slightly greater gains than infants in the SG group. However, male infants who were high-ability at 8 months demonstrated a decrease in their mean rank within the sample over time, and this pattern is similar for both types of gesture training. An inspection of the plot for female infants reveals a different pattern.

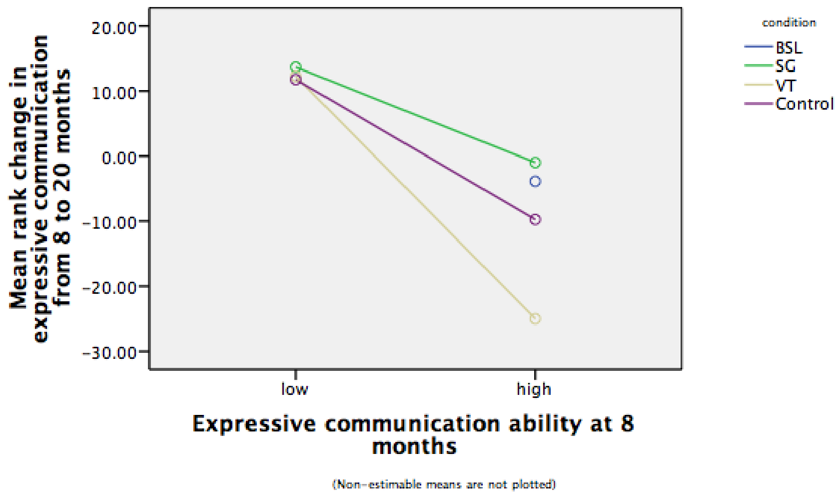

Figure 2.11. Means plot of interaction between ability and condition for female infants

Female infants who were low-ability at eight months demonstrated a gain in their mean rank regardless of whether they participated in the SG, NC or VT condition (no low-ability female infants participated in the BSL condition). Furthermore, the amount of gain is very similar for these infants in the different conditions. Female infants who were high-ability at 8 months and were in the SG condition showed no change in their mean rank. Those high-ability infants in the control condition demonstrated a greater decrease while those in the VT condition appear to have decreased greatly in their mean rank.

The interaction between ability and condition were then tested for each level of gender. This was significant for male infants [$F(3,21) = 6.65$, $p = .002$] though not for females [$F(3,21) = 1.18$, $p = .341$]. The mean rank change for males of high and low-ability in the different conditions is presented in the table below.

Table 2.52. Mean rank change in expressive communication for male infants by ability and condition

Intervention	Expressive Communication Ability	
	Low	High
BSL	26.50 (6.34) n = 2	-19.17 (5.62) n = 3
SG	8.50 (.00) n = 1	-21.75 (17.32) n = 2
VT	1.20 (8.08) n = 5	-
NC	-6.00 (7.78) n = 2	-.67 (10.87) n = 3

This was followed up with a test of the simple simple effects of intervention within levels of ability (low and high) within males[7]. There was a significant difference between low and high-ability male infants in the BSL condition [$F(1, 21) = 28.90$, $p = .000$] and the SG condition [$F(1, 21) = 10.89$, $p = .003$]. There was no significant difference between low and high-ability male infants in the NC condition [$F(1, 21) = .18$, $p = .68$].

Regardless of their initial expressive communication ability, male infants who participated in the control condition did not change in their mean rank ability across the course of the study. However, gesture training (both BSL and SG) differentially impacted upon male infants depending on their expressive communication ability at 8 months. Those who were high-ability significantly decreased in their mean rank from 8 to 20 months, while boys who were low-ability significantly increased in their mean rank in expressive communication.

Gestures, Actions and Pretend Play

GAPP scores at 8 and 20 months were ranked, and the change in mean rank from 8 to 20 months was calculated. A GLM was conducted to assess the impact of

[7] The advantage of this type of analysis over separate t-tests is that t-tests use half of the subjects to compute the error term and are only based on half the degrees of freedom. Using simple effects tests uses the within-cell variation for all the cases in the data set and results in a smaller and more reliable error term, thus leading to higher power.

condition, gender and baseline GAPP score (low or high) on infants' change in mean rank in GAPP score from 8 to 20 months. The means and standard deviations are presented in the table below.

Table 2.53. Mean GAPP rank change (SD) by ability, condition and gender

Condition	GAPP Baseline Ability			
	Low		High	
	Males	Females	Males	Females
BSL	2.75 (22.27) n = 2	10.38 (11.44) n = 4	017.50 (10.83) n = 3	-
SG	13.00 (-) n = 1	-8.50 (-) n = 1	-12.25 (10.25) n = 2	-9.33 (12.00) n = 3
VT	7.00(15.39) n = 3	10.17 (14.74) n = 3	-16.25 (8.84) n = 2	-7.00 (4.24) n = 2
NC	20.33 (3.33) n = 3	.50 (2.12) n = 2	-17.75 (14.50) n = 2	.25 (9.55) n = 2

There was no significant main effect of condition or gender on change in mean rank in GAPP score but there was a main effect of ability (Table 2.53). Low-ability infants had a mean rank change of 8.68 (SD = 12.41) and high-ability infants had a mean rank change of -11.66 (SD = 10.29).

Table 2.54. Results of 4x2x2 ANOVA for mean rank change, outcome variable: GAPP (significant effects in bold)

Factor or Interaction	Test of Between Subject Effect
Condition	$F(3,20) = .21$, $p = .89$, $eta^2 = .03$, power = .08
Gender	$F(1,20) = .20$, $p = .66$, $eta^2 = .01$, power = .07
Ability	**$F(1,20) = 12.62$, $p = .00$, $eta^2 = .39$, power = .92**
Gender * Ability	**$F(1,20) = 5.18$, $p = .03$, $eta^2 = .21$, power = .58**
Gender * condition	$F(3,20) = 1.16$, $p = .35$, $eta^2 = .15$, power = .26
Condition * Ability	$F(3,20) = .29$, $p = .83$, $eta^2 = .04$, power = .10
Gender * Condition * Ability	$F(2,20) = 1.02$, $p = .38$, $eta^2 = .09$, power = .20

There was a significant two-way interaction between gender and ability. This relationship is demonstrated in Figures 2.12 and 2.13 for females and males respectively.

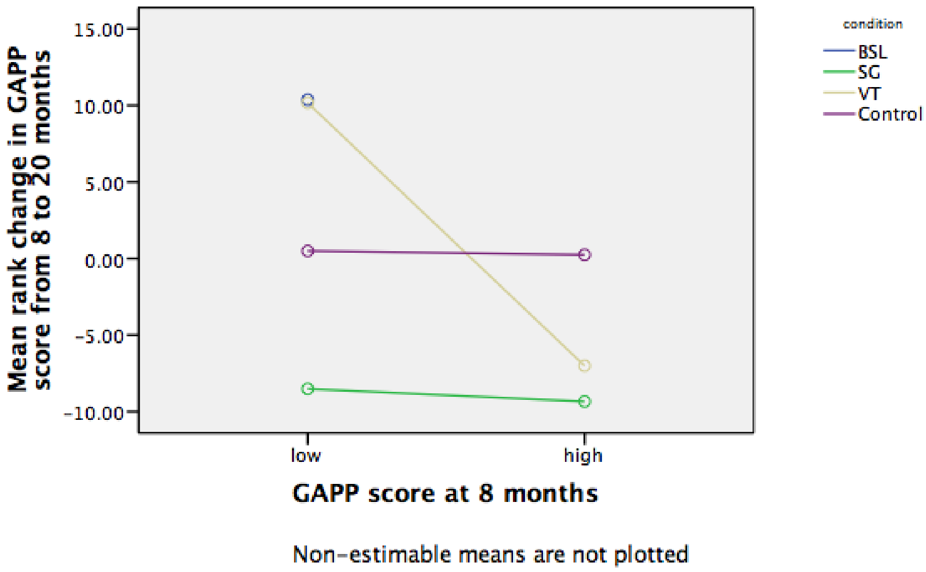

Figure 2.12. Interaction plot of relationship between condition and ability on female infants' GAPP scores

The plot above indicates that for females, regardless of ability, the experience of the VT and NC condition had no effect on mean rank change in GAPP scores. However, depending on whether females were low or high GAPP scorers at baseline, the VT condition impacted upon their mean rank change. Low scorers and high scorers moved in their mean ranking considerably, with low scorers moving up in their rank and high scorers moving down.

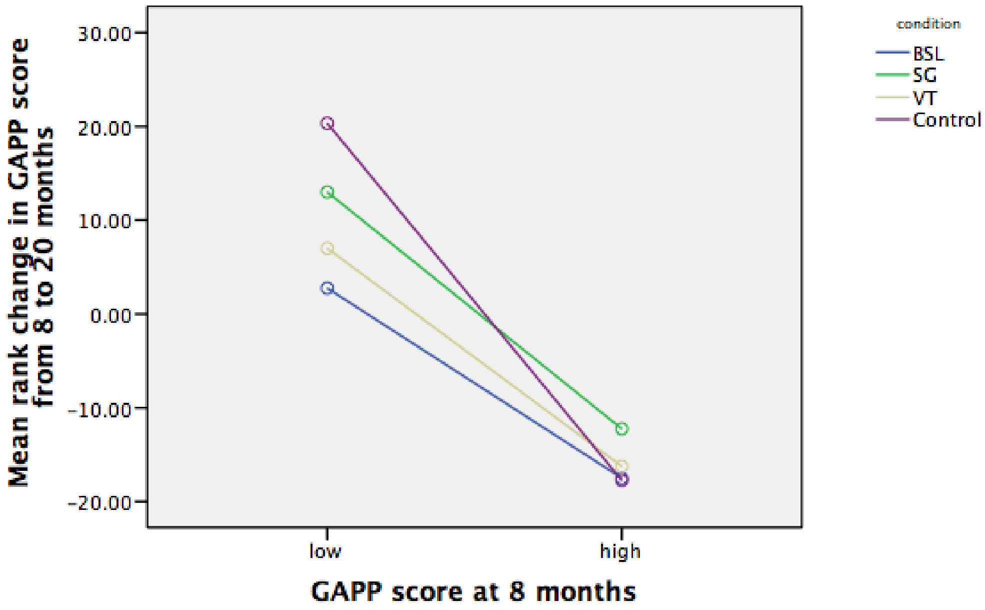

Figure 2.13. Interaction plot for GAPP mean rank change by ability and condition for male infants

In contrast to the females, the plot above indicates that all low-ability males, regardless of condition, moved up in their mean rank and high scorers moved down in their mean rank. The pattern is similar across all conditions. The simple effects were then tested. The mean rank change in GAPP score by ability and gender is presented in the table below. There was a significant difference in mean rank change between low and high scorers for both males [$F(1,31) = 26.96$, $p = .00$] and females [$F(1,31) = 5.59$, $p = .02$].

Table 2.55. Mean rank change (SD) in GAPP score by ability and gender

Ability	Gender	
	Male (n = 18)	Female (n = 17)
Low	11.17 (13.42)	6.45 (11.69)
High	-16.11 (9.14)	-5.93 (9.23)

Within low-ability infants, there was no significant effect of gender [F(1,31) = .54, p = .47], however within high-ability infants there was a significant effect of gender [F(1,31) = 5.31, p = .03]. This indicates that the mean rank of high-ability females changed little compared to high-ability males.

2.3.3.3. What Contribution Did Within-Child Factors have on the Effect of Condition on Infants' Language Development? Summary and Exploration of Findings

Within-child factors contributed to the impact of gesture training on certain domains of language development, however these effects were only apparent when analyses focused on mean rank change rather than mean scores. This finding was specific to expressive communication development. Infants' mean rank change from 8 to 20 months on receptive vocabulary, productive vocabulary, auditory comprehension or gesture development did not vary as a function of condition, ability or gender, or any combination of these factors. A different story was revealed when the effect of within-child factors on expressive communication development was examined. Infant gender and ability interacted with the condition that infants experienced and impacted greatly on infants' mean rank change in expressive communication score. The infants who made the most gain in rank position within the sample were low-ability males who participated in the BSL and SG condition (albeit only three of them). There were no differences between the BSL and SG condition, suggesting gesture training had the same effect on mean rank change in expressive communication regardless of the type of gesture.

Does this trend mean that gesture training boosted the language abilities of these low-ability infants? Or do these findings reveal these infants identified as 'low-ability' were in fact 'late-bloomers'? To understand what was underlying this trend, infants' mean expressive communication scores were examined. The mean scores of low-ability infants who were in the control group are taken to indicate what the natural path of development is for these infants deemed to be of low-ability. If these infants were in actual fact late-bloomers, then we would expect that all low-ability infants, regardless of what condition they experienced, would have similar scores throughout the study. However, if gesture training was responsible for the gain in ability, then this would be reflected in the mean scores as infants in the gesture group would score higher than infants in the control group. The mean expressive communication scores of low-ability infants are summarised in the table below.

Table 2.56. Comparison of mean expressive communication score of low-ability male infants who were in the gesture group or control group

	Mean Expressive Communication Score		Comparison
	Gesture	Control	
8 months	5.50 (.71) n = 3	5.57 (0.53) n = 7	z = -1.00, p = .31
12 months	11.50 (.71) n = 2	9.57 (1.40) n = 7	z = -1.80, p = .07
16 months	12.50 (2.12) n = 3	12.57 (2.37) n = 7	z = -.25, p = .81
20 months	24.50 (6.36) n = 3	16.71 (2.56) n = 7	z = -2.00, p = .04

The mean scores of infants in the control group tell us how the expressive communication abilities of low-ability boys develop if they are left to their own devices. These boys clearly do better if they are gesture trained, scoring significantly higher than their control group peers at 20 months of age. If low-ability infants were late bloomers, both groups would show the same pattern of results, i.e. an acceleration in their scores at the same stage.

Infants' expressive language ability was also assessed by their productive vocabulary score on the CDI. The scores of these same infants was inspected to determine whether the same trend would be evident. The mean scores are presented below.

Table 2.57. Mean Productive Vocabulary score of male low-ability infants by condition

	Mean Productive Vocabulary Score Gesture	Control	Comparison
12 months	4.00 (5.66) (n = 2)	5.14 (7.13) (n = 7)	z = .00, p = 1.00
16 months	64.33 (76.01) (n = 3)	32.29 (34.19) (n = 7)	z = -.80, p = .43
20 months	276.33 (50.01) (n = 3)	140.14 (88.82) (n = 7)	z = -1.71, p = .09

The same pattern emerges for productive vocabulary. Low-ability[8] male infants do better if they are gesture trained. Therefore, the overall productive language abilities (expressive communication and productive vocabulary) of these infants was much improved if they were encouraged to gesture. The possibility that these low-ability infants are late-bloomers is thus ruled out, suggesting that it is gesture that makes the difference.

But how confident can we be that this relationship is due to gesture training? Although these boys participated in the gesture training condition, this does not assume that they were all exposed to the same level of gesturing or responded in the same way to the training. Therefore, analyses were conducted to explore the similarity between low and high-ability infants. Firstly, the number of target gestures acquired by the infants at each age was compared. If there was no difference between the number of gestures acquired by low and high-ability infants, this would suggest that acquiring the gestures helped the low-ability infants but not the high-ability infants. However, if the low-ability infants acquired more gestures than the high-ability infants did, this could suggest one of two alternatives; either that the effect of gesture depends on the number of

[8] Ability as judged by median split of expressive communication score at 8 months

gestures infants acquire (a dose effect) rather than infants' ability, or that low-ability infants are more receptive to gesture.

The mean number of target gestures produced at each age by the low and high-ability infants is presented in the table below.

Table 2.58. Comparison of target gestures produced by low and high-ability infants

	Mean Target Gesture Production		Comparison
	Low-ability	High-ability	
10 months	.00 (.00) n = 3	.17 (.40) n = 6	t(7) = -.68, p = .52
12 months	2.67 (2.52) n = 3	1.0 (.89) n = 6	t(7) = 1.53, p = .17
16 months	9.33 (7.09) n = 3	5.40 (5.27) n = 5	t(6) = .91, p = .40
20 months	7.33 (7.09) n = 3	4.80 (3.49) n = 5	t(6) = .70, p = .51

Clearly there is a trend for low-ability infants to produce more target gestures than the high-ability infants. At 16 months low-ability infants produced on average up to four more gestures than the high-ability infants. However these differences do not reach significance, which is likely due to the sample size. The trend suggests gesture-training benefited low-ability infants but not high-ability infants because the high-ability infants did not gesture as much.

Why did these differences in the amount of gesture produced by low and high-ability infants emerge? One possibility is that high-ability infants may not have been exposed to the same amount of gesture modelling. To explore this further, the rate of target gesture modelling was compared by mothers of high and low-ability male infants. This was compared using Mann-Whitney U.

Table 2.59. Comparison of rate of target gesture modelling by mothers of low and high-ability male infants

	Mean (SD) Rate of Maternal Modelling		Comparison
	Low-ability	High Ability	
10 months	17.67 (7.23) n = 3	15.20 (3.11) n = 5	z = -.45, p = .65
12 months	18.00 (8.89) n = 3	14.67 (3.98) n = 6	z = -.26, p = .80
16 months	30.67 (20.60) n = 3	19.80 (12.13) n = 5	z = -1.04, p = .30
20 months	17.00 (14.73) n = 3	7.80 (5.22) n = 5	z = -.90, p = .37

There was a trend for mothers of low-ability boys to model the target gestures at a greater rate than mothers of high-ability infants. While these differences did not reach significance, the data suggests that the high-ability boys may have gestured less because they were exposed to less gesture modelling by their mothers. High-ability infants may have experienced a 'diluted' gesture training intervention compared to the low-ability infants. However, this does not rule out the possibility that high-ability boys were less receptive to gesture. The mean difference between the rate of maternal modelling by mothers of low and high-ability mothers increased over time. This may reflect the fact that low-ability infants were more receptive to gesture, producing more gestures in response to their mothers' modelling efforts thus encouraging her to gesture more. High-ability infants on the other hand may not have been receptive to gesture, did not gesture back as much to mothers thus leading mothers to reduce her modelling efforts.

Another possibility is that infants may have simply benefited more if they produced more gestures, i.e. a dose effect. To test this possibility, the correlation coefficients were inspected between the number of gestures produced and infants' expressive communication ability. This indicated that there was no significant relationship between the number of target gestures produced and infants' expressive communication score (see table below). Therefore, the fact that low-ability infants did better is not fully accountable for the fact that they produced more gestures, something else is going on which makes these infants particularly receptive to gesture.

Table 2.60. Spearman correlation between target gesture production and expressive communication score

Target Gesture Production	Expressive Communication Score		
	12 months	16 months	20 months
10 months	.15, p = .53	-.03, p = .90	-.07, p = .79
12 months	-.11, p = .66	.12, p = .66	.31, p = .21
16 months		.03, p = .91	.22, p = .38
20 months			.03, p = .91

In sum, low-ability infants did better if they were gestured to than if they were not. The possibility that these infants were late-bloomers was ruled out, as was the likelihood that there was a dose effect of gesture production. Low-ability infants are suggested to be more receptive to gesture training than high-ability infants and this can account for why mothers gestured more to low-ability infants than high-ability infants, and the fact that low-ability infants produced more gestures than high-ability infants.

2.4. Discussion

Mothers were trained to use a target set of gestures that symbolised everyday objects and concepts and were encouraged to use these gestures when communicating with their infants. Infants readily acquired these gestures, and in so doing, were able to communicate about the target set of referents long before the onset of speech. These gestures continued to enhance infants' communicative repertoires, as defined by the number of target items that infants could communicate in either speech or gesture. At 16 months of age in particular, gesture-trained infants could communicate twice as many target items (in either speech or gesture) than did infants in the control conditions. This gesture advantage was greater for infants who had been trained to use symbolic gestures compared to BSL gestures. Infants produced more symbolic gestures than BSL gestures, and this trend is reflected by the fact the mothers modelled the symbolic gestures at a higher frequency than BSL gestures.

So, gesture training appeared to enhance infants' communicative ability. Did this benefit infants' language development? Infants' acquisition of the corresponding target words was no better for infants who had been exposed to the target gestures than for infants who had been exposed to verbal modelling only or even infants who had not been exposed to any intervention. Indeed, even infants who were exposed to a high amount of verbal labelling of the target items did not acquire any more of these words or any earlier compared to infants in the non-intervention control condition. Overall, infants' language development did not seem to be impacted by the intervention condition that they experienced. Being exposed to BSL, symbolic gesture or enhanced verbal labeling did not bring about any differences in infants' receptive vocabulary, productive vocabulary, auditory comprehension, expressive communication or general gesture development.

However, while these findings appeared to suggest that gesture training had no bearing on infants' developing language, an exploration of the contribution of within-child factors to the effect of gesture training revealed that, for some children, gesturing did bring them language benefits. The effect of gesture training was particular to male infants who at eight months scored low in expressive communication. These infants demonstrated a greater gain in their expressive communication abilities relative to the rest of the sample if they had been gesture trained. These infants increased in their expressive communication mean rank whereas male infants who started the study with a high expressive communication ability and were not gesture trained did not. When infants were 20 months, those that had started with a low-ability had a significantly higher expressive communication score than those that started with a high-ability, furthermore they also had a significantly higher productive vocabulary. These infants were ruled out as being 'late-bloomers' and the gain was attributed to gesture training.

While this effect was only found in a small sample of 3 boys (15% of the infants who had been gesture trained), the importance of this finding cannot be overlooked. The finding highlights the importance of being aware that differential effects may emerge from within-child differences in infant data and challenges the assumption that all infants will react in the same way to an intervention. The outcome of this study urges an exploration of how the relationship between the verbal and manual modalities may differ for boys and girls and as such how gesture can be utilised (or not) to offer a helping hand to language development in infancy.

Gender differences are well demonstrated in language development, with girls having an advantage over their male peers (e.g. Murray, Johnstone & Peters, 2000; Roulstone, Loader & Northstone, 2002). Furthermore, language disorders are more prevalent in boys (e.g. Stevenson & Richman, 1976; Tomblin et al. 1997). Differences in brain development (Baron-Cohen, 2003; Kolb & Wishaw, 2003) and prenatal biology (e.g. Lutchmaya, Baron-Cohen & Raggatt, 2002a) have been put forward as potential explanations of the effect of gender. These explanations are not mutually exclusive and likely interact to account for gender differences. Could neurological differences perhaps help to explain why males and females are differentially affected by gesture?

Due to the functional closeness of the cerebral regions responsible for the speech and manual systems means, activity in one area can actually inhibit activity in the other. Kinsbourne and Hiscock (1983) found verbal activity interfered with manual performance of both adults and children, and this interference was more pronounced on the right hand than the left hand. Therefore, verbal activity hampered manual activity. Does this then mean that manual activity can disrupt verbal activity? This throws up a possible explanation of the effect that gesture training had on low and high-ability male infants. While for females, the burden of language is more likely to be distributed across the brain, for males language is more likely to be lateralized to the left hemisphere (e.g. Baron-Cohen, 2003). Therefore, by encouraging gesture in female infants, because both hemispheres are implicated in language, the burden of the left hemisphere will be shared across the brain. However, for males, whose language is lateralized to the left hemisphere, by encouraging manual communication, the burden placed on the left hemisphere will be greatly increased as this area of the brain now has to cope with verbal and enhanced nonverbal communication. Depending on infants' language skills, this may facilitate or inhibit verbal activity. For those infants who have low expressive communication abilities, gesture may give them access to a mechanism to boost their language skills.

Maternal perception of her child's abilities is known to shape the way that she interacts with her child. Mothers who perceived their 14 month-old infants as understanding more have been demonstrated to communicate more with them, both verbally and nonverbally (Rowe, 2000). The present study found that infants who were low in their expressive communication abilities at 8 months and whose mothers were gesture trained, were subsequently exposed to more gesture modeling by their mothers. This could indicate that mothers were receptive to their son's low productive language, as such they may have been focused on encouraging their infants' abilities by using gesture.

Beyond evaluating the impact of gesture training, this study asked a further question regarding of the importance of the type of gesture that infants are encouraged to use. The findings revealed a trend for infants to acquire more symbolic gestures than BSL gestures and this is likely to reflect the fact that mothers were found to model the symbolic gestures at a higher rate than the BSL gestures. This may be due to individual differences in the motivation of mothers or may reveal something about the gestures themselves. The BSL and symbolic gestures were semantically matched and possessed similar levels of manual complexity, ruling out the argument that BSL gestures were physically 'harder' to perform and so less likely to be used. The difference between the gesture types are that all of the symbolic gestures posses a high degree of iconicity, whereas the BSL gestures varied in their level of iconicity with many of the gestures arbitrarily relating to their referent. Research has claimed that infants of this age are not sensitive to iconicity (Namy, 2008), however while the infants may not have been sensitive to iconicity, perhaps the adults were. The iconic nature of the symbolic gestures may have made these gestures more memorable for the mothers, thus promoting a higher frequency of modelling. Indeed, research has found that iconicity facilitates adults' learning of sign language. For example, adults learning signs for the first time are more likely to retain iconic than non-iconic signs in short- and long-term memory (Beykirch, Holcomb, & Harrington, 1990; Lieberth & Gamble, 1991).

The present study addressed many of the shortfalls of previous research. This was done by applying an RCT design and carefully controlling the gesture interventions and using adequate control groups. Infants' verbal and nonverbal expressive and receptive language development was carefully assessed and compared across conditions. No overall effect of gesture training was found on infants' language scores. This finding is in contrast to research that has found an effect of enhanced gesture on language (Goodwyn et al. 2000; Bonvillian et al. 1983a; 1983b; Folven, Bonvillian & Orlansky, 1984; Orlansky & Bonvillian, 1984; 1988)

Why did the present study not detect an effect found in previous research? Goodwyn et al. (2000) reported that infants whose parents were encouraged to model symbolic gestures scored higher than control infants on selected measures of expressive and receptive language at 15, 19 and 24 months of age. However, these findings are undermined by methodological weaknesses, weaknesses which this study sought to address. In so doing, this study's findings questions the conclusions Goodwyn et al. draw about the beneficial effect of gesture training on language development. The Goodwyn study did not report on how infants were allocated to condition, whereas the present study randomly allocated infants to condition thus removing the potential bias caused by highly motivated mothers opting into a gesture training intervention. Furthermore, while the Goodwyn study included a VT condition, this group was not included in all analyses of the effect of condition on language, therefore the effect of gesture training over and above verbal training can not be determined from this study. A more lengthy discussion of the differences between the present study and that of Goodwyn et al. (2000) is presented in Chapter 5.

The research conducted by the Bonvillian and Orlansky research group (Bonvillian et al. 1983a; 1983b; Folven, Bonvillian & Orlansky, 1984; Orlansky & Bonvillian, 1984; 1988) though offering interesting insight into the gesture acquisition and development of hearing infants exposed to sign, focused on infants born to deaf parents. While Bonvillian and Orlansky report an advantage in early vocal word production, this is the product of a high level of sign exposure from birth. The present study has exposed hearing infants to a limited target set of gestures, representing a realistic level of gesture exposure that can be expected of a gesture intervention that can be adopted by parents. In such a context, no overall advantage is found in verbal language development, except in the case of low-ability baby boys.

These findings have significant relevance to the current commercial claims of Baby Sign companies. The Baby Sign promise is that by gesturing with your infant, they will start to talk at an earlier age, develop greater vocabularies and generally benefit from improved language abilities. However, the findings suggest that the Baby Sign promise is not relevant to all. No overall effect was found of gesture training on language development; gesturing with babies did not enhance their vocabulary, their receptive language or their productive language abilities. However, a closer examination identified that a small number of infants did in fact benefit from gesture training. For male infants who began the study with low expressive communication abilities, gesture training brought about significant gains in their expressive language. While Baby Sign may not have an effect for all infants, this research highlights how within-child factors determine the receptivity of some infants to gesture.

However, this study is limited by the fact that the sample was a highly homogenous subset of mother-infant pairs. All of the infants in this study were from high SES families, putting them at advantage when it comes to language development (e.g. Hoff, 2003). Furthermore, all of the mothers were highly motivated to participate in the study. They had responded to adverts to take part in a study of infant language and had committed to the study for a relatively long period of one year. Infants of highly motivated and highly educated mothers are likely to develop greater language abilities. A small number of male infants who benefited from gesture training. For everyone else in this high-SES sample, gesture training had no effect. The fact that it was those infants who had lower abilities that were identified to benefit from gesture suggests that gesture training is likely to be more beneficial for infants known to be at risk of weaker language skills.

Infants from low SES backgrounds are known to have poorer verbal language abilities than those children from more advantaged backgrounds (e.g. Snow, Burns and Griffin, 1998; Arriaga et al. 1998; Pan et al. 2005). The difference between low and high SES infants in their language abilities has been largely attributed to differences in the quality and quantity of maternal communication (Hoff, 2003). Therefore, children from lower SES background are those who are most likely to gain benefit from an intervention aimed at enhancing the communication between mothers and infants. Recent research has highlighted differences in gesturing between high and low SES mothers and suggests that gesture may be a way to enhance the linguistic input that infants from low SES household receive (Goldin-Meadow and Rowe, 2009). This is precisely what the next chapter explores.

Chapter 3. Exploring the Wider Consequences of Encouraging Gesture

3.1. General Introduction

The longitudinal study evaluated the linguistic effects of training mothers to encourage their infants to communicate using gestures. The question this chapter asks is; does encouraging mothers to gesture with their infants have any wider non-linguistic benefits?

The aim of gesture training was to get mothers communicating with their infants using the gestures before the babies could speak. As such, the mothers were encouraged to view their infants as communicative partners from a young age. In so doing, mothers would be likely to utilise 'Maternal mind-mindedness', treating her infant as "an individual with a mind rather than merely as a creature with needs that must be satisfied" (Meins et al 2001. pg 638). Maternal mind-mindedness has been demonstrated to be a better predictor of infant-mother attachment security than maternal sensitivity (Meins, 1998; Meins et al., 2001). Links have been demonstrated between maternal mind-mindedness and children's later understanding of others' mental states, i.e. Theory of Mind. (Meins, Fernyhough, Wainwright, Gupta, Fradley & Tuckey, 2002). Therefore, the way a mother perceives her child can change the relationship between her and her child and can help to develop the child's mentalising abilities.

Sharing a gestured system of communication is likely to promote changes in how mothers perceive their infants. In using gesture to initiate communication with their pre-verbal infants, mothers are implicitly attributing them with a conscious mind that is receptive to their verbal and nonverbal communicative efforts. Training mothers to gesture with their infants encouraged them to focus on their infants' subtle communicative attempts and to attribute meaning and intention to them. When infants reciprocate their mother's efforts with their own gestures, this is likely to build upon and encourage mothers' perception of their infant as an individual who has, and can express, wants, needs and desires.

Possessing insight into her infants' needs via gesture means that mothers will be better equipped to respond contingently to their infants. How a mother responds to her infant's signals and communications, her ability to interpret these correctly and act on them appropriately are features of 'maternal sensitivity'. As defined by Mary Ainsworth, the sensitive mother is able to see things from her baby's point of view. She is tuned in to receive her baby's signals: she interprets them correctly, and she responds to them promptly and appropriately (Ainsworth, 1971).

In the study described in Chapter 2, mother-infant dyads shared a set of gestures that had an agreed meaning between them. When an infant performed a gesture, the mother was anticipated to be able to readily interpret that gesture and to respond appropriately. For example, if a child taps the forefinger of her right hand into the palm of her left, the mother would understand this to mean 'more' and could respond accordingly, giving the child more of what is appropriate to that shared context, be it more raisins, more tickles or another read of a book.

Encouraging mothers to gesture may increase maternal sensitivity, and this in turn may have wider non-linguistic benefits. Indeed, an inverse relationship has been demonstrated between maternal sensitivity and infant frustration. Bell and Ainsworth (1972) found that contingent responses by mothers were associated with less infant crying in the first months of life. Furthermore, these infants subsequently produced clearer and extensive communicative acts at ages 9-12 months. Therefore, if gesturing can encourage maternal sensitivity this could in turn reduce infant frustration.

The ease with which distressed infants can be soothed can predict mothers' sense of efficacy as a parent. In turn, both infants' distress and mothers' sense of efficacy predicted mothers' sensitivity to their infants (Leerkes & Crockenberg, 2002). It is viable that this relationship follows the opposite direction, that more sensitive mothering reduces infant distress and thus increases the mothers' sense of efficacy. Either way, if gestures enable effective communication between mothers and infants, this is likely to reduce infant distress, promote maternal sense of efficacy in her role as parent, and encourage sensitive mothering. This is in line with the view that infants' communicative behaviours reinforce or diminish parental responsiveness (Goldberg, 1977). Therefore, encouraging mother-infant dyads to share a gestured system of communication is likely to enhance infants' communicative behaviour in a way that can be readily interpreted and appropriately responded to by mothers. This will reinforce the communicative exchange between mother and baby and this has the potential to enhance maternal sensitivity and maternal self-esteem. However, these effects rest on there being a potential for improvement in maternal sensitivity. Those mothers who are already highly sensitive will not stand to benefit from gesture training. For these mothers, gesturing is not likely to elicit any effects that they do not benefit from already.

Little research has looked at the socio-emotional consequences of encouraging gestural communication, although preliminary findings are emerging to suggest that there may be effects upon the mother-infant relationship. Parents taught to use symbolic gestures with their infants have been reported to feel more satisfied with the relationship with their infant (Vallotton, unpublished thesis). Furthermore, the gesturing infants in the Vallotton study experienced fewer episodes of distress, and the mothers demonstrated more appropriate maternal responses to their child's' distress cues. Overall, there was a higher degree of affect attunement between mother and child. These findings suggest that gestures offer mothers insight into their infants' behaviour, and as such find it more acceptable and have a greater appreciation of the mental and relational capacities of their child.

Yet, despite the lack of research, there is an abundance of gesture-training programmes that encourage parents to gesture with their infants, with the promise that in doing so they will boost their children's language abilities and benefit from other socio-emotional benefits, such as reduced frustration. Commercially, gesturing with infants using a taught form of gestures is described as 'Baby Sign'. Many of the claims made by Baby Sign companies of the worth of enhanced gesturing with infants using 'Baby Signs' depend on anecdotal evidence. Great importance is attached to testimonials from parents, which are presented as evidence to promote the benefits of Baby Sign. For example, the website for Baby Signs® (the company founded by psychologists Linda Acredolo and Susan Goodwyn) lists the benefits of using the Baby Signs® programme to be: enhances self-esteem and confidence; strengthens the parent-infant and caregiver-infant bond; stimulates intellectual development and reduces frustration. Each claim is supported by an observation from a parent of their signing baby. To illustrate, the following anecdote is presented on the website as evidence to support the claim that using the Baby Signs® Program reduces infant frustration*:*

"There was no doubt about it; fifteen-month-old Emily was upset. Her dad, Ed, had just returned to his easy chair after settling her down for her nap when the wailing began. Ed was puzzled. He thought he'd done everything right. Her diaper was fresh, her tummy was full, and her music box was playing. What could the problem be? As he opened her door, one quick look at Emily's face told the story. There she stood, teary-eyed, furiously tapping an index finger against her lips. Immediately recognizing her sign for pacifier, Ed sighed with relief, pulled one out of a drawer, and handed it to her. But Emily frowned and shook her head. Obviously something still wasn't right. Fortunately for Ed, Emily then stuck out her hands, wrists together, and smacked her palms in a clapping motion. "A ha! That's your sign for "crocodile!" said Ed triumphantly. "You don't want just any pacifier; you want the one with the crocodile on it!" Emily 's answering grin told him he'd gotten everything right at last - with a little Baby Signs® help"
(Retrieved from: https://www.babysigns.com/index.cfm?id=99#rf August 7th 2009)

The power of parent testimonials is persuasive and no doubt leads parents to believe that Baby Sign will bring these numerous benefits. However, without empirical research these claims remain unproven. Furthermore, the benefits of

Baby Sign reported by parents in testimonials may depend on, or interact with numerous other factors (e.g. socio-economic status, modeling frequency, number of siblings, etc). As highlighted in this thesis, socio-economic status (SES) is an important variable to consider when focusing on language development, with marked discrepancies in language abilities being attributed to family SES (Arriaga et al. 1998; Pan et al, 2005; Locke, Ginsborg and Peers, 2002). By their very nature, Baby Sign classes are most likely attended by higher-SES mothers: classes are costly, with most requiring mothers to purchase a course of classes rather than paying for individual sessions. The benefits for infant language from using Baby Sign, as described by the parent testimonials, may be a product of the high SES of the family. Indeed, higher-SES mothers have been found to spontaneously gesture more than lower-SES mothers (Rowe & Goldin-Meadow, 2009), therefore the effects of gesture interventions may be mediated by SES. The infants of high-SES mothers are already exposed to a high number of gestures and as a result gesture more themselves, which may mean that they are more 'ripe' to acquire new taught gestures. Therefore, an evaluation of Baby Sign should explore the factors that contribute to any benefits that enhanced gesturing with infants may have and anecdotal evidence should be treated with caution.

There is currently a lack of unequivocal information for parents to access regarding the worth of Baby Sign. In order for parents to decide whether they invest their resources into Baby Sign, they should be fully informed of the realistic benefits that they could expect to gain. The discrepancy between what is known about the effects of Baby Sign and the benefits that are claimed may even be harmful for parents. If parents have invested effort and money into Baby Sign and do not observe the promised benefits, this is likely to provoke feelings of cognitive dissonance (Festinger, 1957). We are motivated to obtain consistency between our behaviours and our cognitions and feel uncomfortable when there is conflict between the two. To resolve this we may change our behaviour or our attitudes to regain internal consistency.

Parental expectations of their infant's development have been found to vary depending on maternal SES. For example, Ninio (1979) found that lower-SES mothers are less likely than high-SES mothers to believe that the onset of talking can be influenced. According to the lower-SES mothers, infants are born with a particular set of characteristics and the environment has minimal effect on development. Therefore, they did not feel that they could have much influence on their child's development. Because Baby Sign classes are costly, they are more likely to be attended by higher-SES than lower-SES mothers. Therefore, these mothers may feel more strongly about the impact that they can have on their infant's development. If the infants do not sign or their language is not accelerated, this is likely to cause internal inconsistency for the mother who, fully expecting that she can shape her infant's development, will attribute the lack of gains to some failing in herself. Alternatively, in order to resolve the conflict caused by this cognitive dissonance, mothers may seek justification to support the behaviour. In this way, mothers may demonstrate a confirmatory bias, over-attributing their infants' behaviour to be consistent with their expectations of the outcomes of Baby Sign.

It is not just parents who require evidence-based knowledge, but also those working with infants. Baby Sign has an increasing presence in childcare establishments. Baby Sign companies offer packages to nurseries to train their staff to use Baby Sign with the infants under their care. The nurseries then become accredited as being sign trained by the specific Baby Sign company and are promoted by that Baby Sign website. This appears to have a great uptake. One company, 'Baby Signers' list on their website 35 nurseries across the UK that they have approved to be sign trained, while another Baby Sign company 'Tiny Talk' lists over 50 Tiny Talk trained nurseries in the Greater London area alone. The fact that nurseries advertise themselves as being 'Baby Sign trained' promotes the view to parents that Baby Sign is something that they *should* be doing with their infant. Therefore, it is of great importance that parents and health care professionals are provided with evidence-based advice in order that they can be supported to inform best practice in childcare settings.

This chapter examines the wider effects of gesture training and presents two studies that explore and evaluate the socio-emotional impact of gestured communication. Study One interviewed mothers from the longitudinal study to gain a deeper insight into their expectations and experiences of using gestures with their infants. While exploring the linguistic benefits as perceived by mothers, this investigation also allowed any wider non-linguistic effects observed by mothers to be detected. Because the sample was drawn from the longitudinal study, important factors were controlled for, including the age of the infants, the length of gesture training and the amount and type of gesture exposure. To assess the claim emphasised by Baby Sign companies that signing reduces frustration, Study Two compared the stress of parent-infant dyads who had gestured and those who had not. The Parental Stress Index (PSI) (Abidin, 1994) was chosen as the most appropriate tool to assess stress as this is a well validated tool that provides a reliable indication of parents' perceptions of their relationship with their child.

Study One: A Qualitative Investigation of the Expectations and Experiences of Gesture-Trained Mothers

3.2.1.Introduction

The purpose of this study was to provide an in-depth description of the expectations and experiences of mothers in the longitudinal study who were trained to use gesture. Whilst the longitudinal study generated extensive quantitative data to evaluate the impact of gesturing on infants' language development, this study sought to enrich this data with a qualitative exploration of the perceptions and experiences of the parents to further explore maternal perception of any linguistic and wider non-linguistic benefits of enhanced gesturing.

Parental accounts of their personal experience are important to evaluate the practicality of Baby Sign as well as the directly observed benefits and drawbacks as perceived by the mothers. Furthermore, by interviewing mothers who had used either BSL or symbolic gestures with their infants, similarities and differences between these two types of gesturing could be explored. Interpretative Phenomenological Analysis (IPA) was deemed as the most suitable approach to explore the data. According to IPA, the participant is the expert on their own experience and methods of interpretative analysis are used to uncover central themes. In this way, the interviews are recognised as a product of the interaction between researcher and participant and it is acknowledged that the researchers' view will influence the emerging themes (Reilly, Huws, Hastings & Vaughan, 2008). Semi-structured interviews have been highlighted as the exemplary method to use with IPA as they offer a flexible method of data collection where the researcher and participant engage in dialogue, and whereby initial questions are modified in light of the participants' responses, and the researcher is able to probe interesting and important areas that may arise (Smith & Osborne, 2008).

Mothers were interviewed who had been trained to use gestures with their infants under the conditions outlined for the longitudinal investigation, as described in the previous chapter. These mothers were trained to use a limited set of 20 target gestures, when their children were between 8 and 20 months, and were doing so as part of a controlled study. Therefore, the experience of these mothers will be different to that of mothers who attend Baby Sign classes. However, the issues raised by this study are anticipated to be relevant to mothers outside of the sample.

3.2.2. Method

3.2.2.1. Participants

The 20 mothers who completed the longitudinal study in the gesture training conditions (BSL and Symbolic Gesture) were interviewed. However, a sample of the first 11 interviews conducted were transcribed and included in the thematic analysis. This decision was made as it became apparent that there was a high amount of consistency in the themes that emerged from the interviews, and the interviews transcribed were representative of the sample, so it was not deemed necessary to include all interviews. All mothers were educated to at least degree level, were married and their partners lived in the family home.

Table 3.17. Participant Details

Participant	Mothers' Age	Gesture Type	Infant Gender	Siblings Gender	Siblings Age at onset of study
1	Not given	BSL	Male	-	-
2	34	SG	Female	-	-
3	32	BSL	Female	-	-
4	39	BSL	Male	2 male	6 + 4 years
5	38	SG	Male	1 male	
6	40	SG	Male	1 male	5 years
7	33	SG	Female	1 female	Younger
8	38	SG	Female	-	-
9	35	BSL	Male	1 male	3 years
10	34	BSL	Male	1 male	Younger
11	Not given	BSL	Female	1 female	4 years

3.2.2.2. Procedure

A summary of interview topics were developed to include the mothers' expectation of using gestures with their infant, the mothers' experience of using gestures and their perception of the effect that gesturing had on their child. Interviews were conducted by the researcher in the mothers' homes at the end of the infants' 20-month assessment. The interviews were recorded and transcribed in full and IPA analysis was conducted on the interview transcripts (refer to Appendix J for sample interview transcripts). The analysis was conducted in several stages, according to Braun and Clarke (2006). Firstly, as interviews were transcribed, the researcher gave an in-depth consideration of the content and made notes of initial ideas about what was interesting about the data. Secondly, a set of codes was generated which identified features of the data. Each of the interviews was then coded and all data extracts collated within each code. Next, the different codes were combined and sorted into potential overarching themes and all relevant interview extracts for each theme were collated. Finally, the themes were reviewed, where consideration was given to the extent that the extracts matched the theme and how well the themes coherently encompassed the codes of interest. A sample of transcripts was discussed with another researcher and the themes were agreed upon between the researchers.

3.2.3. Analysis and Discussion

Four themes emerged from the data. These were:

1) Mothers' awareness and preconceptions of gesturing with infants
2) Mothers' experience of gesturing:
    i) Socio-emotional
    ii) Language benefits
3) Factors affecting gesturing
4) Implications of type of gesture (BSL or Symbolic Gestures)

Each of these will be described and discussed in turn.

3.2.3.1. Mothers' Awareness and Preconceptions of Gesturing with Babies

All of the mothers interviewed were aware of Baby Sign prior to joining the longitudinal study. Many mothers had friends who had attended Baby Sign classes, others had seen adverts for classes in mothering magazines or leaflets and posters advertising local classes. All except one of the mothers with older children reported that they were aware of classes when their eldest was a baby, though none of them had attended a class. One mother describes the reason she didn't go to any Baby Sign classes was because she "*never really thought there would be any advantage to doing it. I kind of feel like I talk to my children quite a lot anyway and language will come naturally".* Another mother with an elder daughter describes how *"it [Baby Sign] was something that I was going to do with my youngest, with my eldest … but she spoke really early so there was no real point".* Another mother felt that the classes offered a social activity for mothers: *"I think probably erm especially first time mums to make friends more than actually in the class"*

The interviews highlighted just how strong a presence Baby Sign has in film and television media. Mothers mentioned the BBC children's programme, "Something

Special". This is a television programme aimed at pre-school children, which reinforces language using Makaton[9] signs. In 2004, the film *"Meet the Fockers"* introduced the concept of Baby Sign to a wide audience. The film presents Baby Sign as something of an American fad, which is enthusiastically used by a grandfather with his grandchild.

Many of the mothers' preconceptions of Baby Sign reflect this sceptical view that Baby Sign was nothing more than a fad. One mother described how she had felt that signing with babies "*was something a bit like teaching your children to read early, something that was a bit unnatural, that's how it struck me before I started".* Mothers described how they had initially perceived Baby Sign as *"the new, in-vogue thing"* and *"quite a middle class kind of mum thing to do"* and *"one of these kind of trendy American things that probably doesn't have any advantage".*

Being aware of Baby Sign meant that mothers held expectations of the impact that Baby Sign would have, some of which were positive and others were more cautious. On the positive side, mothers expected Baby Sign would enhance their interaction with their infants. One mother said *"I thought there would be benefits, like getting him to communicate with me before he could express himself verbally",* another '*I was hoping yes that it would make it easier for me to communicate with her and her to communicate with me and also for her to learn how to communicate".* These mothers expressed views typical of mothers in the study, indicating their anticipation that by using gestures with their infants, and encouraging them to use the gestures to communicate before they could speak, communication would be greatly improved.

By providing infants with a means to communicate before they could speak, many mothers anticipated that this would have benefits beyond language. Mothers remarked how they had expected signing to reduce infant frustration and that in turn, they anticipated that by having less frustrated infants, they would experience

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[9] Makaton is a system of communication that uses a vocabulary of gesture taken from BSL

less stress as parents. For example, when this mother was asked what she expected to get from using Baby Sign, she replied *" less crying out of my baby … and less frustration from me".*

The expectation that Baby Sign would reduce frustration could have emerged from claims promoted by Baby Sign companies. For example, according to Baby Signs®, babies who sign "can make their needs known quickly and quietly without becoming frustrated and resorting to tantrums and tears". Comments by mothers indicated that they believed the reason why Baby Sign would reduce frustration was because it would give infants a means to communicate. For example, one mother commented: *"if it saves some frustration in their getting their message across then it's always worth trying".*

Although the majority of mothers expected to observe linguistic gains in their infant, a small number of mothers expressed concern that Baby Sign might actually hinder verbal language development. One mother said how "*somebody had mentioned.. possible.. delays in speech because of using signing".* This mother felt that if Baby Sign provided infants with an effective means to communicate then infants would not be motivated to learn to speak, "*if he had a means of communicating to me without talking then maybe he would have opted for carrying on signing and not ever trying the word".*

However, despite the concerns that these mothers appeared to have at the onset of the study, they did go on to introduce the gestures into their day-to-day interaction, and these same mothers reported positive benefits of doing so. For example, the following mother talks in retrospect of her concerns and how they were not evinced:

> *Mother: I was worried that it would stop him from speaking and that he would use signs instead of words*
> *Researcher: Yeah*

Mother: But you made it very clear that the signs were to be placed with the words to support the words
Researcher: Exactly
Mother: And I think… that was the only thing I was worried about and concerned in terms of having a negative effect and that hasn't happened

The relationship between mothers' expectations and their experiences is explored in more detail later on in this section.

Even in this small sample of mothers, a wide spectrum of expectations was evident. At one end of the spectrum are mothers who expected great benefits for their infant, both linguistic and non-linguistic. In the middle-ground, mothers believed Baby Sign to be a trendy exercise with no real worth, but evidently were willing to try it with their infants. At the extreme end of the spectrum are mothers concerned Baby Sign could potentially hinder verbal language development. However, these beliefs were not likely to be very strong given the fact that these mothers went on to take part in the study, despite these concerns. The variability in opinion reflects how little agreed understanding there is of Baby Sign. Given the lack of research in this area in contrast to the powerful claims of Baby Sign companies and the strong presence that it has in the media, the discrepancy in mothers' beliefs is not surprising. Mothers cannot be expected to possess valid and reliable knowledge when current research does not provide an unequivocal answer to the question of the impact of signing with babies.

3.2.3.2. Mothers' Experience of Gesturing

When mothers were asked about their experience of using gestures with their infant, the topics of discussion fell into two broad categories: socio-emotional experiences, and language benefits. These two categories will be dealt with separately here.

3.2.3.2.Mothers' Experience of Gesturing: Language Benefits

Mothers expressed expectations that Baby Sign would benefit communication. The perceived experience of these mothers matched their expectation, as one of the strongest views expressed in the interviews was how gesturing had made communication possible at a much earlier age than would otherwise be expected.

"erm I think the thing I like most was getting [baby name] to communicate to me before he could talk as I felt I knew what he was asking for… Much before he could say anything to me and that was fantastic."

Mothers felt that being able to communicate before the onset of speech enhanced their child's language development. For example, one mother describes how her daughter was *"definitely using the signs before she was saying the word and she definitely associated that with those different activities certainly think that it improved her speech"*

Did gesturing actually improve this infant's speech? The mean rank change of this infant was examined to determine how much of a gain she made relative to the sample as a whole. In terms of productive vocabulary, this infant made little change. At 12 months her mean rank within the sample was high (36.50) and at 20 months was only slightly higher (38.00) therefore indicating that her verbal skills relative to the sample were consistently good. The contribution of gesture training to her speech development is therefore questionable.

3.2.3.2. Mothers' Experience of Gesturing: Socio-emotional

Reduced Frustration

An exploration of mothers' experiences of sharing a gestured system of communication with their infant revealed that the perceived consequences extended into the wider socio-emotional domain. The mothers interviewed perceived the gestures as providing the infants with a means to express themselves, thus forestalling frustration, for example *"I think [child name] really benefited from them and I think his language is quite advanced for, compared to when his brother was that age…[his brother] would do a lot of pointing and Aahhh! Ahh! Ahh!" and [child name] you know, I can actually get him to calm down and go.. more food or drink you know"*

This infant's target gesture and word vocabulary was examined to determine whether he did indeed have advanced language skills as a result of gesture training. At 16 months, this infant's multimodal target vocabulary (words or gestures) was 13 which was much greater than the mean multimodal target vocabulary of the infants in the BSL condition (9.80), Symbolic Gesture condition (9.33) the Verbal Training condition (6.60) and the Non-Intervention Control condition (4.50). Therefore, he could use the gestures to communicate more, but did he have advanced language? To answer this question, his composite language score at 20 months was calculated by summing his score on the CDI, PLS 3-UK and the GAPP. This individual infant had a composite language score at 20 months of 389, which was considerably higher than the mean of the whole sample (329.68) and higher than the mean score of each condition (BSL: 342.67; Symbolic Gesture 327.33; Verbal Training: 346.90; Non-Intervention Control: 302.90). Therefore, the data supports this mothers' perception of her infants' enhanced language abilities. According to the mother, because her child could use the gestures to communicate effectively this evaded frustration. Whether or not this perceived benefit is an actual benefit will be addressed by Study Two which presents a quantitative evaluation of the effect of gesture training on stress.

Insight into Infants' Needs

This mother describes how the ability of her child to communicate her needs made her feel as though she had a better understanding of her child: *"I think it's it's when they when especially when they're preverbal you know and they they honestly cannot tell you what it is that they want, just, like the basic things like you know, do you want something to eat? Are you actually hungry? You know, here I am shoving food in your, at you, and are you actually hungry? You know, are you actually thirsty?"*

Sharing a gestured system of communication allowed infants to communicate their needs and desires, and enabled mothers to identify their child's precise needs, i.e. whether the child is hungry or thirsty, and thus respond contingently. Consequently, mothers perceived themselves as having greater insight into the minds of their babies: *"its very difficult to work out a lot of the time what it is that they're on about you know and anything I I think that anything that gives you a little bit of an edge in being able to understand what's happening in their heads is useful"*

In this way, mothers appeared to be tuned in to their pre-verbal baby's signals and could interpret them and respond to them appropriately, all of which are features of maternal sensitivity (Ainsworth, 1971). Using gestures with a shared agreed meaning between mother and baby appears to increase mothers' sense of her own ability to act contingently toward her infant, which is likely to enhance her sense of efficacy as a caregiver.

Emotions Surrounding Baby Sign

The interviews elicited many comments on the emotions surrounding the experience of gestural communication, both negative and positive. Because there was typically a 4-month lag between mothers first modelling the gestures to the infant and the infants' first production of the gestures, this elicited feelings of frustration. One mother reports that during this time *"It was a little disheartening that I kept doing them and he showed very little interest in using them!"* In fact, mothers frequently refer to feeling disappointment during this time as they waited for the child's first gesture to appear. Another mother describes this time quite negatively, saying *"I can't say I really enjoyed doing it when I didn't see a response from him".*

The negative feelings at this time could have reduced mothers' compliance, however mothers did not comment that they had reduced their rate of modelling, nor is this reflected in the modelling data reported in Chapter Two. The feelings that mothers experienced during this time waiting for their child to gesture back has implications for mothers who attend Baby Sign classes. Baby Sign classes are promoted to mothers to attend with their infants from as young as 4 months of age. Given the fact that the mothers in the longitudinal study felt discouraged after four months of waiting for their child to gesture back to them, increasing this time lag between modelling and production is likely to increase the likelihood of feelings of disappointment in the mothers. Many of the Baby Sign companies report anecdotes of infants just a few months old using signs. These may be exceptional cases or may be over-interpretations of infants' spontaneous hand movements. For example, the sign for milk is one hand clenched and opened again, an act that infants typically produce spontaneously. Because mothers are focusing on their child's hand movements, this natural act may be misinterpreted as a communicative act. Indeed, some of the mothers mentioned examples of infant signing that they had encountered before starting the study, for example: *" I went to baby massage for example and there was a woman there who was doing some signing and one of them* *was milk and her little baby was just a few months old apparently was using the sign to indicate she wanted milk"*

Mothers recalled how they had felt great surprise when their infant produced their first gesture, and this surprise was attributed to the relatively long period in which mothers' gestures were not reciprocated. Reporting an experience shared by many mothers, one mother said *"I was quite surprised after a couple of months of thinking he didn't understand he started using them and surprised me".* The realisation that their infants had indeed been attending to their gesturing efforts for the past few months changed the way the mothers viewed their infant, changing the mothers' perception of their infants from a "creature with needs that must be satisfied" (Meins et al 2001. pg 638) into a communicative partner. By perceiving their infant in this way, mothers demonstrate 'maternal mind-mindedness' (Meins et al 2001. pg 638).

Many of the mothers remarked how their infants would display much pleasure when producing the gestures and this pleasure was perceived to result from the infants' understanding of their own ability to communicate their thoughts to another person. These comments are typical of how mothers described the positive experience of their infants: "*I notice it even now but I remember noticing at some point when he was trying to get the message across to me and he worked out that I had understood what he was asking I could see how happy he was*" Also, "*whenever even to this day when [child name] realises I understand he gives a little giggle."*

Comments such as these demonstrate how these very young infants experienced pleasure from being able to communicate at an age when their comprehension typically far exceeds their ability to verbally express themselves. By gesturing, infants were able to communicate about a referent way before the onset of speech: "*so he's had kind of 3 months of being able to indicate it [aeroplane] to me without actually using the word which I think he's really enjoyed".* This positive experience may enhance infants' confidence in their communicative abilities. One mother commented how the experience of using gestures "*boosted his confidence*". Confidence may in part account for the purported linguistic benefits of Baby Sign, if such benefits exist.

How Did Mothers' Interpretation of Their Experiences Match Their Expectations?

The relationship between mothers' expectations and their perceived experiences (as conveyed to the researcher) was explored. As already described, mothers differed in what they expected from Baby Sign. Mothers could broadly be described to hold high expectations, low expectations or to hold ambivalent expectations of the benefits of Baby Sign. The experience of one of each of these mothers, viewed to be representative of that group of mothers, is compared against the expectations that they described, to explore the relationship between different levels of expectation and mothers' interpretation of their experience. Therefore the extent to which mothers' experiences were contingent on their expectations can be understood.

The Experience of Mothers with Low Expectations

One mother that had low expectations about Baby Sign remarked how at the start of the study she "*never really thought there would be any advantage*". When asked about her experience and whether she saw any advantages of Baby Sign, she commented that:

"I think the main advantage of it and I you know I do a fair amount of this anyway, but I think it improves interaction, mother-child interaction, I definitely think its made me take time to take a step back and think about getting his eye contact, and engaging him and I think it's a very useful tool for that and I definitely think if you're a mother that rushes around and doesn't settle down and play its.. It's a reminder to do that"

This mother appears to describe the benefit not for herself, but more how she feels it would be of benefit to other mothers, such as a mother who "*rushes around and* *doesn't settle down and play*" and may not engage in the positive communicative behaviours (i.e. eye contact) that we assume she already does. This mother goes on to review her own expectation in light of her experience:

"*erm I think, I didn't really consider that before I started it, you know I thought it was something a bit like teaching your children to read early, something that was a bit unnatural, that's how it struck me before I started, that it was one of these kind of trendy American things that probably doesn't have any advantage and I think I've changed my mind slightly because I can see that certainly by encouraging certain groups of parents I could imagine it having quite a lot of advantages actually*"

Again, the mother is clear that, while she feels that Baby Sign has benefits, these benefits are not relevant to her as she is already effectively communicating with her infant, but that "*certain groups of parents*" would stand to reap more benefits from being encouraged to gesture with their infants.

The Experience of Mothers with Ambivalent Expectations

One mother described how she had heard " *very mixed reviews*" about Baby Sign prior to the study, "*some of it erm helped children's communication and other well possibly slowed it down so I wasn't swayed either way really*".

This mother's description of her experience of Baby Sign is contradictory. On the one hand she says how "*its certainly aided understanding and communication*" but then goes on to say "*because he was quite slow to talk at one stage I felt perhaps this is slowing down his speech and unintentionally I did ease off using the signs*". This is quickly followed by "*but erm no I would use them again so I am really pleased that we did take part*".

When asked about her views on any disadvantages to signing this mother again is ambivalent: *"I'm not sure that there are any disadvantages, I think that if you were signing constantly throughout the day and using lots of different signs perhaps it may.*

A child that's perhaps lazy may not speak so soon but again I don't know. I think they're very useful for everyday".

This mothers' discrepancy in her beliefs may reflect inconsistency between her opinion and her desire to fulfil the expectations of the researcher. Torn between telling the researcher what she believes the researcher wants to hear and what opinions she holds about Baby Signing, this mothers' narrative of her experience is inconsistent.

The Experience of Mothers with High Expectations

One mother with high expectations about the benefits of Baby Sign was highly motivated to learn Baby Sign, and she described her expectations of using Baby Sign in the context of a friend's experience: "*she'd done it with her and she'd said to me how it made everything so much easier because the child could communicate a little bit of what they wanted and so I was intending to do it in any case*".

When this mother was asked what she expected from using Baby Sign, she replied: "*Erm, less crying out of my baby…and less frustration from me, I was er you know hoping that it would help and and I was also I I was hoping that it would help her learn to speak quicker that it would you know aid her language development*" This mother adds that "*but obviously I don't know that it would of done that cos you know you can't go and live that life again do you know what I mean*" demonstrating how aware she was that it would be difficult for her to assess the impact of Baby Sign on her baby over and above her babies' natural course of development.

Yet, this mother did feel as though she was greatly benefited from using Baby Sign: "*I think its its when they when especially when they're preverbal you know and they they honestly cannot tell you what it is that they want, just, like the basic things like you know, do you want something to eat? Are you actually hungry? You know, here I am shoving food in your, at you, and are you actually hungry? You know, are you actually thirsty? You know it's quite, it's quite interesting. It's quite useful because you* *can't you know its very difficult to work out a lot of the time what it is that they're on about you know and anything I I think that anything that gives you a little bit of an edge in being able to understand what's happening in their heads is useful*".

For this mother, she got from Baby Sign exactly what she anticipated. Despite commenting at the beginning that "*I don't know that it would of done that*" she is still confident in her description of the benefits that she perceived Baby Sign to bring, i.e. enhanced communication, thus confirming her expectations.

3.2.3.3 Factors Affecting Gesturing

Four factors emerged which appeared to have a strong influence on mothers' use of the gestures. These were:

- Partner support
- Having more than one child
- Form and function of gesture
- Age of child

These factors will be described and discussed in turn.

When mothers entered the study, they were trained to use the target gestures and were encouraged to share these gestures with others in their household, although they were told that the study would focus on their gesture usage and other people would not be expected to use the gestures. Mothers expressed polar views on the role of their partner in using the gestures with their infant. Some felt that it was very important to have their partners' support, for example: *"because I knew that [husband name] my husband would be willing to participate and also do the signs, if he wasn't then it wouldn't be possible, it wouldn't be worthwhile because unless you're both consistent".* In this mother's case, her and her husband used the gestures equally and supported each other in using them: *"we both used them consistently and we used to remind each other too if we didn't".*

Other mothers did not involve their partners in using the gestures and did not expect them to use them: *"he certainly wasn't interested in sitting down and looking at the book [of signs] and I think you know, he's not here through the week and at the weekend I suppose you don't want to concentrate on things you have to do you want to just enjoy*".

This difference in opinion could reflect different views that mothers held regarding the father's role in parenting in general. This comment hints at the perception of Baby Sign as an extra activity that is effortful ("things you have to do"). Regardless of whether the mothers did encourage their partner to use the gestures, they all felt that if their partner had used the gestures as consistently as they did, that they would have felt more supported and would have been more encouraged to use them themselves. For example, one mother says how *"I think I should have encouraged [husband name] to use them a bit more which is why I say I think if we started using them from the beginning next time I think just form more naturally, he would make a little bit of an effort with drink, but like I didn't really push him to if I'm honest, I sort of erm I did it on my own a bit really, but I think if there had been both of us I think that would have helped erm helped you remember them all".*

Equally disparate in the views that it elicited from mothers was the experience of those who had more than one child. Of the mothers interviewed, six had more than one child: four mothers had children older than the child in the study and a further two had younger children born in the course of the study. Some mothers found that having more than one child meant that they felt that they had fewer resources available to focus time and effort on using the gestures. One mother who had an elder son commented how: *"if I'd done this with my first child and had more time I would have been able to concentrate a bit more but you know usually I'm dealing with two kids at the same time, and I think that probably meant that I've had less time and energy to focus on this"*

However, another mother who also had one elder son saw the use of gestures as an opportunity to focus time and energy on her second baby: *"so yeah it could slow me down to focus on take the time, especially with the second child, so I would take the time to teach him the signs"*. This mother went on to discuss how she felt that it was the increased amount of eye contact encouraged by gesturing that helped her to focus on her second child: *"it's kind of especially with this, with the second child that you take that time and you don't feel rushed over.. And you just, I think they both benefited from sharing these moments where we look eye to eye"*

Mutual shared gaze is the earliest form of communication that infants engage in with their mothers and is important for mothers as it "signals that the infant is really participating in the interactive exchange and is not simply a recipient" (D'odorico & Levorato, 1990, p9). Eye gaze plays an important role in language learning. The amount of time spent in joint attention, when both infants and mothers are visually attending to the same referent, is highly correlated with infants' subsequent vocabulary (e.g. Tomasello & Farar, 1986). As part of the gesture training, mothers were instructed to always gain eye contact with their infants before performing a gesture. This may have enhanced the mothers' sensitivity to their infants' eye gaze. As such, mothers may have attended more to where their child was looking and this could have influenced the verbal and gestural input that mothers gave their infants. Researchers have speculated that encouraged gesturing may enhance the amount of time spent in joint attention episodes, and preliminary findings appear to support this (Moore, Acredolo & Goodwyn, 2001).

Mothers found it easy to incorporate gesturing into their daily routines and found that gesturing became very natural to them: *"once I'd started and once, once I got sort of very used to using the signs in a particular context, before I knew it I was using it constantly".* However, not all gestures were used as frequently as others and the interviews indicated that the feature, form and meaning of the gestures affected how often mothers used the individual target gestures. Mothers found some gestures physically easier to perform and to remember than others. For example the two-handed gestures were commented to be less practical than the one-handed gestures, *"I found the two handed signs difficult to do sometimes because you often only have one hand free".* Examples of two-handed gestures include sleep, for both the BSL and SG groups.

Mothers were trained to use either BSL or symbolic gestures with their infants. The symbolic gestures were highly iconic, clearly representing in form or function the referent, whereas many of the BSL gestures were arbitrary. While most mothers were unaware of the other type of gesture that mothers had been trained to use, some were friends with mothers on other conditions. As such, these mothers had insight into the differences between the gestures and were able to compare the gestures.

"I think some of them are a bit complicated, that's all I'd say, I'd be more interested in looking at Baby Sign, because obviously I did the British Sign Language sign and I think some of those erm were quite complicated and not very natural, I would, I would prefer kind of the more instinctive ones… I think I would be more likely to use more signs if they'd been more obvious and easier"

Natural gestures are interpreted to refer to the iconic gestures, resembling hand movements that would be performed spontaneously which have a high degree of semantic relatedness to the referent. For example, mothers commented how they were more likely to use "simple signs" more often, *"certainly more simple ones like flower and er duck I used much more frequently because they are simple"* (mother from SG condition). Both of these gestures are highly iconic actions and can be easily identified by even an untrained observer. So not only are these gestures simple to perform, but also likely to be more memorable. Indeed, adults have been demonstrated to be sensitive to iconicity when learning signs (Beykirch, Holcomb, & Harrington, 1990; Lieberth & Gamble, 1991).

The context in which gestures were appropriate to use contributed to the frequency of gesture use. The gestures that mothers said they used most often were "*the ones to do with daily activities have all been the most useful"* and *"those that I could use at mealtimes".* Being a routine that mothers and infants engage in daily, meal times provided an optimum context to use the gestures. The physical positioning of mother and baby at meal time, mostly baby sat in a high chair at a table and mother sat opposite her infant, allowed mothers to engage in a high amount of eye contact and shared attention with their infants, an ideal situation for gesturing. Mealtime allows the opportunity for conversations with mother and baby taking turns to communicate and respond through action or verbalisations. Many of the gestures were relevant to mealtime, including drink, food, more, hot and all-gone. Not all gestures were obvious to use in a specific context and required mothers to create opportunities to use the gestures. *"I did make an effort to find reasons to use signs – especially those such as flower and dog, stopping when we were out on walks to use them".* Mothers made effort to use these gestures and describe how they would "*force the situation where you might use that sign".*

The rate at which mothers used the gestures changed over time. Some mothers described how they were more likely to use gestures for words that infants did not yet understand, and would decrease their use of the gestures once they felt the infant understood that word. For example, "*I think he already knew what I meant by Bath and I didn't feel there was a need for it*". In addition to comprehension, mothers' gesture use was related to the production abilities of the infants. For example, *"I was enthusiastic at first and used the signs whenever I could but as [child name] started to speak rather than use signs, I tended to use them less". Also: "as her language has developed we then kind of, you know they didn't suddenly stop, they just sort of tailed off gradually over time so between September and now it's become less and less and less"*

Mothers were trained to use the gestures to augment and nurture verbal communication, and so it is natural that as infants began to speak mothers turned their focus to encouraging infant speech. Furthermore, children would be called upon by other people in their linguistic environment to communicate verbally rather than using gestures. Observations of parents' spontaneous gesturing indicate a natural decrease in the rate of gestural labels that parents produce (Namy & Nolan, 2004). Maternal interactional style appears to be in-tune with what type of input their infants are receptive to at different stages of their development.

3.2.3.4. Type of Gesture

The mothers that were interviewed had either been taught to use a set of symbolic or BSL gestures. Mothers were not made aware that mothers in other conditions were using a different type of gesture to them. The interviews elicited discussion of the mothers' views of the gestures themselves, which raises interesting questions about the experience of gesturing using different forms of gestures included in the study.

Mothers in the BSL condition felt that learning a few gestures from a formal sign language was a beneficial thing to do both for them and for their infant, and even described it as equivalent to learning a new language. This is illustrated by this mother who said: " *I see the advantage to using BSL is that they're going to see it throughout life, things like, so there'll be certain signs he will always now understand and be able to communicate with deaf people who are using those signs".* This view is echoed by another mother who saw the potential future positive implications of being able to communicate using signs: "*I think long-term as well, going into school, going into nursery I think it's, it would be such a valuable thing to have , because you never know because so many obviously children are being integrated into schools and if he has the ability to be able to communicate with a child that happens to be in his environment then how wonderful that would be, not just for him but for the other children"*

One mother expressed a view to the contrary, questioning the importance of learning a formal set of signs, compared to creating your own idiosyncratic gestures: "*I think also maybe doing your own signs maybe not necessarily following the signs that are recommended".* It was this mother who described her struggle to remember some of the gestures, in particular those that were arbitrary and did not represent the feature or form of the referent. Therefore, for this mother the connection between referent and gesture was stronger for some items (namely iconic gestures) than for others, placing differing demands on memory.

3.2.4. Conclusion

The purpose of this study was to describe and explore the experiences and views of the mothers who shared a gestured system of communication with their infants from a preverbal age. Rich qualitative data was generated and insight was gained on the experiences of mothers, highlighting important issues. Current research that has evaluated the impact of encouraged gesturing in infants has focused on linguistic outcomes (e.g. Goodwyn et al. 2000). This analysis has drawn attention to the fact that the experience of sharing a gestured system of communication was perceived by mothers to have linguistic and socio-emotional benefits.

By being able to communicate effectively with their pre-verbal infants from a young age, mothers felt they better able to understand their infants' needs, which in-turn was perceived to reduce frustration on both the part of the mother and baby. The interviews elicited much discussion of the emotions surrounding the experience, with mothers remarking upon how much their infants enjoyed being able to use the signs to communicate and how they felt this boosted their infants' confidence about their communicative skills.

To determine the extent to which these are perceived or actual benefits, mothers' experiences of Baby Sign were examined in light of their expectations, revealing consistency between what mothers anticipated and what they experienced. This suggests two possibilities: that mothers' expectations shaped the perception of the experiences that they had, or that mothers' expectations directly impacted the infants' development.

Maternal knowledge and expectations can directly influence a child's development (e.g. Dichtelmiller et al. 1992) however this is unlikely to be the case here as data on infants' language development was available to corroborate maternal perceptions. While mothers may have felt that gesturing afforded their child advanced language skills, the linguistic benefits as perceived by mothers were not fully verified by the data.

What influences mothers' perceptions and accounts of their expectations and experiences? There are a number of possible explanations. Firstly, mothers may have been aware of and influenced by the marketed claims of Baby Sign companies, including reduced frustration. As such, mothers may have anticipated such effects and sought confirmation of this expectation in manner of a self-fulfilling prophecy. Realistically, there is no way for a mother to determine that her infant experienced less frustration than if she had not of used Baby Sign. Therefore, mothers can only comment on instances where they felt Baby Sign served to reduce frustration. However, contrary to the assumption emphasised by Baby Sign companies, there is no evidence to suggest that infants actually experience frustration from not being able to communicate. Maternal perception of reduced stress as a result of gesturing is evaluated in Study Two.

Secondly, in the absence of any observed linguistic outcomes of Baby Sign, mothers may then focus on seeking non-linguistic benefits. Having invested time and effort into Baby Sign, the lack of an expected effect on their child's language would have resulted in cognitive dissonance, an uneasy feeling between two contradicting beliefs. Therefore, to resolve this discrepancy, mothers may have sought out other benefits to justify to themselves their investment and to avoid feelings of inadequacy. Furthermore, the close relationship between the researcher and the mothers was likely to influence mothers' account of their experience, resulting in response bias. Mothers may have been motivated to fulfil expectations that they perceived the researcher to hold regarding the effect of Baby Sign, and so offered positive accounts of their experience in line with what they felt the experimenter wanted to hear. Study Two presents an examination of the extent to which perceived wider non-linguistic benefits are in fact real benefits, by comparing quantitative data regarding the mother-infant relationship.

The qualitative analysis has shed interesting light on the issue of gesture iconicity, contributing to the picture emerging from the quantitative data. Two types of gesture were included as gesture interventions in the longitudinal study to determine whether the impact of gesture training varied as a function of the type of gesture infants were encouraged to use. One group was trained to use BSL gestures and another trained to use symbolic gestures. While BSL signs can be as arbitrary as words in language, symbolic gestures are highly iconic and represent a feature or function of the referent. A key question is whether the similarity between gestures and their referent facilitate the infants' mapping of the gesture to the target. The sensitivity of infants to iconicity in symbol learning appears to fluctuate throughout infancy. Infants aged 18 months will just as readily map iconic gestures to referents as they will arbitrary gestures, however at 26 months infants will only accept iconic gestures as labels. By the time that children are four years of age, they will just as readily accept iconic and arbitrary gestures as labels (Tomasello et al, 1999; Namy & Waxman, 1998; Namy, Campbell & Tomasello, 1994).

The qualitative analysis revealed that the adults themselves were sensitive to the degree of iconicity of the gestures and this contributed to how readily the mothers acquired, remembered and modelled the gestures. This is consistent with the trend reported in the previous chapter, that mothers modelled the symbolic gestures at a higher rate than the BSL gestures. Therefore suggesting that mothers apprehended the similarity between the symbol and its referent and showed a preference for gestures that represented in form or function the corresponding object or concept.

The greater the distance between the action and the referent, the greater the demand placed on memory, meaning that the less iconic gestures are more difficult for the mothers to remember. This is consistent with research that has found adults have a better memory for iconic over non-iconic signs (Beykirch et al, 1990; Liebert & Gamble, 1991).

While IPA has garnered valuable insights into the experiences of mothers, the interviews are context-specific as they were conducted by the researcher with whom the participants had developed a relationship with throughout the duration of the yearlong longitudinal study. As such, the participants may have been sympathetic to the perceived direction of the research. Furthermore, the participants themselves had invested their time and effort into the gesture-intervention and so the influence that this may have on their perception of the experience must be considered. However, this study has shed light on how mothers perceive the wider non-linguistic benefits of gesturing with infants, and future research would benefit from exploring the socio-emotional impacts that sharing a gestured system of communication has for both mother and baby. The next study examines the perceived socio-emotional effect of gesturing on mother-infant dyads more rigorously and quantitatively compares the stress scores of mothers who have gestured with their infants and those who have not.

Study Two: The Impact of Gesture Training on Parent and Infant Stress

3.3.1. Introduction

The qualitative investigation of mothers' experiences of using gestures with their infants suggests that as a by-product of enhanced gesture communication, mothers perceived other wider non-linguistic benefits. According to maternal accounts of their experience, actively communicating with their infants from a pre-verbal age using gestures gave them insight into their infants' needs and feelings, allowed them to respond contingently to their infants and alleviated frustration. Did this strong communicative relationship between mother and infant, as described by mothers, lead to perceived or actual social-emotional benefits for both mothers and their infants? There is a dearth of research available to address this question, however findings are emerging to suggest that gesturing may enhance the mother-infant relationship and reduce both maternal and infant frustration (Vallotton, unpublished thesis).

Gesturing mother-infant dyads have been reported to experience fewer episodes of distress for the child, demonstrate more appropriate maternal responses to childs' distress cues as well as a higher degree of affect attunement between mother and child (Vallotton, unpublished thesis). Vallotton suggests that by sharing a gestured form of communication, parents gain insight into their infants' needs, allowing parents to interpret and respond appropriately to infants' communicative efforts, overall encouraging a greater appreciation of the mental and relational capacities of the child.

These initial findings recommend this to be an area that warrants further exploration. The longitudinal study reported in this thesis makes possible an examination of the wider non-linguistic benefits of gesturing with infants. A sample of mother-infant dyads that participated in a controlled evaluation of gesturing provide the ideal cross-section to explore whether parental functioning is enhanced in gesturing mother-infant dyads.

The present study aimed to assess maternal anxiety, stress and infant behaviour and emotional adjustment, using the Parental Stress Index (PSI) (Abidin, 1995) to address whether gesturing with infants reduces the stress experienced by mother-infant dyads and improves maternal functioning. The PSI is a self-report questionnaire designed to measure parents' perception of their relationship with their child and identify parent-infant systems that are under stress. The PSI yields a total stress score, plus scale scores for both child and parent characteristics, which pinpoint sources of stress within the family. High scores in the child domain may be associated with children who display qualities that make it difficult for parents to fulfill their parenting roles. The child characteristics are measured in the following six subscales: Distractibility/Hyperactivity, Adaptability, Reinforces Parent, Demandingness, Mood, and Acceptability. High scores in the parent domain may suggest that the source of stress is related to the parents' functioning. The parent personality and situational variables component consists of seven subscales: Competence, Isolation, Attachment, Health, Role Restriction, Depression and Spouse. The PSI has been standardized for use with parents of children ranging from one-month to 12 years (Abidin, 1995).

Previous work by Vallotton (unpublished thesis) has used the PSI to examine how a gesture intervention impacts upon the stress experienced by mother-infant systems. The use of gesture was found to be related to lower stress regarding the subscales on the child domains of 'reinforces parent' and 'acceptability'. Vallotton interprets these findings to suggest that by using gestures, mothers have better insight into their child's behaviour and thus find it more acceptable.

In the present study, the total stress scores, child stress, parent stress and all subscales of the PSI will be compared between the gesturing mother-infant pairs (those who completed the study in the BSL or SG conditions) and the control mother-infant pairs (VT and NC). The sample was compared as two groups, as the rationale was that the experience of sharing a gestured system of communication (regardless of type of gesture) would be what impacts upon mother-infant pairs, and so the investigation aimed to compare the global impact of gesturing against not gesturing.

If the perceived benefits as described by mothers in their narrative accounts of their experience of gesturing are accurate, then gesturing mother-infant dyads would be expected to have lower total stress scores than the control mother-infant dyads. Furthermore, mothers who gesture with their babies would score lower on the parent domain than the control condition. If previous findings reported by Valloton are robust, then gesturing infants will score lower on the subscale 'reinforces parent'. This subscale represents the degree to which the parent-child interaction results in a positive affective response in the parent and is a component of the bonding process, developing as a function of both the signals the child emits and the parent's ability to understand the child's cues accurately (Abidin, 1995).

3.3.2. Method

3.3.2.1. Participants

Mothers who had completed the longitudinal study were asked to complete the PSI at the last assessment visit of the longitudinal study, when infants were 20 months of age. Participation was voluntary and as such, some parents did not complete the questionnaire. Compliance was 87.5% with 16 mothers from the gesture-trained groups (BSL and Symbolic Gesture combined) and 19 of the control group mothers (Verbal Training and Non-intervention control combined) returning the completed PSI.

3.3.2.2. Materials and Procedure

An information sheet explained to parents the purpose of the study, that their participation was voluntary and that their responses would be kept confidential. They were given the PSI item booklet and an answer sheet. The first page of the item booklet contained instructions for completing the questionnaire. The PSI consists of 120 items, including 19 life stress items (see Appendix G). Participants were asked to complete the questionnaire in their own time and to return to the researcher in a self-addressed envelope upon completion. Mothers were given information about parent services (e.g. Parentline) that they could contact if they felt they needed any support.

3.3.3.Results

The PSI scores were collated and compared for mothers in the gesture ($n = 16$) and control groups ($n = 19$). The life stress scores are reported first. These were compared to check that there was no significant differences between the life stress scores of mothers in the gesture and control groups that would affect the stress experienced in others domains. The Parent Domain and Child Domain subscales are then reported and analysed.

Life Stress

Initial analyses compared mean scores of life stress to determine that parents in the gesture and control group were equivalent. The mean life stress score of mothers in the gesture group was 8.25 ($SD = 7.23$), which lies at the 60th percentile of scores, within the normal range. The mean life stress score of mothers in the control group was 7.05 ($SD = 4.56$), lying at the 55th percentile, within the normal range of scores. Therefore, neither groups experienced a great amount of stress outside of the parent-child relationship. There was no significant difference between the life stress scores of mothers in the gesture and control groups [$t(33) = -.60$, $p = .56$].

Total Stress

The mean total stress score of the mothers in the gesture group was 197.50 ($SD = 23.06$) and the mean total stress score of mothers in the control group was 200.84 ($SD = 37.37$). Both scores lying between the 25th and 30th percentile (percentile scores appropriate to one year old infants), therefore at the low end of normal indicating that parents are functioning well. The difference between the total stress scores was not significant, $t(33) = .31$, $p = .76$.

Child Domain

The mean child domain stress score for mothers in the gesture group was 90.06 (SD = 15.19), which lies at the low end of the normal range of score, between the 30th and 35th percentile. The mean child domain stress score of mothers in the control group was 86.32 (SD = 16.78), lying at the 25th percentile. These low scores indicate that the children are not judged by their parents to display qualities that create difficulty for the parents to fulfil their roles. This difference between the scores was not significant, $t(33) = -.69$, $p = .50$.

Next, mean scores on the child domain sub scores were then compared (means are reported in the table below). All of the mean scores of the subscales fall within the normal range of scores, between the 15th and 85th percentile. Independent t-tests indicated that there were no significant differences between the gesture and the control group on the subscale mean scores (p-values are presented in Table 3.2).

Table 3.18. Mean scores (SD) on child domain subscales

	Gesture Group n = 16	Control Group n = 19	p-value
Distractibility/Hyperactivity	22.13 (3.38)	21.89 (4.79)	.87
Adaptability	25.06 (7.14)	23.26 (5.45)	.40
Reinforces Parent	8.50 (1.93)	8.05 (2.07)	.52
Demandingness	16.06 (4.52)	14.95 (3.46)	.42
Mood	8.56 (2.71)	8.53 (2.22)	.97
Acceptability	9.75 (2.44)	9.63 (2.67)	.89

Parent Domain

The mean total stress score for the parent domain was 107.44 (SD = 14.75) for the gesture group, a score that lies between the 25th and 30th percentile of scores for parents of one-year olds. The mean score of the control group was 114.53 (SD =

22.26), a score lying at the 40th percentile. This difference between mean scores was not significant, $t(33) = 1.09$, $p = .29$. Mean scores on the parent domain subscales were then compared. Means, standard deviations and p-values are presented in the table below. All of the mean scores lay within the normal range of scores, between the 15th and 85th percentile.

Table 3.19. Mean scores (SD) on parent domain subscales

	Gesture group n = 16	Control group n = 19	p-value
Competence	22.63 (5.37)	24.37 (6.18)	.38
Isolation	9.56 (2.22)	11.74 (3.60)	.04*
Attachment	11.13 (2.16)	10.84 (2.32)	.71
Health	11.50 (1.90)	13.37 (3.73)	.08
Role restriction	18.00 (3.93)	18.74 (5.60)	.66
Depression	17.69 (4.42)	18.47 (4.43)	.60
Spouse	16.94 (4.04)	16.84 (4.91)	.95

*significant at $p < .05$

There was a significant difference between mothers who were in the gesture group and mothers in the control group on the subscale 'Isolation'. The mean isolation score of mothers in the gesture group was significantly lower than mothers in the control group. The mean score of the mothers in the gesture group lies at the 15th percentile, at the very low end of the normal range, and the mean score of the mothers in the control group is at the 35th percentile. There were no other significant differences between mothers in the gesture and control groups on parent domain subscales.

3.3.4. Discussion

This study evaluated the perceived reduction in frustration that mothers reported in Study One. However, a comparison of PSI scores indicated that mothers in the gesture group did not score significantly lower than mothers in the control group. Does this mean that mothers' perceived impact on frustration is exaggerated or inaccurate? As indicated in the interviews, mothers were aware of the promoted claim that Baby Sign reduces frustration, therefore they may have anticipated this effect and so interpreted their experience accordingly to be consistent with this expectation. Alternatively, the impact of gesturing on stress may not be strong enough to be detected in a small sample of mother-infant dyads.

Mothers in the gesture group did score significantly lower on the parent domain subscale 'Isolation' than mothers in the control group. This subscale refers to the stress associated with feeling socially isolated from peers, relatives, and other emotional support systems (Abidin, 1995). The mean isolation scores of mothers in the control group, though higher than that of mothers in the gesture group, is very low, laying at the 35th percentile, and so does not indicate a problem in this area. Therefore, this difference is not interpreted to indicate that gesture improves this domain of parental stress.

The results are not consistent with those reported by Valloton, as no association was found between gesture training and the subscales 'reinforces parent' or 'acceptability'. However, differences between the samples may account for this discrepancy. The parents in the Valloton sample (n = 29) were from low-income families, whereas the participants in this study were all high SES. The relationship between stress and SES means that lower-SES parents are more likely to experience higher stress in their roles as parents (e.g. Jackson et al. 2000) therefore they stand to benefit more from a gesture intervention in terms of stress reduction. In contrast, the parents in this study scored at the low end of normal on the PSI indicating that they experienced very little stress. As such, the impact of an intervention is less likely to be apparent in a high-SES sample. Furthermore, there was a high amount of variability in the ages of the infants in the Valloton study, with infants' ages ranging from 10 to 34 months at the start of gesture training. Stress levels and type of stress experienced is likely to vary with infant age. A further possibility is that there is an optimum age at which gesturing is most effective in reducing frustration and promoting better relationships between mother and infant. Finally, the length of intervention was much longer in the present study, whereas the Valloton gesture training lasted for seven months. The present study administered the PSI at the end of a yearlong gesture intervention. By this point, the rate of gesturing by mother-infant pairs had reduced as infants' verbal skills were gaining in proficiency. Therefore, any impact of gesture intervention on stress may have been most apparent at the height of gesture production when being able to communicate manually potentially served its optimum purpose.

3.4. General Discussion

The overall aim of this chapter was to explore and assess the wider linguistic and non-linguistic impacts of gesture training for mothers and infants. In Study One mothers were interviewed who had completed the longitudinal study in the gesture training conditions to explore their perception of the impacts that sharing a gestured system of communication had for them and their infants. The main themes that emerged from the interviews included mothers' awareness and preconceptions of gesturing with infants and mothers' experience of gesturing, which comprised both linguistic and non-linguistic outcomes. Factors were highlighted which affected the rate at which mothers modelled the gestures and these included the level of support they had from their partners in using the gestures, having more than one child, the form and function of the gesture and the age of the child.

Mothers described how their infants were able to communicate with them before the onset of speech, and this, they felt, improved their infant's verbal development. Furthermore, according to the mothers, gesturing allowed clearer and more effective communication between them and their baby, which they felt resulted in wider socio-emotional benefits, such as reduced frustration and greater insight into their babies' thoughts and needs. Infants were perceived by their mothers to experience less frustration by being able to communicate their wants and because they were readily understood by their mother and could have their needs met efficiently.

To empirically test the perception that gesturing reduced frustration, Study Two compared the stress experienced by mothers using the PSI. Overall, both groups of mothers scored very low on all domains, indicating low levels of stress within the sample. No significant differences were found between mother-infant dyads who had been gesture trained and those who had not on total stress or on stress scores on the parent domain or child domain. There was a significant difference on the subscale 'isolation' with mothers in the gesture group scoring significantly lower than mothers in the control group, however both groups had very low mean scores on this subscale therefore neither groups experienced stress in this area. As such, gesture training is not assumed to reduce stress in this domain.

The qualitative investigation highlighted how the experience of sharing a gestured system of communication appears to alter the mothers' perception of their child and this is suggested to be likely to encourage maternal mind-mindedness (Meins, 1998). Because the child is communicating in a way that is readily understood, interpreted by and responded to by mothers from a young age, mothers view their young infant as an individual with her own mind. Mind-mindedness is related to attachment security (Meins, 1998; Meins et al 2001) and Theory of Mind (Meins, et al. 2002). Therefore, if gesture training does indeed enhance maternal mind-mindedness then the benefits are likely to extend beyond infancy and have much longer lasting effects. An evaluation of the impact of gesture training on maternal mind-mindedness was beyond the scope of this PhD but this is an area that would benefit from further investigation. While the linguistic effects of gesture training are equivocal, the real worth of encouraging mothers to communicate using gestures with their pre-verbal infants may lay in the wider socio-emotional domain. This would be particularly beneficial for at-risk mothers, such as those suffering from post-natal depression. Gesture training could offer a simple way to encourage effective behaviours that may promote changes in maternal attitude and behaviour towards their infants.

This study has failed to find support for the widely promoted claim by Baby Sign companies that enhanced gesturing with infants reduces parent and infant stress. While the perceived reduction in frustration as described by mothers in the qualitative study is consistent with anecdotal reports by Baby Sign companies, the absence of a significant effect of gesture training on stress indicates that this is not a robust effect and may depend on many factors.

This chapter has highlighted the worth of applying qualitative methods to provide an enriched investigation. While quantitative data is undeniably valuable, it is limited as it is restricted to measure precise variables and cannot capture the richness of an individual's experience. Applying qualitative methods allows an exploration beyond the data to elicit a deeper understanding of the mechanisms at work. This has allowed valuable information regarding mothers' experiences and views to be explored, thus enriching the quantitative data and opening up new areas of worthwhile investigation. However, this is not without drawbacks, as while maternal accounts are rich and insightful they are influenced by a number of psychological factors that can distort a mother's perception and presentation of their views. Therefore, by utilising a combination of quantitative and qualitative methods, objective and subjective measures are synthesised to provide a thorough evaluation of gesturing with infants.

To bring this chapter to a conclusion, let's revisit the question we started with: does encouraging mothers to gesture with their infants have any wider non-linguistic benefits? Mothers did perceive gesturing to bring about socio-emotional benefits; however, the extent to which these are actual benefits is questionable given that mothers' accounts are vulnerable to a number of psychological factors. One perceived benefit described by mothers, reduced frustration, receives considerable promotion from Baby Sign companies. Yet this was not validated by the findings of Study Two, there was no difference in the stress scores of mother-infant dyads who had and had not taken part in a gesture intervention.

However, any effect of gesture training depends on there being some room for improvement. The PSI data from mothers in the control group who had not gestured with their infants indicated that within this sample there was little room for improvement – all of the mums experienced very little stress in the their role as parent. This means that within this sample of mothers, affluent and highly educated, it is unlikely that gesture training can make a significant impact. Whereas, other mothers may stand to benefit from an enhanced communication system, and for these mothers a gesture-training intervention could bring about discernable improvements. The quality and quantity of maternal interaction is demonstrated to be lower in low-SES families (e.g. Hoff, 2003). Furthermore, the stress experienced by low-SES mothers and their infants is higher (Lupien et al 2000), thus identifying low-SES mother-infant dyads as those most likely to benefit from gesture training. Ideally, psychological factors would also be removed that influence a mother's perception, including knowledge of the advertised claims of Baby Sign and personal investment into a study or course. So, the answer to the question is as that encouraging mothers to gesture did not have any *actual* wider non-linguistic benefits. However, it is proposed that mothers whose socio-emotional relationship with their infant could be improved via enhanced communication, is likely to be improved by gesturing.

Chapter 4. An Evaluation of a Community Based Gesture Training Intervention Aimed at Improving the Communication between Low-SES Mothers and Infants

4.1 Introduction

Infants are born in possession of an impressive repertoire of expressions to engage their caregiver in interaction. They can initiate and maintain eye contact with another person, vocalise, use facial expressions and body and head movements to elicit care and transmit emotions of interest and pleasure (Trevarthen & Aitkin, 2001).

Early on, infants can act intentionally and take account of others' intentions and mental states, thus demonstrating intersubjective communication (Trevarthen, 1969). This is achieved without words and can be observed mere seconds after infants enter the world. Newborns can imitate simple expressions of face, hands and voice and they anticipate a response from the person they are attending to (Nagy & Molnar, 2003). Mothers are willing communicative partners for these "protoconversations" (Bateson, 1971, 1975; Trevarthen, 1979) imitating the vocalizations of their infants immediately after birth and throughout the first six months of life (Papousek & Papousek, 1977; Trevarthen, 1977).

This reciprocal exchange nurtures infants' development and the way a mother interacts with her infant has been described as the 'cradle of thought' (Hobson, 2002). When normal social interaction does not occur, infants' reaction is to cease to actively engage in the interaction. If during face-to-face play with her infant, a mother holds her face still for a minute, infants will first look towards their mothers and try to elicit a reaction through vocalisation and body movement. Failure of these efforts to evoke a reaction in their mothers causes the infant to turn away and show distress (Cohn & Tronick, 1983; Tronick et al., 1978; Murray and Trevarthen, 1985).

In the long-term, disruption in mother-infant interaction can cause sustained infant withdrawal, characterised by diminished positive behaviours (e.g. lack of eye contact, smiling and cooing) and diminished negative behaviours (e.g. crying) (Guedeney, 1997). Because depressed mothers interact less with their infants, withdrawal behaviour is especially prevalent in these infants (e.g. Field, 1984; Field, 1992; Tronick, 1989).

The quality of early mother-infant interaction has long-term implications for the development of a secure bond between mother and baby. The mother-infant attachment relationship is a cumulative product of infants' experience in interaction with their mother during their first year of life (Ainsworth et al, 1979; Bowlby, 1969). Infants are more likely to be securely attached if they have mothers who are responsive to their signals (e.g. Ainsworth et al 1978; Isabella & Belsky, 1991) and are contingent in their responses (Smith & Pederson, 1988).

A secure mother-infant attachment in childhood has long-term effects for children. Infants who are securely attached as infants are more self-reliant and have better self esteem as toddlers. Furthermore these infants have been demonstrated to have superior cognitive development in later childhood (Bus & van Ijzendoorn, 1988; Stams, Juffer & van Ijzendoorn, 2002). Secure attachments in childhood result in better relationships through life (e.g. Grossman & Grossman, 1991) and individuals who were securely attached in infancy even have better relationships with their own children when they become parents (Quinton & Rutter, 1988). These long-term benefits are the product of a healthy mother-infant relationship and this develops from good maternal interaction.

Therefore, early mother-infant interaction is important for infants' social and cognitive development. Children's linguistic development also varies as a function of the interaction they experience during infancy. Differences in how mothers interact with their infants accounts for the strong relationship between SES and infant language development.

Lower-SES parents talk less and use fewer different words with their children (Hoff, 2003; Hoff-Ginsberg, 1998; Hart & Risley, 1995, 1999). Non-verbal interaction also varies as a function of SES. Higher-SES mothers use more gesture types with their infants and these infants subsequently gesture more. In turn, children's subsequent vocabulary is predicted by the number of gestures that they produced as infants. Therefore the effect of SES on child vocabulary is mediated by infant gesture use, which is directly related to maternal gesture use (Rowe & Goldin-Meadow, 2009). Similarly, Pan et al (2005) demonstrated maternal pointing to accelerate child vocabulary production. These findings demonstrate how differences in interaction have considerable consequences for infants' language development. Indeed, infants from lower-SES backgrounds are more likely to be diagnosed as having a language delay (Locke, Ginsborg & Peers, 2002).

Gesture has been identified to be an important feature of early language development. The gestures that infants are exposed to have been suggested to support language development by scaffolding infants' comprehension (Morford & Goldin-Meadow, 1992; Zukow-Goldring, 1996). The more gestures that infants are exposed to, the more gestures they produce (Rowe & Goldin-Meadow, 2009). Infants' production of gestures establish joint attention (Moore et al. 2001), elicit verbal labelling from caregivers (Goldin-Meadow et al. 2007) and benefit word learning (Rowe et al. 2008). It is unsurprising therefore, that the diminished gesture exposure of low-SES infants is related to their weaker language development in comparison to their higher-SES peers. Gesture may offer a means by which interaction in low-SES mother-infant dyads can be enhanced. Indeed, Rowe and Goldin-Meadow (2009) called for future research to explore the potential of encouraging lower-SES parents and children to gesture. This is precisely what this study addresses.

The findings of this thesis thus far suggest that infants who stand to benefit most from encouraged gesture are those with weaker language skills. The longitudinal study identified that, within a sample of high-SES mother-infant dyads, baby boys, who had a low baseline expressive communication language ability were particularly advantaged by gesture. Therefore indicating that gesture may be particular beneficial for infants likely to have low expressive language abilities. Extensive research indicates SES as one of the strongest predictors of an infant's language development (e.g. Hoff, 2003). For infants at risk of communicative delay, gesture takes on greater significance in the potential it has to enhance the child's language learning environment.

The principle objective of the present study was to encourage parents from low-SES backgrounds to enrich their communication with their infants using gestures, and to evaluate the impact this had on infants' verbal language development. No research to date has examined how nonverbal communication strategies can enhance the language development of infants from low-income families. This is particularly important given that infants from low-income families enter the school system at a disadvantage compared to their high-income peers (Locke, Ginsborg & Peers, 2002). According to the Royal College of Speech and Language Therapy "Communication difficulties have a large impact on the formation of relationships and can often lead to behavioural problems. These preventable and treatable difficulties have determining role on an individual's life course, with a significant impact on education attainment, employability, mental health and offending behaviour" (Memorandum submitted by the Royal College of Speech and Language Therapists to the UK Government Select Committee on Education and Skills, 2007).

Further to the high social importance of this research, this study addresses an important gap in the literature. The majority of the parents in the limited studies conducted to date examining the impact of teaching pre-verbal infants to communicate manually have been middle class, highly educated and heavily invested in the study (e.g. Goodwyn et al. 2000). The longitudinal study presented in this thesis, while offering a rigorous scientific evaluation of encouraged gesture, was also conducted with high-SES families highly motivated to take part in the investigation. Outside of the laboratory, many of the positive claims of the benefits of baby signing come from parents who have purchased a commercially available programme (e.g., http://www.babysigns.com). This poses an important research question. Is the impact of gesture training as effective when parents have not made a financial investment, are not highly motivated and the family background poorer? This project will make an important contribution to the literature by elucidating the extent to which beneficial outcomes are determined by parental motivation and socio-economic status.

The present study evaluates the effectiveness of a gesture training intervention delivered in the setting of a Sure Start children's centre[10]. Sure Start is a government programme that aims to achieve better outcomes for children, parents and communities. One key Sure Start objective is to improve parent-child interactions in low-income families and those in poor quality housing, known to be at risk of slow communication development. Sure Start children's centres provide the frontline delivery of integrated services for children 0-4 years and their families. They reach out to children and families most in need including teenage parents, lone parents, families living in poverty, workless households, parents with disabled children, disabled parents, and families from minority ethnic communities (http://www.hertsdirect.org/childrenstrust).

In Hertfordshire, midwives and health visitors signpost vulnerable families to children's centres where support is available from a range of professionals,

[10] This project was a collaboration between the University of Hertfordshire's School of Psychology, the Hertfordshire County Council's Sure Start Early Years team and the East and North Hertfordshire Primary care trust (PCT) Speech and Language Therapy and Health Visitor Service.

including Speech and Language Therapists and Health Visitors. This study integrated gesture training into communication sessions for families attending the Greenfields children's centre in Waltham Cross.

The centre holds a number of regular sessions for mothers to attend with their infants or children. The decision was made that the best way to deliver gesture training would be to incorporate it into a communication session, to fit in with what was already in-place at the children's centre. Given the target age of infants in the communication sessions (6 to 10 months) the most appropriate group was Baby Lounge, a weekly group for mothers to attend with their infants under one year of age. Baby lounge is an informal session, held from 9.30 a.m. to 11.30 a.m., in which mothers have access to a purposefully designed room where they can sit and play with their infants in the company of other mothers. Each session is attended by a Speech and Language Therapist and a Health Visitor who are on hand to answer any questions that mothers may have and to offer them relevant information and advice. The communication sessions ('Communicating with your Baby') were held at the end of the Baby Lounge session at 11.30am to make attendance as convenient as possible for mothers.

To enable gesture training to be evaluated two types of sessions were developed, one that focused on general communication and another that included some gesture training. From here on in, these groups will be referred to as the 'General Communication Group' and the 'Gesture Group'. All mothers were expected to benefit from the sessions, as all would be supported in enriching their communication with their infant. It was important that all of the sessions focused on encouraging effective mother-infant interaction and that the use of gesturing was placed in context. Therefore, the gesture sessions did not solely focus of gesture training, but on encouraging all-round better communication with the inclusion of a discussion of how a small number of key-word gestures could be used to augment communication.

The sessions were designed to be informal and enjoyable. The aim of each session was to initiate a dynamic exchange between the Speech and Language Therapist and researcher leading the sessions and the mothers. Dialogue was encouraged between the mothers around the topics and materials introduced. In this manner, it was hoped that the sessions would inform mothers without necessarily instructing them. The type of gesture that parents were taught was Makaton. Makaton is a system of communication that uses a vocabulary of gestures to support speech. These gestures are based on BSL. This system of gestures was chosen as the most appropriate to use in this context given that Makaton was used by the health care specialists and teachers at the children's centre with children who have language or developmental delay. Makaton is widely used by and with people who have communication, language or learning difficulties. It can be used to help the development of speech and language in children, or by adults as a means of functional communication for every day use. Makaton has been used widely with infants with Down's Syndrome and has been found to support language development (E.g. Abrahamsen, Lamb, Brown-Williams and McCarthy, 1991). The success of Makaton gesture training with this population of infants suggests that encouraging early Makaton use may be of benefit to other children at risk of language delay.

By enhancing the early communication between mother and infant with gestures it was hoped that the discrepancy between high and low-income families in terms of children's language development could be reduced giving all infants a positive start to become successful communicators. It was predicted that by encouraging mothers to use Makaton gestures with their infants that these infants would demonstrate greater advances in their language abilities than infants of parents who had not. The effect of gesture training was explored both quantitatively and a qualitatively. Infants' language and communication abilities were assessed and compared. A sample of mothers who attended the gesture training sessions were interviewed to obtain more in-depth and meaningful information about maternal experiences and understanding of using the gestures. The quantitative and qualitative findings are reported and discussed concurrently at the end of this chapter in relation to the literature and the implications are considered.

4.2. Method

4.2.1. Participants

There were twenty-five participant pairs (mother and child) in the study[11], including eighteen baby boys and seven baby girls. The mean age of the infants at the beginning of the study was 224 days (SD = 43). The youngest baby was aged 154 days (approximately 5 months) and the oldest 325 days (approximately 10 months).

The number of hours spent at work was compared for mothers in the general communication and Gesture Group. The majority of the mothers in both groups did not work at all, with only three mothers working in each group. The mean number of hours worked per week by the mothers in the General Communication Group was 7.58 (SD = 14.00) and mothers in the Gesture Group worked a mean of 5.59 (SD = 11.26) hours per week. This difference was not significant ($t(20.7)=0.38$, $p=0.71$). Infants spent very little time in childcare (means reported in table below). Comparisons were not conducted as both groups spent a negligible amount of time in childcare.

Table 4.20. Mean maternal hours at work and hours in childcare for infants across conditions

	Gesture		General Communication	
	M	*SD*	M	*SD*
Hours per week infant in childcare	.23	*.75*	0	*0*
Hours per week mother at work	5.59	*11.26*	7.58	*13.99*

[11] Mother-infant pairs were not included in the study if mother's first language was not English, although the mothers were free to attend the sessions, data was not collected from them.

The level of education was compared for mothers in the General Communication and Gesture Groups. Maternal education is a significant predictor of children's language development (Arriaga et al. 1998; Hoff, 2003; Scarborough & Debrion, 1994). The percentage of mothers that had attainted each level of education is presented in the table below. Mothers were deemed equivalent in terms of their education level, with the majority of mothers being educated to GCSE level.

Table 4.21. Maternal level of education

	Gesture	General Communication
Below GCSE	0%	8%
GCSE or equivalent	73%	75%
A-Level	27%	17%
Degree level	0%	0%

This sample of mothers had a distinctively lower education level than the mothers in the longitudinal study (Chapter Two). All except one of the mothers in the longitudinal study were educated to at least degree level.

A similar number of mothers in the Gesture and General Communication group had more than one child. Seven mothers in the Gesture Group had older children and six mothers in the General Communication Group had elder children. The number of children that mothers had ranged from one to four in both the Gesture and General Communication groups.

4.2.2. Procedure

Recruitment

One month prior to each Communicating with your Baby course, mothers with infants aged between five to nine months that attended the Baby Lounge session at Greenfield children's centre were invited to attend the Communicating with your Baby sessions. Midwives and Health Visitors informed families in the community with infants of the target age of the Communicating with your Baby course. Mothers had the opportunity to discuss what the course and the research involved with the researcher. Ineligibility criteria for participation in the research included infants who were born prematurely or who had problems at birth and infants from families whose first language was not English. It was a prerequisite that parents and infants were hearing. All mother-infant dyads were free to attend the sessions regardless of whether they met the criteria to be included in the research or not.

The Sessions

The Communicating with your Baby sessions were delivered by a Speech and Language Therapist who was familiar to the families that attended the children's centre. Participants attended one of two types of Communicating with your Baby course, either 'general communication' or 'general communication + gesture'. These groups are described as the General Communication Group and the Gesture Group. In both groups mothers were taught a variety of ways in which mother-infant communication can be enhanced, including the importance of sharing attention, turn-taking, and making the most out of songs and rhymes. Each of the sessions focused on three target words and the songs and activities in the session all centred on these. In the Gesture Group the same course material was covered with an additional emphasis on how gestures can be incorporated into communication. Each week mothers were taught gestures for the three target words of that session. In total mothers were taught twelve gestures for simple everyday objects and requests and were shown how best to use these gestures to enrich their everyday communication with their infant. These were Drink, Food, Sleep/Bed. More, Mummy, All-gone/Finished, Bath, Ball, Teddy, Book, Car, and Duck. One Communicating with your Baby course was delivered each term over a two-year period (from November 2007 – January 2009) resulting in a total of six courses. Each course included four half hour sessions, taking place weekly. (Refer to Appendix H for a summary of the sessions).

Assessment

The following language measures were used:

- Communication Checklist
  This was developed to help evaluate the baby communications course. The checklist listed a number of communicative behaviours and routines that parents may do with their infant, such as reading books together and copying infant vocalisations. Parents were asked to rate on a 5-point Likert scale the frequency with which they performed that behaviour with that infant (see Appendix I).

- Oxford Communicative Development Inventory (CDI)[12]
- Gestures, Actions and Pretend Play checklist (GAPP)
- Preschool Language Scale-3 UK Edition (PLS-3UK) [13]

[12] For a description of these measures refer to the Method section of Chapter Two. A sample of these measures can be found in Appendices D – F)
[13] Due to a high attrition rate of mother-infant pairs in the Gesture Group, PLS data is missing for the Gesture Group. Therefore, analyses are not conducted on PLS data

Table 4.22. Schedule for administration of assessment measures

Test point	Time	Measures
Pre- test	One to two weeks preceding the CWYB group	PLS, CDI, GAPP, Communication questionnaire
Post- test	One to two weeks following the CWYB group	CDI, GAPP, Communication questionnaire,
Follow-up	Three months after the end of the CWYB group	PLS, CDI, GAPP, Communication questionnaire,

4.3. Results

Quantitative and qualitative data are presented here. The first half of the results section presents an analysis of the language assessment data and the second half presents a thematic analysis of interviews conducted with a sample of the mothers who attended the gesture sessions.

4.3.1. A Quantitative Evaluation of the Impact of Encouraging Gesture on Infant Language and Maternal Communication

Infants' language scores at pre-test were inspected to determine whether this sample of infants displayed a disadvantage compared to the higher-SES infants from the longitudinal study. Infants in the longitudinal study were first assessed at eight months, while infants in the present study were aged between five and nine months at pre-test. Therefore, the language scores of only those infants aged 8 months (+/- 2 weeks) were compared against the language scores of infants in the longitudinal study. These are presented in the table below.

Table 4.23. Baseline language scores of infants in the children's centre study and the longitudinal study for infants aged 8 months.

	Children's Centre Sample (n = 11)		Longitudinal Sample (n = 37)	
	Mean (SD)	Range	Mean (SD)	Range
Receptive Vocabulary	5.27 (4.90)	0 – 13	17.32 (36.80)	0-220
Productive Vocabulary	.00 (0.00)	0	.32 (1.03)	0 - 5
GAPP	3.73 (3.38)	0 – 10	7.43 (4.75)	0 - 18
Auditory Comprehension	6.73 (1.01)	5 – 8	5.86 (1.03)	4 - 8
Expressive Communication	6.64 (0.92)	5 – 8	6.22 (1.13)	4 - 8

Infants in the children's centre sample scored below the longitudinal sample on measures of vocabulary and gesture production. However, these measures are based on maternal report, therefore these scores may indicate a difference in perception of language ability. The infants did not differ on their language ability scores, as assessed by the researcher using the PLS 3 UK, which may further suggest that these infants were not objectively different but that the difference is subjective. However, at this age, the range of abilities assessed using the PLS is limited. For instance, in terms of expressive communication, a score of four indicates that infants engage in solitary vocal play (e.g. cooing and babbling) and a score of eight indicates that infants produce at least four different consonant-like sounds. Infants would only be scored nine if they had a vocabulary of at least one word, a significant verbal milestone. Therefore the difference between a score of eight and nine on the PLS is substantial, compared say to the difference between a score of five and six. This means it would be difficult for this measure to detect great differences in language ability at this young age. Based on the vocabulary and GAPP scores then, the children's centre infants are assumed to have lower language abilities than the higher-SES infants in the longitudinal study.

Communication

The Communication Checklist listed a number of communicative behaviours and routines mothers engage in with their infant, and mothers were asked to indicate how frequently they performed these behaviours on a five point Likert scale. The ratings were such that: 'rarely or never' = 1; 'every couple of days' =2; 'at least once a day' =3; and 'a few times a day' = 4. The aspects of communication assessed in the questionnaire were types of interaction generally accepted to contribute positively to language development, such as singing songs and rhymes to the baby, telling the baby the names of things, and repeating oneself when talking to the baby. The Likert ratings given were added up for the twelve questions, yielding a score of up to 48 for each mother. The mean communication scores are presented in the table below. Due to attrition, there was no follow-up data for infants in the Gesture Group, therefore no follow-up data is reported.

Table 4.24. Mean communication score at pre-test, post-test and follow-up

	Pre-test		Post-test	
	General communication (n = 13)	Gesture (n = 11)	General communication (n = 11)	Gesture (n = 4)
Communication score	38.23 (6.35)	36.82 (5.51)	41.64 (4.32)	39.67 (6.03)

Gain in communication score was calculated by subtracting infants' mean score at pre-test from their score at post-test. The mean gain score for infants in the General Communication Group was 4.18 (SD = 7.10) and the mean gain score for infants in the Gesture Group was 1.75 (SD = 3.86). A Mann-Whitney U test found no significant difference between the gain in communication score between infants in the General Communication and Gesture Groups, $z = -.33$, $p = .74$. The mean rank of infants in the General Communication group was 8.23 and the mean rank of infants in the Gesture Group was 7.38.

For many of the items in the questionnaire the majority of mothers in both groups were scoring 4 both before and after the intervention, so for most of the questions there was little change overall. When broken down and examined more closely, there were differences between mothers in the General Communication group and mothers in the Gesture Groups for certain items in the questionnaire, and the analysis of these differences provides more meaningful information than the comparison of overall means.

In particular, for question 6 "I use actions as well as words when I talk to my baby" there was an increase in score by mothers in Gesture Group (from a median of 3 to

3.5) but no change by mothers in the General Communication Group. For question 8, "I make up games to play with my baby" there was also an increase by mothers in the Gesture Group (from a median score of 2 to 3) but not by mothers in the General Communication Group. However, for question 10 "we dance to music together" there was an increase in score by mothers in the General Communication Group (from a median of 2 to 3) and a decrease by mothers in the Gesture Group (from a median 3 to 2). It is possible that this decrease is due to mothers in the Gesture Group replacing this activity with others, such as making up games and using actions or gestures with their babies.

Due to attrition the sample sizes were unequal, with only data from four infants in the Gesture Group at post-test. Therefore, these four infants were matched with infants from the General Communication group by age at pre-test (in days) and gender. Infants' communication score at pre-test, post-test, and the gains made by individual infants are presented in the table below.

Table 4.25. Communication scores of matched infants

	Participant ID	Gender	Age (days) at pre-test	Communication Score		
				Pre-test	Post-test	Gain
Gesture	16	Female	233	30	34	+4
	19	Male	239	43	46	+3
	20	Male	248	43	39	-4
	23	Male	172	38	42	+4
	Gesture Total			**154**	**161**	**+7**
General Communication	6	Female	235	40	39	-1
	3	Male	179	41	47	+6
	11	Male	246	33	37	+4
	7	Male	234	36	37	+1
	General Communication Total			**150**	**160**	**+10**

The matched participant scores above indicate the similarity between infants in the gesture and General Communication Groups. The mean gain in communication scores by the matched general communication infants was 2.50 (SD = 3.11) and the mean gain of infants in the Gesture Group was 1.75 (SD = 3.86). A Mann-Whitney U test found no significant difference between infants in the gesture and General Communication Groups on their gain in communication score, $z = -.20$, $p = .77$. The mean rank of infants in the General Communication Group was 4.75 and the mean rank of infants in the Gesture Group was 4.25.

Vocabulary

Infants' productive and receptive vocabulary scores are compared for infants in the general communication and Gesture Groups to evaluate whether the addition of Makaton to the Communicating with your Baby sessions impacted on infant vocabulary development[14]. The table below contains the means and standard deviations of infant receptive and productive vocabulary scores.

Table 4.26. Mean vocabulary scores by group and time of assessment

	Pre-test		Post-test	
	General Communication (n = 13)	Gesture (n = 11)	General Communication (n = 11)	Gesture (n = 4)
Receptive Vocabulary	2.08 (3.38)	5.45 (3.91)	11.55 (10.32)	23.25 (10.28)
Productive Vocabulary	0.54 (1.94)	0.00 (0.00)	0.18 (0.41)	1.75 (2.36)

Infants' gain in receptive vocabulary from pre- to post-test was assessed. The increase in infants' receptive vocabulary from pre- to post-test was higher for

[14] The follow-up scores are not included in the analysis due to a high rate of participant attrition in the Gesture Group.

infants in the Gesture Group (M=16.25, SD = 7.97) than infants in the General Communication Group (M = 9.73, SD = 8.06). A Mann-Whitney U test found no significant difference, z = -1.57, p = .12. The mean rank of the general communication infants was 6.91 and the mean rank of the gesture infants was 11.00.

As anticipated for infants of this age, mean vocabulary production scores are low for both groups at the pre-test and post-test stages, and the changes in score are minimal. However, the mean increase in productive vocabulary by infants in the Gesture Group (M = 1.75, SD = 2.36) was higher than the mean increase by infants in the General Communication Group (M = .18, SD = .40). A Mann-Whitney U test was conducted to test the difference in the mean rank of infants in the gesture and General Communication Groups. The mean rank of infants in the General Communication Group was 7.17 and the mean rank of infants in the Gesture Group was 10.25, however the Mann-Whitney U test was not significant, z = -1.51, p = .13.

Comparisons were then conducted on the matched data. The total vocabulary (additive measure of receptive and productive vocabularies) of the matched infants (matched on gender and age at pre-test) at pre- and post-test is presented in the table below.

Table 4.27. Total vocabulary scores of matched infants

	Participant ID	Gender	Age (days) at pre-test	Vocabulary score Pre-test	Post-test	Gain
Gesture	16	Female	233	2	13	+11
	19	Male	239	4	29	+25
	20	Male	248	9	19	+10
	23	Male	172	13	39	+26
	Gesture Total			**28**	**100**	**+72**
General Communication	6	Female	235	5	28	+23
	3	Male	179	0	7	+7
	11	Male	246	11	30	+19
	7	Male	234	0	2	+2
	General Communication Total			**16**	**67**	**+51**

Infants' gain in vocabulary was calculated by subtracting their total vocabulary at pre-test from their total vocabulary at post-test. Again, the Gesture Group demonstrated a higher gain in vocabulary. The average rank of infants in the General Communication Group was 3.50 and the average rank of infants in the Gesture Group was 5.50. However, a Mann-Whitney U test indicated that this difference was not significant, $z = -1.16$, $p = .25$.

How does this gain in vocabulary compare to the vocabulary scores of the higher-SES infants in the longitudinal study? The infants in the children's centre sample had, on average, a lower receptive and productive vocabulary score than infants in the longitudinal sample at eight months. Did the increase in vocabulary by gesture-trained infants in the children's centre sample bring the scores up to match that of the higher-SES infants or did these infants now outperform the higher-SES infants?

The mean vocabulary scores of infants in the children's centre sample, who had attended gesture training was compared with the mean vocabulary scores of infants in the longitudinal study at baseline when they were aged eight months. At post-test the mean age of infants in the children's centre Gesture Group was 261.75 (SD =

39.64) days (approximately 8 months) and so were an equivalent age to the longitudinal sample at their 8 months assessment. The scores are summarised in the table below.

Table 4.28. Comparison of vocabulary scores of infants in the children's centre Gesture Group and all infants in the longitudinal study at baseline

	Children's Centre Gesture Sample at Post-Test (n = 4)		Longitudinal Sample at Pre-Test (n = 37)	
	Mean (SD)	Range	Mean (SD)	Range
Receptive Vocabulary	23.25 (10.28)	11 - 34	17.32 (36.80)	0 - 220
Productive Vocabulary	1.75 (2.36)	0 - 5	.32 (1.03)	0 - 5

The advantage afforded by gesture training for the children's centre infants may have increased their vocabulary scores compared to children's centre infants who were not gesture trained, however when compared against the baseline scores of the higher-SES infants in the longitudinal sample no great gain is evident. Gesture training therefore diminished the discrepancy between low and high-SES infants.

Gesture Development

Would teaching mothers to communicate using gesture impact upon infant's gesture production more generally? Infants' mean gesture production (as assessed using the GAPP) at pre and post-test is presented in the table below.

Table 4.29. Mean (SD) GAPP scores by group at pre- and post-test

	Pre-test		Post-test	
	General Communication (n = 13)	Gesture (n = 11)	General Communication (n =11)	Gesture (n=4)
GAPP Score	2.00 (2.97)	3.64 (3.20)	8.09 (3.11)	10.75 (5.44)

The mean gain in GAPP score for infants in the General Communication Group was 6.73 (SD = 3.66) and for infants in the Gesture Group had a mean gain score of 5.50 (SD = 6.03). Differences were compared using a Mann-Whitney U test. This indicated that there was no significant difference between infants in the general communication and Gesture Groups, z = -.40, p = .69. The mean rank of infants in the General Communication Group was 8.27 and the mean rank of infants in the Gesture Group was 7.25.

To account for the unequal sample sizes at post-test, the four infants from the Gesture Group for whom there was post-test data, were matched with four infants from the General Communication Group. Infants were matched by age at pre-test (in days) and gender. The infants GAPP score at pre-test, post-test and the gains made by individual infants is presented in the table below.

Table 4.30. GAPP scores of matched participants

	Participant ID	Gender	Age (days) at pre-test	GAPP score		
				Pre-test	Post-test	Gain
Gesture	16	Female	233	2	5	+3
	19	Male	239	9	9	0
	20	Male	248	13	18	+5
	23	Male	172	4	11	+7
		Gesture Total		**28**	**43**	**+15**
General Communication	6	Female	235	0	12	+12
	3	Male	179	0	3	+3
	11	Male	246	5	7	+2
	7	Male	234	0	7	+7
		General Communication Total		**5**	**29**	**+24**

Gain in GAPP score was calculated by subtracting infants' GAPP score at pre-test from their GAPP score at post-test. A Mann-Whitney U test found no significant difference, between infants in the gesture and General Communication Groups on their gain in GAPP score, $z = -.29$, $p = .77$. Infants in the Gesture Group had an average rank of 4.25 and infants in the General Communication Group had an average rank of 4.75.

Results Summary

Even with small sample sizes and high attrition, a trend is apparent in the data that favours infants who were in the Gesture Group. Infants whose mothers were taught Makaton gestures showed a greater improvement in productive and receptive vocabulary than those whose mothers were not taught the gestures. Gesturing mothers also reported an increase in the frequency of using actions with words when communicating with their child, and an increase in making up games to play with their child. These are both possible mechanisms through which infant communication skills could be improved. Unfortunately, the challenge of conducting research in this context means that the data set is incomplete therefore this data does not present an unequivocal answer to the question of the impact of gesture training on low-income families. Nonetheless, the data does offer indication of the potential worth of such an intervention for bringing linguistic gains for these mother-infant dyads. To further explore the perceived benefits of gesture training, a sample of mothers who attended the gesture sessions were interviewed and a thematic analysis of these interviews is presented in the next section.

4.3.2. A Qualitative Exploration of Mother's Views of Using Gestures with Their Infants

4.3.2.1.Participants and Setting

Attempts were made to contact all of the mothers who had attended the 'Communicating with Your Baby' gesture sessions. However, only three of the participants were successfully contacted, all of whom agreed to be interviewed. This meant that the quantity of data for transcription and analysis was limited, enabling a richer and more thorough analytic process. The mothers were interviewed approximately four months after the last Communicating with your Baby session.

Table 4.31. Participant information

	Infant Gender	Age of Infant	Sibling(s)	Maternal Education Level	Marital Status
Mother A	Male	11 months	None	A-level	Married
Mother B	Male	9 months	One girl, aged 4	GCSE	Married
Mother C	Male	12 months	One boy, aged 10	NVQ/BTech	Married

The interviews were carried out at Greenfield children's centre, in the staff office away from other people using the service. Interviews were conducted by a research assistant, who the mothers had not met previously. The interviews were conducted by someone unknown to the mothers and who had not been involved in the sessions at Greenfields to reduce the degree to which mother's accounts would be influenced by social desirability effects.

4.3.2.2. Method and Assumptions

A semi-structured interview protocol was designed, consisting of fourteen open-ended questions addressing the main topics of: maternal beliefs; maternal experiences; and maternal perception of the effect of gesturing on the child. Semi-structured interviews were used to ensure that information about the main topics was obtained, whilst maintaining a natural conversational flow with an informal feel. Open-ended questions were used so that participants felt able to express their genuine opinions without being overly constrained by interview structure, or influenced by perceived researcher aims or expectations. The protocol was used as a loose guide and conversation allowed to flow as naturally as possible during the interviews.

The interviews were transcribed (see Appendix K for a sample transcript) and thematic analysis was selected as the most appropriate method for this study, based on the guidelines suggested by Braun and Clarke (2006). The initial research questions for this study relate to maternal beliefs about Baby Sign, maternal experiences of gesturing with their baby, and maternal perception of the effect this had on their child. True grounded theory involves the exploration of the data for concepts and themes and subsequent analysis and theorising that is not based on an initial hypothesis or research question (see Craig & Hanlon, 2009; Fenwick et al, 2008; Wilson & Crowe, 2009). In this study, although the interviews are designed around predetermined research questions, it is an explicit intention to go beyond the research questions and identify themes from the data set as a whole.

4.3.2.3. Analysis and Discussion

Six themes were identified. These are:

1. Motivation
2. Integration
3. Communication
4. 'Within Child' Factors
5. Relationship
6. Involvement of others

Each theme is discussed and illustrated with extracts. To uphold confidentiality, interviewees are referred to as Mother A, Mother B and Mother C, rather than by name. Mothers refer to the gestures as 'signs' and 'baby signs'.

Theme I: Motivation

The mothers expressed beliefs relating to their motivation to use gesturing with their infants, referring to their remembered past, present, and possible future motivation to use gestures. Two of the mothers explained that although they had been aware of Baby Sign prior to the Communicating with your Baby sessions, they had not previously taken any interest in it or felt inclined to try it. Mother A referred to television programmes she had seen containing signs, indicating that she was aware of the possibility of using signs with children but had not paid any particular attention to this idea: "*I mean sort of on the kids' programmes they sort of incorporate it with the, you know like when they have people presenting it they often do a lot of it, but I hadn't really taken much notice before to be honest*".

A key feature of these mothers was that they all expressed low expectations of the impact of using gestures with their child. This view is represented in this comment by Mother A: "*to be honest honestly I didn't expect there to be much difference, cause it's, I mean cause I didn't know much about it I didn't expect him to all of a sudden by signing everything and for him to be this genius child but yeah, yeah I just sort of* *thought whatever happened happens, there was no sort of cause I never knew anything about it I didn't know I didn't have any level of expectation really, to be honest*".

Both lack of interest and low expectation contribute to low levels of motivation to use gestures with a child and this differentiates these mothers from those who would typically attend Baby Sign classes. To access gesture training, mothers would generally have to have some interest, expectation, and motivation. However, for these mothers, gesture training was made available to them at the children's centre that they regularly attend, at no cost, and so required little effort for them to access. All of the mothers interviewed mentioned convenience as the key, or only factor in their decision to take part in the gesture-training course. Mother B cites both convenience and encouragement from a staff member as reasons for participating: *"they were happening here and, um, I'd just come back to Greenfields for the Baby Lounge, and um… I think [staff name] mentioned it to me that they um held a little course for it and I thought oh that'll be good".*

Two of the mothers spontaneously raised the issue of possible future continuation with gesture training, suggesting an increase in motivation to use gestures after attending the sessions. Mother A expressed a notion that continuing to learn gesture may result in more of an impact on her child's communication: *"I mean some people might be different if you carry it on more, I know I, from my experience I believe there would be there would be more of a communication side".* However, this mother appears to present this 'in theory' rather than expressing an intention to actively pursue using gesture herself, suggesting that she would have continued if there were more classes but implying no plans to carry on anyway: *"it would've been nice to carry it on for a little bit longer… I think yeah we probably would've we probably would've carried it on more and would've been… yeah, a couple more classes would've been nice".*

This further emphasises the role of convenience, encouragement and incentive in motivating mothers to take up gesturing. Two of the mothers refer to the literature provided at the classes as a tool they have used at home. Mother B expressed an intention to continue learning gestures, using the leaflets to help: *"but I've got the rest of the signs that she's given me all the leaflets so from from the course I've kept everything together… and I think as we go along we'll probably use more cause I'm keen for him to do more and to to understand more".*

Mother B appears to be motivated to continue with gestures and this motivation is facilitated by the convenience of having access to literature provided at the classes. Usually accessing books and classes on gesturing would be expensive and time consuming and it seems likely that the mothers in this study were helped by the fact that the classes took place free of cost during a time slot when they were already regularly attending the children's centre.

Mothers A and B both imply that they do not have the time resources available to commit to gesturing. Time is likely to be a factor that would influence the motivation of mothers to use gestures. For example, Mother B said: *"well I'm not really using too many signs at the moment because it just seems so chaotic my life at the moment, four year old just in school, as I say, for a couple of hours a day, we only really get a couple of hours on our own".*

This extract creates the impression that gesturing is considered an additional activity, an 'extra thing' to do rather than a natural part of general communication. However, this contradicts the view that gesturing was naturally integrated into daily routine, as discussed in Theme 2.

Theme 2. Integration

The ease with which gestures could be incorporated by mothers into daily activities was one of the topics addressed in the interview schedule. All of the interviews contained some comment about how 'natural' the gestures felt and how easily they fitted in with daily activities. The role of context, relevance and regularity in determining the utility and integration of gestures was a topic identified across all three of the interviews.

Mother A discussed the importance of relevance, regularity and context in establishing which gestures she uses: *"but I'd say that some of the signs that you got were weren't relevant do you know what I mean so I wouldn't do the I wouldn't do them all the time, whereas stuff like food related or bedtime related and things like that I'd use".*

This extract demonstrates the mother's felt need for gestures to be relevant to activities and contexts that arise frequently in day-to-day life. Gestures are inevitably more useful if they are relevant, and the more often they are used then the more likely they are to be learnt and consolidated by both mother and infant. Gestures that are rarely practiced or seem irrelevant are less useful and harder to integrate into communication.

Two of the mothers spoke about idiosyncratic gestures that they had developed themselves and how these felt more natural to use than the taught gestures. Mother C talks about the gestures she had developed in advance of attending the classes, noting that they were similar to the gestures taught in the classes: "*um, when we started doing the classes I found that some of the signs we already used like um all gone and things like that were things that we'd I'd been using without knowing the meaning of".*

This highlights an important point that is often neglected by proponents of Baby Sign. Mothers gesture with their infants, without instruction or encouragement and regardless of whether they do so consciously or unconsciously, these gestures support infant's language development. Mothers modify their gestures directed to their children, referred to in the literature as 'gesturese' (Iverson et al, 1999; Bekken, 1989; Schatz, 1982) and these gestures support infant's comprehension

(Brand, Baldwin and Ashburn, 2002; Zukow-Goldring, 1996, O'Neill, Bard, Linnell & Fluck, 2005). There are SES related differences in the number of gestures that mothers perform, with lower-SES mothers producing fewer gesture types and this bears on infants subsequent vocabulary (Rowe & Goldin-Meadow, 2009). This suggests that simply bringing mothers' attention to the gestures that they perform anyway and informing them about the worth of gesturing, this may bring about benefits for infant's language development.

When Mother C was asked if she was still using the gestures, she explained that she was using the ones that she had been using prior to the classes, rather than those she was taught: *"um, not really, mainly the ones [ ] yeah, not really anymore the ones that we were just, like the all gone and things like that that we were doing spontaneously ourselves, that's still used"*

This demonstrates the need for gestures to be intuitive to appeal to the mothers, an idea further supported in mother's comments on how natural the gestures felt. One mother described the ease of using gestures in contrast to nursery rhymes. Each session included singing nursery rhymes together as a group and mothers were encouraged to sing nursery rhymes with their infants at home. For one mother, however, singing was more effortful for her than gesturing: "*it's just it's just part of what I do, I think that the thing that I've found um… a bit strange is the singing cause I've never really been… singing nursery rhymes… um and as signs themselves they weren't they didn't seem to be straight you know forced on or anything that, so they seemed nice and easy to do".*

The notion of automaticity of gesture implied in this extract ("*it's just part of what I do")* is recognised more explicitly by Mother A, who mentioned that some of the gestures were automatic when she introduced words to her child: *"I try and emphasise certain words so that I know he's picking words up… emphasising words and obviously automatically with that I sort of do a, I sort of make it a little bit more interesting, a little bit more so he notices it with signs and stuff."*

The use of '*obviously automatically'* implies that the gestures came very naturally to this mother. This extract also conveyed an impression that gesturing can make communication more interesting, and the idea that this mother uses gestures intentionally to emphasise words so that her child will notice them. The role of gesturing in the development of communication is central to Theme 3.

Theme 3. Communication

Mothers were asked about their views of the impact of gesturing on communication. All of the mothers describe improvements in communication between them and their infant as a result of gesturing. The mothers talked about their expected benefits and those that they had experienced through using gestures. Mother C spoke of how she had hoped that her child would learn to use the gestures and how she expected this to facilitate her ability to understand her infant: *"I just thought it might be a nicer way to try and understand what he was saying if I could get him to… use any of the signs and let me know and help me out a little bit then… seemed like a good option"*

Mother B talks about increased understanding that has resulted from the use of gestures, and how this has benefited her: *"and there's that thread of… understanding that's that's calmed me I don't know if it's ca it probably has calmed him, but it's made me less apprehensive about things."*

Here she touches on the possibility that the improvement in communication has benefited her child as well as benefiting her, and later in the interview she goes on to affirm this meaning: *"it just makes you that bit more aware of the communication but I do feel it's it's really benefited him cause he seems a lot calmer when you can do this at times of the day of course when we use them and he seems to understand more and it's less frustration."*

That the use of gesture can reduce frustration is one of the major claims of commercial Baby Sign programmes and although research in this area is limited, Vallotton (2008; 2009) has found evidence suggesting that gesture use may reduce episodes of distress for the child, result in more appropriate maternal responses to her child's distress cues, and improve affect attunement between mother and child. The role of gesture in reducing maternal and infant frustration is further discussed in relation to the theme 'Relationship'.

Mother C also suggests that using the gestures made communication easier: "*but um from an from an age where they can start letting you know what they what they want it does make things a lot easier."* Suggesting that this mother felt more effective in her role as parent because of the enhanced communication brought about by gesturing.

This extract also implies how the use of gesture is appropriate for a child at a particular age 'when they can start letting you know what they want'. The implication of this is that mothers were aware of how infants' comprehension exceeds their verbal production abilities and as such, gesture offers them a vehicle to express themselves in advance of the onset of speech. Further ideas about attributes of their infants, such as age, that the mothers perceived to be related to how appropriate it was to use gesture are discussed in Theme 4.

Theme 4: 'Within Child' Factors

The mothers expressed various beliefs about gesture in relation to particular characteristics of a child that make gesture use appropriate. These include the age or stage of development of the child and the personality of the child. It is important to note that this theme relates to the mother's perception of her child's personality, and her perception of the child's developmental stage that is expressed, even when she is talking in terms of chronological age (as this is based on her perception of what stage of development that chronological age means or should mean). This theme also encompasses the mothers' expectations of their children with regard to gesturing, as this represents their perception of their child's abilities.

When asked why she chose to attend the sessions, Mother A identified an aspect of her child's development to suggest that her decision was influenced by her perception that he was 'ready' to do something like this: "*um, I mean he was sort of starting to um sort of be a bit more receptive to things I was doing and because it was something offered here I thought it would be good to give it a go".*

Mother C spoke about her expectations in advance of participating in the classes as being related to her child's stage of development. Her comment here demonstrates how she felt that gesturing would serve a particular function for her child at this stage in his development: "*yeah, or maybe just to even for um… just the time between talking and you know when they're learning to eat their food and things like that and they want something to eat, and things like, I thought maybe it might help with those things".*

Mother C goes on to mention age and stage of development frequently throughout the interview, generally to convey a belief that gesture is only suitable for a certain period of development and that her child has now developed beyond that stage and outgrown the need for using gesture. For example, she refers to him moving on from gesture use when he became able to communicate in other ways: *"and then um… gradually after a little while he got to the point where he was showing you, or you could see what he wanted without using the signs… he's got to the stage now where he sort of grabs them and tries to look and point at what he wants and makes certain noises and I know it's a drink time".*

It is clear in this extract that although stating that the taught gestures are not being used, this mother and her child are making use of gesture as a communicative tool as he is developing. Whether this mother would have been as receptive to her infants' nonverbal communicative efforts if she had not been gesture trained is an open question. The child looks and points at things he wants whilst making certain noises, and although these noises are not necessarily actual words the implication is that the noises are particular to the object being pointed or looked at. This is a clear example of a child using a gesture in combination with a sound to convey meaning. Özçalişkan and Goldin-Meadow (2005) found that specific gesture-speech combinations predict oncoming changes in children's language abilities and it can be argued that this supports the hypothesis that the developing infant is expressing a single underlying representation through the different modalities of gesture and speech. This provides a case for gesture training playing a significant role in the development of language.

Mother C is quite specific about the age and stage at which she believes gesture is useful: *"I think it wa I think it was um useful at the time, that sort of stage between them… babbling and gurgling and actually knowing what they want and talking and being able to point out and let you know vocally I think it helped then, um now obviously they sort of grow out of it unless I was usi I had to use it for a purpose, obviously he's just going to grow out of it as he's finding his voice, but at that time, from I don't know I'd say about seven months… onwards up until they're about… ten, eleven, twelve months it was, it's quite good to use"*

Interestingly, in this extract Mother C clearly identifies that gesture was useful at a particular stage and although she does not claim that it continues to be of use, she states that it still serves a purpose in that she sometimes 'has to' use gesture. This further demonstrates how closely and inextricably linked gesture and language are in communication, such that it is difficult for Mother C to determine whether and when she has been relying on gestures and gestures compared to words.

Mother B also relates gesture use to age, but suggests that her child has not yet reached the age where gesturing would be useful: *"you know and cause he's still so young… he's only nine just over nine months now I don't know what I should be expecting of him."*

Two of the mothers also mention aspects of their children's personalities as relevant to their use of gesture. For example, Mother A describes her child as naturally animated and energetic and therefore taking to gesture: *"cause he's very active anyway so he's always moving he's always doing things with his hands expressions with his face".*

It is possible that this mother became more aware of her child's nonverbal behaviours as a consequence of attending the communication sessions. Her increased awareness and receptiveness to his gestures may have made her more able to understand and attribute meaning to her infants' communicative efforts. Indeed, this mother commented on how she believed her awareness of her own gestures has increased as a result of the Communicating with your Baby course: *"you become a lot more aware of the hand gestures even though I'm talking now, doing it, (laughs) hand gestures that you use when you speak do you know and become maybe a lot more aware of what you do with your [ ] yeah, you become a lot more aware of what you do with your hands and stuff when you speak, more than what I was before"*

The idea that the enhanced communication facilitated by gesture use has an impact on a mother's relationship with her child through enabling better understanding of one another is explored further in Theme 5.

Theme 5. Relationship

All of the mothers conveyed that the use of gesture had impacted upon their relationship with their child, particularly in terms of it encouraging one-to-one interactions, improving the bond between them, and providing opportunities for shared enjoyment.

Mother A felt that her bond was improved with her child as a product of increased interaction bought about by gesturing: *"even if they don't you know pick anything up directly you you sort of you get to interact more… there's times you spend together and the signs you do and you you sort of get it gets it's it's interesting, but you get more of a sort of bond if you know what I mean"*

Mother B associates an improved relationship with her child with the perception that gesturing reduced frustration. This mother felt better able to communicate effectively with her child and this was perceived to enhance her connection with her child:

"yeah I feel like he can understand me more… and there's that thread of… the understanding that's that's calmed me I don't know if it's ca it probably has calmed him, but it's made me less apprehensive about things… um… because he'll understand when the food's stopped coming and that he hasn't just got to keep screaming at me for it or, um that I am acknowledging that he's looking at me and I'll be with him in a minute when I say hello and stuff"

For this mother, gesturing appeared to increase her sense of efficacy as a mother. In this situation described by the mother, she could use the gestures to communicate effectively with her infant, thus alleviating his frustration which in-turn helped the mother to feel "less apprehensive". This suggests that because gestures offer mothers and infants a shared communication system this equips mother-infant dyads with a means to understand one another and to thus interact efficiently.

This mothers' comments demonstrates that although her infant has needs to be satisfied (i.e. hunger) she perceives her child as capable of expressing emotions and of understanding her, thus demonstrating mind-mindedness (e.g. Meins et al. 2001). Maternal mind-mindedness contributes to infant-mother attachment security (Meins et al. 2001) and to infants' understanding of the mental states of others (Meins, Fernyhough, Wainwright, Gupta, Fradley & Tuckey, 2002). Therefore, if gesturing can influence a mothers' perception of her infant this can foster the infant's mentalising abilities and improve the mother-infant relationship.

The ability of preverbal infants to express their feelings has been explored by Vallotton (2008) who argues that infants have a sophisticated understanding of the social world and provided evidence that children from as young as ten months were able to spontaneously represent feelings and emotions using gesture. Vallotton (2008) identifies ways in which symbolic gestures can enhance the emotional development of preverbal children, including encouraging them to express their emotions in both positive and challenging situations.

As well as this sense of a shared understanding with the child, and the resultant reduction in distress and frustration, the mothers also mentioned a shared enjoyment of learning and using gesture. For example, Mother A presents gesturing as something more for enjoyment than for communication, expressing that she feels it is beneficial even if it does not make a difference to her child's development in the long term:

"yeah, so even if there's no sort of long term effects… there's this you still enjoy it and they still enjoy it, so… like I say, even if you're not going to carry it on the whole communication thing, it's definitely a good thing to to experience [to baby: we had fun didn't we? yes we did, yes]"

The mothers also spoke of the enjoyment they had taken from attending the classes and socialising with one another, which relates to the final theme below.

Theme 6: Involvement of others

All of the mothers mentioned the impact of involving other people in the process of gesturing, including other children, their partners, and other mothers attending the classes.

Two of the mothers mention that their partners were not able to participate in gesturing very much. For example, Mother B expresses that her husband is minimally involved in gesturing due to working full time and having less contact with the child: "*my husband does a couple of them but he doesn't he's at work all day so he doesn't really you know see me do most of them"*

Two of the mothers also talk about their friends joining in with gesturing. Mother C highlights the benefits of gesturing with a friend who did the classes with her so that their children are gesturing together and both mothers are practicing the gestures: *"yeah I mean I do it with [mother name], she's got [child name] her little boy and we come here together and we see each other a lot in the week so we used to sort of, when you've got someone there who's doing it as well it's easier to remember to do things and then you've got two people doing it instead of just one… so it becomes a lot more familiar for them*"

Similarly, Mother A talks about enjoying the interaction with other mothers at the classes: "*yeah, yeah, there wasn't we had um the cla classes were not too big so we had quite a lot of one to one, it was quite, you know mums getting together and enjoying the classes together"*

Two mothers talk about the involvement of an older sibling in the gesturing. Mother B describes how her four year old daughter likes to use gestures with her son: "*oh, definitely, well my daughter likes it she she joins in a lot and she does thank-you and a few things when she plays with him*"

Mother C also describes her ten year old son joining in with gesturing: "*um, my el my eldest got really into it I mean he's ten so he got really into using them with him and what have you*"

In these extracts the involvement of others, where it has been possible, is seen by the mothers as a positive experience. However, Mother B also presents a less positive perspective of the involvement of others when she talks about her anxieties that other people would expect too much of her son if she told them that she was learning to use gesture with him, and that he would not meet those expectations: "*I was just a bit concerned that maybe everyone was expecting my son to be (pause) able to sign at the end of (pause) the course… so I thought OK this might not go according to plan*"

This mother goes on to talk about occasions when other people have expected her son to understand gestures because they know she has been doing the classes:" *some of my friends say oh yes I know a sign for this or for that, and then when they talk to him they they do that sign as well, it's as though they're expecting to, oh yeah that's a sign he's going to understand that*"

These extracts highlight the potential for mothers to feel under pressure for their child to achieve. It is therefore particularly important for gesture training to emphasise the use of gesture as a tool rather than a marker for development.

How Did Mothers' Expectations Compare to Their Experiences of Using Gesture?

Mothers' narratives on their experience of using the gestures were considered in light of their expectations and motivations for attending the sessions. It was important to consider how a mothers' interpretation of her experience may have been shaped by her expectations about the benefits of gesturing with their baby. Mothers' expectations of Baby Sign can affect their account of their experiences in many ways. Mothers' perceptions of their infants' abilities can directly influence their infant's development. For example, the development of infants' communicative abilities has been demonstrated to be predicted by maternal expectations of infant ability (Tulkin & Kagan, 1972). Maternal expectations vary as a function of maternal SES. Tulkin and Cohler (1973) found that middle-class mothers believed more than lower-class mothers in their infant's ability to communicate and as such would interact more with their infants. Therefore, the expectations that a mother holds about her infants' abilities are likely to impact upon how she behaves with her infant. In turn, these behaviours will nurture those abilities and so mothers' expectations are met.

However, if expectations are not met, mothers may perceive their experiences to be consistent with their expectations or adjust their expectations to fit their experiences. In this way, the cognitive dissonance that a mother may experience from the inconsistency between what she expected and what she actually gained would prompt her to reduce this feeling by altering her perception. With these possibilities in mind, mothers' narratives were analysed to explore how congruent their experiences were with their expectations.

Mother A initially claimed not to have any expectations, and comments how she did not expect her infant to become a "genius child". However, she then goes on to say that she had almost assumed that gesturing would help communication.

Mother A: um, to be honest honestly I didn't expect there to be much difference, cause it's, I mean cause I didn't know much about it I didn't expect him to all of a sudden be signing everything and for him to be this genius child but yeah, yeah I just sort of thought whatever happened happens, there was no sort of cause I never knew anything about it I didn't know I didn't have any level of expectation really, to be honest
Interviewer: yeah did you have any hopes then, you know?
Mother A: oh yeah, obviously that he'd sort of pick a few things up and it'd be easier for us to communicate with each other sort of before he started speaking and everything like that so.

This mother comments that she hadn't expected her son to "*all of a sudden be signing everything*" but that "*obviously he'd sort of pick a few things up*" demonstrating her moderate expectations. However, mothers were describing their expectations in retrospect and as such recalled expectations may be shaped by their experiences, therefore this mother may have expected more from her infant in terms of gesturing and adjusted her recalled expectations based on what she observed.

This mother remarked on how little she had known about Baby Sign, indicating a difference between this sample of mothers and the mothers who were interviewed in Chapter 3. The mothers who participated in the longitudinal study were all high-SES mothers and had opted to take part in the study and all of these mothers had some knowledge of Baby Sign and expressed higher expectations than the mothers in this sample. These high expectations may be a result of social class (e.g. Tulkin & Cohler, 1973), knowledge of Baby Sign or a combination of these factors.

Mother A's account of her experience was examined to determine the relationship between expectation and experience. Similar to her expectations, her account of her experience was modified, commenting that although the outcomes were not vast she did find benefits. For example, Mother A commented "*even if they don't you know pick anything up directly you you sort of you get to interact more*". In this way, this mother appears to be justifying to herself that even though her child did not pick up the gestures, they still benefited from them. She goes on to say that while the infants "*don't know all these signs off the top of their head*" she did perceive other non-linguistic benefits of gesturing, for example "*there's times you spend together and the signs you do and you you sort of get it gets it's it's interesting, but you get more of a sort of bond if you know what I mean".*

This mother's initial expectations may have exceeded her experiences thus leading her to adjust her perception. Because her son did not acquire many of the gestures, the mother may then have exaggerated the alternative to make it unrealistic, describing a 'genius child' that knows 'all these signs of the top of their head'. This would serve to diminish any feelings of cognitive dissonance this mother would likely experience when being faced with inconsistency in her expectations and experiences. This mother emphasises the socio-emotional benefits that she has gained from gesturing. While these benefits may exist it is important to acknowledge that they may have arisen from a need to justify her investment in gesturing or because in being asked about her experience she wants to offer a positive account to the interviewer.

Mother B describes not having great expectations herself, but was concerned with other people's expectations of her son's abilities: *"I didn't have um too many expectations but I was just a bit concerned that maybe everyone was expecting my son to be (pause) able to sign at the end of (pause) the course"*

This mother's concerns were reduced when she changed her perception of gesturing from something that the infants perform to a tool that mothers use to enhance communication: "*I wanted to use it on him and you know take my time but um it's it's worked well it has worked well cause I've realised now that it's just for him to understand… what I'm trying to say to him rather than him to repeat it back to me*"

Consistent with this, Mother B's expectations focused on enhanced communication: "*just some extra communication between um us both because (pause) it's just, it's so apparent that they're they're just so reliant on you and they don't understand what's going on around them*"

This mother hoped that the improved communication afforded by gesturing would alleviate frustration felt by her infant: "*and the frustration when they cry and they don't understand why they've got to wait or what's going on and er just, just hoping to be able to communicate with him that I'm trying (laughs) trying to to produce what he needs and um trying to keep him happy and that we're both on the same side… kind of thing*"

The description this mother gave of her experience matches her expectations. She commented that "*I feel like he can understand me more*" and that "*there's that thread of (pause) the understanding that's that's calmed me I don't know if it's ca it probably has calmed him, but it's made me less apprehensive about things"*

The comment that she is now "less apprehensive" indicates that this mother may have been experiencing some stress in her role as parent. The fact that she attributed gesturing with a reduction in anxiety suggests that regardless of the direct impact of gesturing on her infant, she perceived gesture to help her feel more effective in her role as mother and thus felt less apprehension.

Mother C had hoped that her infant would acquire the gestures and this would help her to understand him better: "*I just thought it might just be a nicer way to try and understand what he was saying if I could get him to (pause) use any of the signs and let me know and help me out a little bit then (pause) seemed like a good option"*

This mother felt that the gestures would be of particular use at critical times in her infant's development, specifically before the onset of speech and in certain contexts: "*just the time between talking and you know when they're learning to eat their food and things like that and they want something to eat, and things like, I thought maybe it might help those things"*

Indeed this mother describes how gesturing fulfilled her expectations: "*at that time when they're not saying anything you get it's a guessing game to think about it to find out what they want, I think it's quite good*"

Mother C draws on her experience with her eldest son to illustrate how she felt gesturing benefited communication: "*I think with my eldest it was (pause) really hard trying to work out what they what they want and what have you, but a couple of signs, even if he doesn't show you physically that copy them um himself at least you can sort of (pause) um work out what he does or doesn't want"*

However, these mothers did not have any great expectation of the effects of gesturing. This reflects the fact that these are not highly motivated mothers that have sought out a Baby Sign class to attend, neither are they mothers that have self-selected to take part in a University study. These mothers were asked to attend the sessions that were occurring at the children's centre that they regularly attend and required little effort or motivation for them to attend. Therefore, the mothers' expectations are less likely to be influenced by high motivations. However, the effects of gesturing would have been assumed to be positive as the classes were provided by professionals so mums would believe this was good for their infant.

Did mother's experiences match their expectations? While Mother A talks about anticipating communicative benefits it is the socio-emotional benefits that she describes in her experience. This could suggest that her experience did not match her expectation and as such, she focused on wider non-linguistic benefits.

For Mother B and C, their experiences with gesturing matched their expectations. Mother B expected gesturing to aid communication and reduce frustration and did remark how gesturing had brought these benefits. Her infant may indeed have experienced less frustration, or the mother may have felt better equipped to deal with her child's frustration and so perceived less frustration. In this sense, we see a self-fulfilling prophecy. Findings from Chapter 3 suggest that mothers who gesture with the babies do not experience less stress, however this finding comes from a sample of high-SES mothers, who overall experienced very little stress. For this low-SES sample of mothers, gesture may have a more pronounced effect on stress reduction.

4.3.3. Discussion

This is the first study of its kind to evaluate whether the reported benefits of Baby Sign extend to infants from disadvantaged backgrounds. The goal of this investigation was to evaluate the effectiveness of encouraging parents from low socioeconomic status backgrounds to use simple gestures with their preverbal infants to improve communication. The studies aimed to explore whether teaching gestures, in the form of Makaton, to this group of parents could improve infant language development, and thereby reduce the discrepancy in language ability between infants from low and high-SES families. Furthermore, the qualitative aspect of the study aimed to explore parental attitudes, beliefs and experiences of using gesture with their infants, in terms of communicative and linguistic outcomes as well as other non-linguistic factors.

A 'Communicating with your Baby' course was developed and delivered at a Sure Start children's centre. Two types of course were included, both of which focused on encouraging better communication between mothers and infants, however one course included instruction on using Makaton gestures with infants to augment communication.

Communication between mothers and infants was benefited by the sessions, with mothers in both the general communication and Gesture Groups demonstrating a similar gain in the frequency of communicative behaviours and gestures, actions and pretend play behaviours that they engaged in with their infants. The aspect of language development that was impacted by gesture training was vocabulary. There was a trend for infants in the Gesture Group to show a greater improvement in both their receptive and productive vocabularies than infants in the General Communication Group.

This finding is consistent with research that has demonstrated a relationship between maternal gesturing and infant vocabulary development. Rowe, Özçalişkan and Goldin-Meadow (2008) found that the amount of gesture types produced by parents was related to a child's subsequent vocabulary at 54 months. However, this relationship was mediated by the number of gestures that children produced. The more the mothers gestured, the more their infants gestured and this enhanced their verbal vocabulary. Therefore, parental gesture is indirectly related (through child gesture) to vocabulary development.

However, in the present study, gesture training was not found to impact upon infants' GAPP scores, suggesting that encouraging mothers to gesture with their infants did not generally increase the number of gestures that the infants produced. However, the GAPP checklist only measures whether or not infants produce a certain type of gesture, it does not measure the frequency with which they produce that gesture or the number of different meanings conveyed by gesture. Therefore, it is possible that the infants of the mothers who were gesturing did produce more gesture types and this is what supported their vocabulary development.

Why would gesturing increase an infants' verbal vocabulary? One explanation is that children's gestures elicit verbal labelling from parents (Goldin-Meadow, Goodrich, Sauer & Iverson, 2007). Applying this to the present study, infants may have produced more gesture types as a result of being exposed to a high amount of maternal gesturing. In turn, mothers would have responded to their children's gestures with a verbal label. Without a measure of the rate of maternal and infant gesturing, it is difficult to confirm this relationship.

However, the gesture-training sessions focused on encouraging mothers to attend and attribute meaning to their infants' communicative efforts and to respond verbally to them. Indeed, the qualitative evidence demonstrates that mothers felt that they were more in-tune with their infants nonverbal communication attempts and the mothers perceived that the use of gesture had benefited communication.

This suggests the sessions were successful in getting the mothers to focus on their infants' subtle hand movements and pre-verbal communicative attempts, and to attribute a communicative intention to them. It is assumed that mothers would have also responded verbally to these acts, as was encouraged in the sessions. Therefore, in line with Goldin-Meadow et al. (2007) it is likely that infants' gestures elicited verbal labelling from mothers and this then may have supported their developing vocabulary.

Furthermore, by encouraging mothers to gesture with their infants, this may have increased the amount of time that mother-infant dyads engaged in joint attention. Mothers were instructed always to engage eye contact with their infants before performing the gestures. Therefore, a by-product of encouraging gesture would be an increase in episodes of joint attention and this may contribute to the relationship between gesture and vocabulary. Joint attention is known to contribute significantly to the learning of word meanings (Bruner, 1978) and the amount of time infants spend in joint engagement with their mothers has been shown to be highly correlated with their later vocabulary (e.g. Tomasello & Todd, 1983; Smith et al. 1988). However, while research cannot yet tell us whether encouraging mothers to gesture increases the amount of joint attention that they initiate with their infants, what we do know is that infants who have been encouraged to gesture initiate more joint attention with their caregivers (Moore, Acredolo & Goodwyn, 2001).

It is important to bear in mind that vocabulary was assessed via maternal report. As such, there may be a discrepancy between an infant's actual ability and their ability as perceived by their mothers. Although, maternal report has been demonstrated to be a reliable index of infant vocabulary (Bates, Bretherton & Snyder, 1988; Dale, Bates, Reznick & Morisset, 1989), maternal perceptions are nonetheless subject to psychological influences and biases. However, even if the vocabulary scores are only a mark of the mother's over-judgement of her infants' ability, this still tells us something important about gesture training. If mothers rate their infants as understanding more words as a result of attending gesture training sessions, this may indicate an increased understanding of mothers that their infants can comprehend that things have names in advance of the onset of speech. Therefore, mothers may have changed their perceptions of their infants, and as such were more likely to attribute comprehension abilities to their infants. However, it is also possible that mothers were simply more aware of their infants' language abilities as a result of attending communication sessions. The trend for infants in the Gesture Group to score higher than infants in the General Communication Group suggests that using gestures may alter maternal perception of their infants.

To enrich the quantitative data, a qualitative investigation of maternal beliefs and experiences of using gestures with their infants was conducted. The relationship between gesture training and improved vocabulary comprehension suggested in the quantitative study was supported by qualitative data. The mothers conveyed in the interviews a belief that using gesture improved their ability to share understanding with their child in various ways. Mothers highlighted an increase in one-to-one time spent interacting with their child as a consequence of using gesture, which relates to evidence suggesting joint attention as a possible mediator of the improvement in vocabulary associated with gesture use.

Taken together, the quantitative and qualitative data suggest that encouraging mothers to gesture increased the number of actions they combined with words, therefore enabling the child to match a gesture with an appropriate word. In the quantitative study, self-report data suggests that mothers who were taught gesture increased the number of actions they used with words, whereas the mothers who were not taught gesture did not. In the qualitative study, mothers who had been taught gesture reported matching words with gesture to emphasise new words being introduced to the child. One of the mothers interviewed also gave examples of her child spontaneously pointing and making sounds to communicate with her.

The interviews confirmed that the main motivation of mothers to participate in this study was convenience. The sessions were held at the children's centre they already attended, were free of cost and required little time commitment. The mothers did not seek out a Baby Sign class, nor did they self-select themselves to take part in a university study. These factors make this a unique sample, as previous research involves samples of mothers with high-SES and who are highly motivated to take part in research (e.g. Goodwyn et al. 2000). However, for the very same reasons, this sample is also a difficult sample to conduct research with.

Participation in all stages of data collection required mothers to attend the children's centre on a regular basis at a specific time. However, the mothers were not invested in the research project, they had agreed to take part as a by-product of being at the centre, as such they were not motivated to commit to the study. Furthermore, their ability or desire to attend the children's centre would have been influenced by a number of factors outside the general communication of the research. Issues concerning work, family, childcare and personal concerns are all likely to have contributed to mothers' attendance.

The issue of attrition is highlighted by missing data. Many mothers ceased attending the children's centre after the sessions had ended. Effort was made to contact the mothers by post and telephone and the questionnaires were posted to the mothers, however the response rate was poor. A higher attrition rate for the Gesture Group than the General Communication Group was problematic for analysis and likely to be attributable to the fact that the classes including gesture ran subsequently to the classes without gesture, and therefore later in the research period. This meant that a lot of the mothers who had originally shown an interest in the research had moved on from the children's centre by the time they had completed the course and it was not possible to make contact with them to collect post-test and follow-up data. Unfortunately, this is a risk difficult to overcome when conducting research with such a sample in an applied setting. However, the emerging findings do suggest that this is a worthwhile project, which stands to make significant social and academic contributions.

The ‘Communicating with your Baby’ sessions were well received at the children’s centre. All mothers who attended Baby lounge with babies in the appropriate age range at the time of the sessions attended the course. Therefore, uptake was extremely high and all mothers expressed enjoyment of the sessions. The success of the sessions has meant that they have been continued at the children’s centre and ‘Communicating with your Baby’ courses with gesture training are now an ongoing component of Baby Lounge.

The initial findings suggest that the language abilities of infants from low-SES families stand to be improved by encouraging their mothers to use a small number of gestures (or Makaton signs) with their infants from a pre-verbal age. This requires further evaluation to determine the extent of this effect. The mechanisms by which maternal interaction is enhanced by gesture training have been speculated upon to include an increase in joint attention, an increase in infant gesture and maternal responsiveness to infants’ gestures. Future research needs to focus on measuring these aspects of mother-infant interaction to determine how, in low-SES families, important communicative behaviours may be increased as a function of gesture training.

Based on the findings of both the quantitative and qualitative aspects of this investigation it is clear that further investigation into the impact of gesture training for low socioeconomic status parents on communicative, linguistic, social and emotional development may yield some important findings. Accessibility, affordability and convenience of gesture training are paramount if low socioeconomic families are to be expected to take it up. These factors also need to be seriously considered when approaching this participant group for research purposes.

Gesture training was effectively incorporated into a course of sessions, delivered in an accessible format and well received by low-SES mothers. This has implications for informing how infants at risk of slow language development can be targeted at an early age. Infants from lower-SES backgrounds are at a disadvantage compared to their higher-SES peers in terms of their language development. The infants' linguistic environment has been identified to vary as a function of SES. The quality and quantity of verbal and nonverbal input is diminished in lower-SES households. This study suggests that gesture can be used to enhance the communication between low-SES mothers and infants and could help reduce this discrepancy in language development between low and high-SES infants.

Chapter 5. Conclusions

Early mother-infant interactions are a “cradle of thought” (Hobson, 2002) in which mothers scaffold their infants’ social, cognitive and linguistic development. Healthy interaction between mother and baby is important for bonding and attachment (Ainsworth et al, 1979; Bowlby, 1969) and for nurturing infants’ communicative skills. From birth, mothers and infants engage in “protoconversations” (Bateson, 1971, 1975; Trevarthen, 1979). Infants use their expression, gaze, body movement and gesture to partake in communicative exchanges with their caregiver. These are conversations without words that are coordinated and reciprocal. According to Trevarthen, “being conversational is what it takes for a young person to begin learning what other people know and do, and this is the behaviour a fond parent expects, and enjoys. It is the human adaptation for cultural learning” (Trevarthen, 2004, p1). This thesis has examined the role that hand gestures play in these early mother-infant interactions and has undertaken an evaluation of whether encouraging more gesturing within mother-infant dyads would enhance infants’ language development.

The prominence of gesture in infants’ early communicative efforts have prompted the view that infant language emerges from their hands (e.g. Tomasello, 2003). Gesture has been claimed to be a forerunner of verbal gains in infancy, as verbal milestones are presaged by equivalent gains in gesture (Bates & Dick, 2002). Speech and gesture have been suggested to form a unified system (McNeil, 1992), offering ‘different windows on a unified developmental process’ (Bates, 2003, p15). Speech and gesture share an underlying neurological basis (Rizzolatti & Craighero, 2004), furthermore the relationship between the manual and verbal modalities has been suggested to have evolutionary origins (Corballis, 2002).

This close relationship between speech and gesture prompted the question of whether encouraging infants to gesture would promote verbal gains, which is the focus of this thesis. A review of the existing literature in this area revealed a lack of empirically sound research, with methodologically weaknesses precluding the drawing of definitive conclusions (Johnston et al, 2005).

Therefore, this thesis focused on the following three research questions:

- Can encouraging preverbal hearing infants to gesture benefit language development?

- What effect does gesture training have when parents have not made a financial investment and the family background poorer?

- What are the wider non-linguistic benefits of gesturing with infants?

Studies were conducted to address these questions and I will briefly review the findings in this chapter. Where there are limitations in the studies, these will be discussed and the findings will be described in the context of previous research findings. The role of gesture in language development and the mechanisms by which gesture impacts upon language are discussed. The more practical outcomes from the research are also discussed in terms of the worth of Baby Sign and the application of gesture training to mother-infant dyads that stand to most benefit from it. Finally, proposals are made for the direction of future research.

5.1. Chapter Summaries

5.1.1. Can Encouraging Preverbal Hearing Infants To Gesture Benefit Verbal Language Development?

Goodwyn, Acredolo and Brown (2000) report a limited advantage of encouraging preverbal infants to use symbolic gestures. The study, while promising and leading research into a worthwhile direction, was not methodologically ideal, thus the conclusions drawn about the worth of encouraged gesture in infancy are not convincing. Until this thesis, the effect of enhanced gesture on language development in infancy has not been re-examined. A review by Johnston et al (2005) lamented the lack of research in this area. With the ever-increasing popularity and uptake of Baby Sign, the paucity of research is a major concern. One Baby Sign company alone, 'Tiny Talk', teaches over 4,500 families each week in the UK. Mothers are investing their money, time and effort in the belief that gesturing with their baby will improve development, both linguistic and social. Psychologists have a duty to inform parents of the worth of Baby Sign and to provide evidence-based knowledge regarding how their infants' development can best be nurtured.

The longitudinal study presented in this thesis is unique, offering a rigorous evaluation of gesturing with infants. The design improved upon that of Goodwyn et al. (2000), resulting in a carefully controlled evaluation, which was methodologically sound and applied appropriate measures of infants' verbal and nonverbal, receptive and expressive language development. This study addressed the question of whether encouraging gesture impacts upon infant language. Furthermore, this study addressed a hitherto unanswered question, whether the effect of gesture training depends on the type of gesture to which infants are exposed and encouraged to use. This is a key question given that Baby Sign sells parents a set of gestures to use with their infants and does so without knowing whether these particular gestures are the optimum gestures to use, or if indeed, it matters what the gestures are. If the latter is true, this calls into the question the necessity of parents paying money to learn gestures when they could create their own and get the same effect.

In the longitudinal study reported in Chapter Two, forty mother-infant dyads were randomly allocated to one of four conditions. Two gesture training conditions were included, one of which trained mothers to use a target set of British Sign Language (BSL) gestures and another trained mothers to use a set of symbolic gestures for the same target set of everyday objects and concepts. The inclusion of a verbal training group controlled for mothers in the gesture groups saying the target words at a high frequency. A non-intervention control group provided a baseline control group.

Mothers were encouraged to use these gestures frequently with their infants in day-to-day activities, from when infants were eight months of age. All of the infants acquired these gestures and used them to communicate about a number of referents prior to the onset of speech, and continued to use the gestures alongside speech until they were 20 months old. While adding to their communicative repertoire, gesture did not impact upon infants' language development. There was no difference in infants' scores on measures of verbal and nonverbal receptive and expressive language ability between infants in the four different conditions at 12, 16 or 20 months. Furthermore, there was no difference between the language development of infants in the BSL and symbolic gesture groups, ruling out the possibility that this finding was simply an artifact of the type of gesture that infants were exposed to.

However, not all infants were affected in the same way. A closer examination of the impact of within-child factors on infants' ability relative to the sample did reveal an effect of gesture training. Male infants who had a low baseline expressive communication score (referred to here-on-in as 'low ability') in relation to the sample benefited from gesture. Low ability infants were more likely to improve in their mean rank expressive communication score relative to the sample. They also showed greater gains in their mean expressive communication scores and productive vocabulary scores than low ability infants in the control condition. This effect was found for both BSL and symbolic gestures, suggesting both gesture types had the same effect. However, this finding is limited to a small subsample of three infants. In sum, the findings suggest that encouraging infants to gesture does not enhance infant language development overall but did benefit a sub-group of boys in terms of their expressive language. This evaluation therefore, brought to light the fact that some infants are helped by gesture whereas others do not need it. The findings suggest that those who stand to benefit the most from gesture to be infants whose language can be improved upon.

5.1.2. What Effect Does Gesture Training Have When Parents Have Not Made a Financial Investment and the Family Background Poorer?

The longitudinal investigation presented in Chapter Two was conducted with mothers who were highly educated, affluent and highly motivated to advance their child's development. This is the demographic of mothers who are most likely to attend Baby Sign classes and to purchase Baby Sign products. However, as revealed by the evaluation, it is precisely these infants that need it least. This is because the educational level and parenting skills of these parents means that their infants are already being raised in an environment conducive to good outcomes for the infant. Yet, a thorough cross examination of the data did bring to light that gesture training may benefit some infants more than others, namely boys with lower language scores. This finding implies that those infants who stand to gain the most from gesture are those at risk of poor language skills.

Children identified to be at risk from slow communicative development are more likely to come from low-income families (E.g. Arriaga et al. 1998; Pan et al. 2005; Hoff, 2003). The quantity and the quality of maternal interaction has been recognised to account significantly for the impoverished language development of infants from lower socio-economic status (SES) families (e.g. Hoff, 2003). This thesis explored whether gesture could enhance the early communication between mothers and infants to reduce the discrepancy between high and low-SES infants' language.

Research to date has not examined how nonverbal communication strategies can specifically enhance the language development of infants from low-income families. Chapter Three presents a quantitative and qualitative evaluation of the effectiveness of a gesture training intervention delivered in the setting of a Sure Start children's centre. Between November 2007 and January 2009 six 'Communicating with your Baby' courses were delivered at a children's centre, each comprising four weekly 30-minute sessions. Three of the six courses also included a gesture-training component. This course type comprised the gesture condition, while the other three courses formed a comparison condition, referred to as the 'general communication' group. Mothers who attended these gesture sessions were shown how to use gestures with their infants in everyday interaction. This design allowed for an evaluation of the effectiveness of gesture training by comparing pre- and post-test measures of both groups. Infants' language was assessed before and after the communication programme and at a three-month follow-up. Measures used were the Pre-school Language Scale (PLS-3 UK) and the Oxford Communicative Development Inventory (CDI), scales validated for this age group. Twenty-five mother-infant pairs participated and infants were aged between five and ten months at pre-test. Thirteen attended the general communication sessions and twelve attended the gesture sessions.

Infants in the gesture groups showed greater gains in receptive and expressive vocabulary. Before the intervention, infants' mean vocabularies were lower than the vocabularies of the higher-SES sample of infants in the longitudinal study. The improvement made in vocabulary by infants of mothers who attended the gesture sessions meant that these infants now had a vocabulary equivalent to the higher-SES infants. Gesture had reduced the discrepancy between low and high-SES infants.

The qualitative study found that encouraging mothers to use gestures with their infants also led to wider, non-linguistic benefits, as perceived by mothers. The socio-emotional consequences of gesture were further explored in Chapter Four, which is summarised next.

5.1.3. What Are The Wider Non-Linguistic Benefits Of Gesturing With Infants?

In addition to claims that Baby Sign will enhance infant language development, Baby Sign is promoted to parents as having the power to reduce infant frustration, enhance self-esteem and confidence and strengthen the caregiver-infant bond (Acredolo & Goodwyn, 1997). Unsurprisingly, there is a distinct lack of research that links gesturing with any socio-emotional outcomes. However, mothers participating in the longitudinal and the children's centre studies anecdotally reported how communicating with their baby using gestures before the onset of language made day-to-day life easier and more enjoyable. This strong communicative relationship between mother and infant is likely to lead to social-emotional benefits for both mothers and their infants. Therefore, it was deemed worthwhile to explore the possibility of wider non-linguistic outcomes.

Chapter Four aimed to explore and assess the wider linguistic and non-linguistic impacts of gesture training for mothers and infants. Mothers in the longitudinal study who had used gesture with their infants were interviewed about their motivations, expectations and experience of using gestures. An Interpretative Phenomological Analysis (IPA) of these interviews revealed how mothers perceived socio-emotional consequences of gesturing. However, the extent to which these are actual benefits is questionable given that mothers' accounts are vulnerable to a number of psychological factors, including social desirability. One of the perceived benefits described by mothers was reduced frustration, an outcome that receives considerable promotion from Baby Sign companies. To test the validity of the claim that gesturing reduces stress experienced by mother-infant dyads, the stress of those who had gestured and those who had not was compared. The Parental Stress

Index (PSI) (Abidin, 1994) was selected as the most appropriate tool to assess stress, as this is a well validated tool that provides a reliable indication of the parents' perception of their relationship with their child. PSI scores for mothers who had gestured with their infants were no different from those of mothers who had not, suggesting there was no significant impact of gesturing on stress reduction. Therefore, mothers may perceive gesturing with infants as having wider non-linguistic benefits, but this does not show up in measures of maternal or infant stress.

5.2. Why Were The Findings of Goodwyn, Acredolo and Brown (2000) Not Replicated?

The study reported in Chapter Two replicated the study of Goodwyn et al. (2000) addressing many of the shortfalls of their design, including lack of randomised control trials, unequal gender distribution in conditions whilst also controlling for the number, type and token of the gestures that infants were exposed to. The results of the longitudinal study did not replicate those of the Goodwyn et al. (2000) study, which found a small but significant effect of gesture on selected group measures of infants' language. In this section the differences between the two studies (referred to as the Goodwyn study and the longitudinal study) will be explored to identify why the same effect was not found in the current study.

Differences in sample size may have meant that the Goodwyn study was able to detect an effect whereas the longitudinal study could not. The overall sample size of the Goodwyn study was 103 infants, with 32 infants in both the gesture training and verbal training groups and 39 infants in the non-intervention control group. The longitudinal study contained forty infants overall, ten per condition, with an equal number of males and females in each condition. However, if the effect sizes of the differences reported in the Goodwyn study are high, then the magnitude of the effect of gesture training would be such that it would be detected by a smaller sample.

Goodwyn et al did not report the effect sizes of their results. Therefore, effect sizes were calculated for the significant results using Cohen's d. These are reported in the next table. Goodwyn et al report a significant effect of gesture training on the following two composite measures:

- Composite Receptive Language Score: the average z scores of 6 measures; Sequenced Inventory of Communicative Development Receptive Communicative Age (SICD/RCA) assessed at 15 and 19 months; Receptive-One-Word-Picture-Vocabulary Tests (ROWPVT) at 24, 30 and 36 months and Phonemic Discrimination Task at 30 months.
- Composite Expressive Language Score: the average z scores of 11 measures; Sequenced Inventory of Communicative Development Expressive Communicative Age (SICD/ECA) at 15 and 19 months; Expressive-One-Word-Picture-Vocabulary Tests (EOWPVT) at 24, 30 and 36 months; Communicative Developmental Inventory at 15, 19, 24, and 30 months, and Mean Length of Utterance (MLU) at 24 months and longest utterance at 24 months.

Despite the fact that both these measures draw on data from a number of different measures, the effect sizes are small to medium[15], suggesting that although there was a significant effect of gesture training, the magnitude of this effect was relatively small. This is even when an additive measure is used, where you would expect mean differences between the groups to be maximised.

When Goodwyn et al. (2000) conducted analyses on individual measures by age, only three significant differences emerged (out of 17 comparisons). Again, all of these differences have small to medium effect sizes, a reported in the table below.

[15] According to Cohen (1988), small effect size: d = .2 , medium d = .5, large d = .8.

Table 5.32. Significant comparisons mean scores and effect sizes

	Gesture training group mean (SD)	Control group mean (SD)	Cohen's d (effect size r)
Composite Receptive Language Score	.21 (.73)	-.10 (.72)	0.43 (r = .21)
Composite Expressive language score	.17 (.70)	-.17 (.69)	0.49 (r = .24)
SICD/RCA at 19 months	18.4 (2.9)	17.3 (3.1)	0.37 (r = .18)
ROWPVT at 24 months	29.2 (6.3)	26.3 (6.9)	0.44 (r = .21)
MLU at 24 months	2.26 (.8)	1.94 (.66)	0.44 (r = .21)

Therefore, given the limited number of significant differences found in the Goodwyn study and the weak magnitude of these effects, it is not surprising that these were not detected in the longitudinal study which contained fewer infants. However, there were some consistencies in the findings of the two studies. Both failed to find a significant effect of gesture training on vocabulary as measured using the CDI and neither found an overall main effect on expressive communication and receptive comprehensions.

Further differences between the Goodwyn sample and the longitudinal sample are also likely to contribute to the difference in the findings. This thesis highlighted that within-child factors, i.e. SES and gender, contributed to the effect that gesture training had on individual infants. Therefore, the effect found by Goodwyn and Goodwyn could have been a product of their sample of infants. The mothers in their study were predominately middle class, however 15% of the sample earned less than $20,000 putting them into a lower-SES category. Goodwyn report that there were no significant differences between the intervention groups on family income or maternal education. However, those infants in the gesture training condition who were lower SES may have been those most receptive to gesture and their mean scores could have boosted the mean score of the gesture group as a whole. This thesis found that lower-SES infants benefit more from gesture than higher-SES infants. The participants in the longitudinal study were all high-SES therefore differentiating this sample from the Goodwyn sample, a difference which could potentially account for the difference in the findings.

Gender is another factor likely to contribute to the effect of gesture training. Goodwyn's sample had an unequal number of boys and girls, with 19 boys and 13 girls in their gesture group. This thesis identified that boys with a low language ability[16] benefited especially from gesture. The Goodwyn sample, containing more boys, may have been more susceptible to gesture training. So both gender and SES may have compounded to give rise to significant gesture training effects.

Differences in the gesture interventions used in the Goodwyn and the longitudinal study may also account for differences in the findings. Mothers in the Goodwyn study were equipped with a target set of eight gestures to start them off but were then encouraged to create their own symbolic gestures. Crucially, what is not reported is to how many gestures each individual infant was exposed. There was likely to be great variation in the number and token of gestures to which infants were exposed. The mean number of gestures acquired by infants in the Goodwyn study was twenty. This suggests that infants would have been exposed to more than twenty gestures. Comparatively, infants in the longitudinal study were exposed to twenty gestures and acquired a maximum mean of seven gestures (measured at twenty months). This difference might suggest that the effect of gesture requires a high exposure to gesture, much higher than that of the infants in the longitudinal study.

In sum then, Goodwyn et al. report a significant effect of gesture training, yet when examined it is a somewhat limited and weak effect. It appears that for the most part,

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[16] Those whose expressive communication score (as measured using the PLS 3-UK) was lower than the median score of the sample at baseline assessment when infants were aged eight months.

gesture training had little impact upon infant language development. The cause of the reported effect is also difficult to determine given that the sample contained mothers of different income levels and an unequal number of males and females, therefore the effect could be specific to baby boys only or to those from lower income households. Furthermore, the gestured input was not controlled for, so the amount of gesturing necessary to elicit an effect, though weak, is unknown. Therefore, it is argued that the longitudinal study in this thesis did not detect an overall effect because there was not a strong effect to detect. The effect may be small because it may have only occurred in infants who are more likely than others to benefit more from gesture (i.e. low ability males or low-SES infants).

5.3. Limitations and Constraints

The studies of this thesis were successful in achieving their aims. Nevertheless, it is always important to consider the limitations of any study in order to put the findings into perspective.

The longitudinal study rigorously evaluated the effect of gesturing in a sample of forty mother-infant dyads. Ideally, this study would have had a much larger sample size to enhance the power of the study, however this was not possible in the context of this research programme. As this study aimed to evaluate the effect of gesture training, infants were randomly allocated to four different conditions. This balanced potential contributing factors, including the type of gesture that infants were exposed to and the increased verbal labeling by mothers as a by-product of gesture modeling. The maximum number of infants that a single researcher could manage with repeated testing was forty infants, yielding ten per condition. Each infant was assessed in the home five times over the course of the one-year long study, involving a total of 200 home visits. Adherence to the study by mothers was 100% therefore, despite not having a greater sample size, this study achieved as much as possible in the context of these pragmatic constraints.

One weakness of the longitudinal study is that the sample was not fully representative of the population. All of the mothers who responded to calls for participants were highly educated, high-SES women. Despite the fact that advertisements for participants were distributed widely, e.g. in local libraries, NCT groups and on-line parenting communities, these perhaps still did not reach lower-SES mothers. Furthermore, mothers most inclined to participate were highly educated, motivated to enhance their child's language and had time to commit to a year-long study. All except one of the mothers in the study held a degree, perhaps making them more inclined to cooperate with University research. On the other hand, lower educated mothers (as was the case in the children's centre study) may have felt intimidated about being the subject of a research study.

While this was a biased sample, this sample was representative of those mothers who are most likely to attend Baby Sign classes and to purchase Baby Sign products. Therefore, evaluating whether gesturing had any effect for infants from high-SES backgrounds has real world relevance. As a whole, this sample was not found to benefit from gesture and this has implications for those mothers who purchase Baby Sign. This point is discussed further later on in this chapter.

Because the question remained over the effectiveness of gesture training for lower-SES mothers, who may also be less motivated to take part in research or a language intervention, a further study was conducted in which gesture training was delivered to a low-SES sample in a naturalistic setting.

The research described in Chapter Three is the result of a successful collaboration with local government agencies, led by the researcher to set up a community-based intervention accessible to lower-SES families. The 'Communicating with your baby' sessions were well attended by mothers. The sessions were held at the children's centre that mothers already attended, were free of cost and required little time commitment. The mothers did not seek out a Baby Sign class, nor did they self-select to take part in a university study. These are reasons that make this a desirable sample, as previous research in this area is limited by the fact that samples of mothers are high SES and highly motivated to take part in research (e.g. Goodwyn et al. 2000). These mothers were acknowledged to be a hard-to-reach group and therefore a difficult sample with which to conduct research, and attrition inevitably affected data collection.

Participation in all stages of data collection required mothers to attend the children's centre on a regular basis. However, the mothers were not invested in the research project in the same way that mothers in the longitudinal study (Chapter Two) had committed themselves to a study. Instead, these mothers had agreed to comply with the research as a by-product of being at the centre, so they were not highly motivated to commit to the study. Furthermore, their ability or desire to attend the children's centre would have been influenced by a number of factors outside the control of the research. Issues concerning work, family, childcare and personal concerns are all likely to have contributed to mothers' attendance. Unfortunately, this is a risk difficult to overcome when conducting research with such a sample in an applied setting. However, the emerging findings do suggest that this is a worthwhile project, which stands to make significant social and academic contributions. Future research needs to address how to access this population so that the effects of gesture training for low-SES families can be better understood.

The children's centre study evaluated the language outcomes of gesture training, however the qualitative data from the interviews indicated that it would have been worthwhile to examine the effect of gesture on parental stress. Mothers described how they believed gesturing had improved their relationship with their infants, and in their minds, gesture reduced infant frustration. These mothers expressed little awareness of Baby Sign prior to the study, therefore would presumably have been less aware of the claim that Baby Sign reduces frustration. In retrospect, the evaluation of gesture training would have been improved by including a measure of maternal and infant stress to determine before and after the intervention.

However, a comparison of the stress of mothers in the longitudinal study who had and had not gestured revealed no difference. This does not rule out the possibility of an effect of gesture on stress. These samples of mother-infant dyads differed in their SES and in the effect that gesture had on infant language. Low-SES mothers and their infants have been demonstrated to experience more stress than higher-SES families (Lupien et al 2000). Furthermore, according to the 'Family Stress Model' the relationship between low income and child development is mediated by parental mental health (e.g. Conger et al, 1992, 1993).

Therefore, if the perceived effect of gesture training on reducing stress is an actual effect, it is more likely to be detected in a sample of low-SES mothers who are likely to experience more stress in their role of parents and whose infants are more affected by a gesture intervention. However, the addition of this measure would have involved asking mothers (already reluctant participants) to complete a parental stress index questionnaire on three separate occasions. This would add substantially to what was already being asked of mothers, as they were already completing a number of questionnaires, which may have contributed to the high level of attrition in this sample. Furthermore, the personal nature of the PSI means sensitivity has to be considered. The questions may make mothers feel uncomfortable and that their quality of parenting was being judged. Therefore, as much added value the PSI data would have brought, it could have compounded the issue of attrition.

5.4. How do the Findings Add to What we Know about Language and Gesture in Infancy?

The studies conducted contribute to our understanding of the role of gesture in enhancing mother-infant interaction and the consequences that encouraged gestures has for mothers and babies. The findings will be discussed in the context of the following pertinent questions:

- To what extent can the course of infants' language development be altered by their linguistic environment?
- What's so special about gesture?
- Does gesture type matter?
- Can gestures change mothers' minds?
- Who needs Baby Sign?

5.4.1. To What Extent Can the Course of Infants' Language Development Be Altered by Their Linguistic Environment?

The longitudinal study revealed that, with the exception of a small number of boys, encouraging mothers model target items in gesture and/or speech, did not affect infants' language development. Does this mean that the infants' linguistic environment has little influence on the course of infants' language development? Alternatively, does this indicate that, while the input that infants' receive is important, language learning is constrained and there is a threshold of achievement above which infants' abilities cannot be enhanced?

This taps into one of the most important questions widely debated by psychologists and linguists in the last half century concerning the source of language and the extent to which language-learning capacities reside within the child or are attributable to the infants' linguistic environment. According to socio-cultural accounts of language acquisition, learning occurs in a socio-cultural context in which adults and primary caregivers support or "scaffold" young children to higher levels of thinking and acting (e.g. Tomasello, 1999; Bruner, 1983). This view attaches great importance to the linguistic input that infants receive and research has demonstrated significant relationships between social input and linguistic outcomes. In the extreme case, "Social deprivation, whether imposed by humans or caused by atypical brain function, has a devastating effect on language acquisition" (Kuhl, 2004, p.85). For normally developing infants, the quality and frequency of maternal interaction is related to gains in infant language. For example, the amount of parental speech to which infants are exposed accounts for variation in children's rate of vocabulary growth (Huttenlocher et al. 1991), and infant vocabulary is predicted by the frequency with which mothers encourage attention to the environment (Bornstein & Ruddy, 1984). Mothers modify their speech when addressing young children and the amount of this child-directed speech correlates with child language (Hoff-Ginsberg & Shatz, 1982). Viewing language in this way would suggest that enhancing the input to which infants are exposed would lead to gains in their linguistic output, yet this was not the case for the majority of infants in the longitudinal study.

To what extent then is language driven by the input that infants receive? Features that have been identified to be specific to caregiver speech and mother-infant interaction in western research have been demonstrated to be neither universal nor necessary for language to be acquired (Ochs & Schiefflin, 1995). For instance, mothers from the Kaluli community of New Guinea do not engage in eye contact with their infants, very little language is directed towards the preverbal infant and mothers organise triadic interactions in which their children are orientated away from them and toward a third party and mothers speak for their infants. Yet, in the absence of behaviours deemed important in mother-infant interaction in western society, these Kaluli infants are successful language learners (Ochs & Schiefflin, 1984).

Language can even emerge in the absence of exposure to a useable language model. Deaf children who have not been exposed to sign language have been observed to create their own structured, language-like gesture systems (Feldman, Goldin-Meadow, & Gleitman, 1979). The creation of such a system by children in the absence of input supports the view that language acquisition is innately guided. According to the nativist account of language, the infants' linguistic environment does not contain sufficient information for the infant to inductively learn language,

infants are proposed to be genetically determined to acquire language (Chomsky, 1975).
However, opponents to nativism challenge whether the inborn capabilities are language-specific or domain-general. This is a view championed by Liz Bates, according to whom "Language is a new machine built out of old parts" (Bates & Goodman, 1997). Bates acknowledged both nature and nurture in the language debate and considered how innate mechanisms interact with linguistic input. This view accepts that infant language development can be altered by the linguistic environment, but only within certain boundaries as specified by underlying cognitive maturation.

Let's reconsider the original question: to what extent can the course of infants' language development be altered by their linguistic environment? The stance of Bates is in agreement with the proposition that language learning is constrained and that there is a threshold of achievement over which infants' abilities cannot be enhanced upon. This explains both the finding that, a) contrary to the longitudinal sample, the infants of lower-SES mothers who were encouraged to gesture, did demonstrate a trend for improved language, and b) boys in the longitudinal sample who had low language abilities at the start of the study benefited from gesture.

The lower-SES infants started out with a lower ability compared to that of the higher-SES infants, and gesture improved these infants' language but only insofar as it raised these infants' scores to be equivalent to the scores of their higher-SES peers. The lack of any overall effect for the higher-SES infants of the longitudinal study suggests they were at the threshold of achievement. This threshold is likely to be constrained by more general brain development; "At all levels, language learning is constrained – perceptual, computational, social and neural constraints affect what can be learned, and when" (Kuhl, 2004, p 841). This is supported by research that found a nonlinear effect of SES on infant vocabulary, leading the authors to suggest that there is a threshold effect for language input (Arriaga, Fenson, Cronan & Pethick, 1998).

Gesture training can enhance the linguistic environment when the infants' language ability has the potential to be improved upon and when the quantity and quality of maternal input is less than optimal. Gesture can improve infant language development, but only within the confines of maturational constraints. This is consistent with an emergentist view of language acquisition, in which the interaction between biology and experience represents "two forces as engaged in a complex synergy" (Elman, 1999, p.2).

5.4.2. What's so Special about Gesture?

The vocabulary of infants of low-SES mothers was improved by encouraging mothers to gesture with their infants. Two mechanisms by which gesture may benefit word learning are posed here:

- Gesture enhances mothers' interaction with their infants and this in turn supports infant language development; within-mother effect.
- There is something intrinsic about the act of gesturing that benefits the child during this stage of language learning; within-child effect

These two alternatives will be described and evaluated.

5.4.2.1. Within-Mother Effect of Gesture on Infant Vocabulary

Encouraging lower-SES mothers to gesture with their infants improved their infants' language abilities to a level on a par with those of higher-SES infants. One explanation for this is that the act of gesturing improves the way a mother communicates with her infant. This effect may not be solely attributable to the act of gesturing but to the affiliated communicative behaviours that are enhanced by gesturing.

When mothers were instructed on how to incorporate gestures into their communication with their infants, they were told to seek and maintain eye contact with their infant, to simultaneously repeat the target word slowly alongside the gesture, and to wait for a response from their child. Mothers were encouraged to focus on their infants' verbal and non-verbal communicative attempts and to respond to these, thus engaging in proto-conversations. In this way, gesture training is likely to have enhanced the quality of mother-infant interaction.

Research has not assessed whether maternal communication style is generally enhanced by encouraging mothers to gesture with their infants. Therefore, we can only speculate on how encouraging mothers to augment their communication with gesture may increase these behaviours.

However, if we assume that gesture training does increase the frequency with which mothers engage in these behaviours, this would explain the finding that gesture training differentially affected infants from low and high-SES backgrounds. Maternal interaction is known to be of higher quality and quantity in higher-SES mothers compared to lower-SES mothers (e.g. Hoff, 2003). Therefore, we might assume that the high-SES mothers in the longitudinal study were already effectively communicating with their infants and so the additional gestural communication did not improve the quality of their interaction. Whereas, for lower-SES mothers, who are assumed to engage in less interaction with their infants, gesturing may have encouraged other positive communicative behaviours, such as shared attention.

This explanation assumes that the effect of gesture is not tied to gesture itself, but that it is the by-products of maternal gesturing that infants benefit from. However, if gesture simply acts as a vehicle to generally enhance maternal interaction with her infant, then something else could equally enhance the interaction of lower-SES mothers to make their input equivalent to that of higher-SES mothers. However, the children's centre study controlled for this by including a general communication group in addition to a gesture training group. Mothers in the general communication group attended the same 'Communicating with your Baby' sessions, in which they were instructed on effective ways to interact with and engage young infants to nurture their language in the same way that mothers were in the gesture group. Yet in the absence of simple gesture training, infants of these mothers did not make the same gains in their language, suggesting that it is the gesture component that benefits infants. This may be because encouraging mothers to gesture is a more effective way to elicit positive interactional behaviours more so than simply telling mothers what behaviours are optimal, or because there is something intrinsic to gesture that benefits infants. Infants acquired the gestures and used these to manually label objects and concepts in their world. The way in which this may directly enhance verbal word learning will next be discussed.

5.4.2.2. Within-Child Effect of Gesture on Infant Vocabulary

Encouraging gesture with infants from low-SES backgrounds brought about gains in their vocabulary, suggesting there may be something inherent to the act of gesturing that supports infants word learning. One possibility is that gestures may serve a "boot-strapping" function, allowing infants to communicate about a range of referents in advance of vocal abilities. Gesture provides an opportunity to practice generating particular meanings by hand, at a time when those meanings are difficult to produce by mouth (Iverson & Goldin-Meadow, 2005).

Evidence for gestures bootstrapping language development comes from the longitudinal target data. Despite the fact that, for the majority of the infants in the longitudinal study no effect of gesture was found on vocabulary, the gestures the infants reproduced shed light on how gestures are used by infants in the early stages of language.

Gesture training enabled infants in the longitudinal study to communicate twice as many target items bi-modally than infants in the control condition at 12 and 16 months. By twenty months of age, infants were continuing to use the gestures but their target word production now outnumbered their gesture production. This is consistent with the observation that infants make use of spontaneous symbolic gestures while they need them and drop them as they become efficient word users (Goodwyn & Acredolo, 1988). It is likely that infants in the lower-SES sample would have acquired and used the gestures in the same way as the higher-SES infants, communicating about specific objects and concepts in advance of acquiring the affiliated verbal label. Only a small number of baby boys in the high-SES sample showed gains in their language following gesture, whereas for the rest of the sample, language was already developing at an optimum rate and so gesture did not accelerate their development. Meanwhile the lower-SES infants, like the low ability boys in the longitudinal sample, were in a position where their language could be improved and this is what gesture did for them.

Gestures afford infants some control over their language-learning environment and enable infants to direct the input and shape the nature of the interaction, thus creating an optimal language-learning environment. Infants' gestures initiate joint attention with their caregiver (Moore, Acredolo & Goodwyn, 2001) and elicit verbal labelling (Goldin-Meadow, Goodrich, Sauer & Iverson, 2007). Joint attention provides a rich context for language learning and is an important predictor of language abilities (Achtar, 2005; Tomasello & Farar, 1986). Verbal naming occurs within these episodes of joint attention, scaffolding the infants' matching of verbal label to referent. The frequency of mother and infant joint attention predicts toddlers' subsequent vocabulary (Tomasello & Todd, 1983). Therefore, in lower-SES mother-infant dyads where the level of interaction is less than optimal, equipping infants with gesture means they can draw engage their caregivers in episodes of joint attention. This increase in maternal focus as a product of gesture may serve to promote verbal labelling within these episodes and thus nurture infant word learning.

So, infants' gestures can improve the level of interaction that low-SES infants receive. Does this fully account for the effect of gesture on language, or is there anything special about the gestures themselves that actually helped the infants to learn words? The gestures physically symbolise objects or concepts in the world, and in this way gestures provides a link between the external world and the infant's mental concepts. According to Barsolou (1999) meaning is grounded in action. Conceptual symbols (mental representations of objects and concepts) are built from perceptual symbols and perceptual symbols are formed from visual, auditory, and sensory information, which enriches the concept's meaning. Therefore, gestures embody meaning. The act of gesturing is proposed to provide proprioceptive feedback, which continually reinforces the infants' mental representation. The fact that verbal labels can be accessed via a spatio-motoric route demonstrates this framework of word learning. Pine, Bird & Kirk (2006) found that in childhood, word finding was facilitated by gesture. Because verbal labels can be retrieved via gesture, this supports the notion that sensory and kinesthetic information is encoded alongside verbal information in mental representations. Gesture may support word learning by providing a manual label for a developing mental representation of a concept. The gesture then may act as a placeholder onto which the child can subsequently attach an appropriate verbal label.

This may be the case, yet why would this not benefit all children? While gestures may serve this function, it may be achieved by other routes as well and only a fragment of words are likely to be tied to gesture. For some children whose verbal language is not as strong, gesture may facilitate word learning via this alternative spatio-motoric route. Indeed, in cases where verbal language is difficult we see children utilising gesture more often. For example children with a specific language impairment (SLI) gesture more than typically developing children (Evans et al., 2001; Mansson and Lundstrom, 1996) and their gestures contain more sophisticated information than their speech (Evans et al., 2001). It has been suggested by Evans et al., (2001) that children with SLI represent their knowledge in a format that is more readily accessible to gesture and less readily accessible to verbal expression. Fex and Masson (1998) found similarities between the gesture use of adults with acquired aphasia and the use of gestures by children with SLI, leading them to conclude that gesture acts as a compensatory mechanism when the speech system is impaired. Gestures represent information in a different way to speech. While spoken language is linear and segmented, gestures are global and imagistic (McNeill, 2002) and as such may be easier for some children to access, especially those who have weaker language abilities.

Indeed for such children who have weaker language skills, the challenge of making sense of the verbal input and formulating speech may create a large cognitive load. The ease of gesturing compared to verbal communication may reduce cognitive load and free resources, which can then be expended elsewhere in the child's cognitive system (Goldin-Meadow et al, 2001).

The within-mother and within-child effects of gesture identified here are not necessarily mutually exclusive and are likely to interact to bring about benefits for the infant. Interaction between low-SES mothers and infants may be improved by encouraging mothers to gesture, infants are sensitive to these gestures, and the act of gesturing is beneficial to the infant, because of both how mothers react to these gestures and for how these gestures serve the infants' developing linguistic system. To properly disentangle within-mother from within-child effects, it would be necessary to observe closely how encouraging mothers to gesture changes the way they interact with their infant. This will be discussed further under future research.

5.4.3. Does Gesture Type Matter?

While the main aim of the longitudinal study was to assess the impact of enhanced gesturing on infant language, the inclusion of two gesture training interventions in the longitudinal study meant that the importance of the type of gesture to which the infants were exposed and encouraged to use could be determined. Furthermore, since all the symbolic gestures possessed a high level of iconicity this comparison allowed exploration of the child's sensitivity to iconicity.

There was no significant overall effect of gesture training on language development, and the language scores of infants in both the BSL and the Symbolic Gesture group were similar at all ages. An analysis of the target data indicated that infants did acquire more symbolic gestures than BSL gestures. Infants were not sensitive to iconicity and readily accepted manual labels to which they were exposed. However, rather than revealing a preference of infants for manual labels that are iconic, this is telling us something about the mothers and gestures. Indeed, adults learning signs for the first time are more likely to retain iconic than non-iconic signs in short- and long-term memory (Beykirch, Holcomb, & Harrington, 1990; Lieberth & Gamble, 1991). This was supported by the finding that mothers modeled the symbolic gestures at a higher frequency than the BSL gestures. Furthermore, interviews with mothers revealed they preferred the simple gestures that made sense, i.e. iconic gestures.

This is consistent with previous arguments that have asserted that infants are not sensitive to iconicity (e.g. Bates et al.,1979) supported by findings of deaf children learning sign (Orlansky & Bonvillian, 1984; Morford, Singleton & Goldin-Meadow, 1995) and experimental tests of infants label learning (e.g. Tomasello, Striano & Kochat, 1991; Namy & Waxman, 1998; Namy, Campbell & Tomasello, 1994). Therefore, the findings of this thesis accord with the view of Tomasello, that 'the iconicity in such cases is in the eyes of the adult only and plays very little role in acquisition' (Tomasello, 2003, p. 35).

5.4.4. Can Gestures Change Mothers' Minds?

Qualitative data, reported in Chapters Three and Four, strongly suggests an apparent change in how mothers perceived their infants as a consequence of gesturing. By being preverbal yet able to communicate infants were seen by mothers to be communicative partners who could specify their wants and needs. Since the infants had responded to the mothers' actions, i.e. the mothers modelled the gestures and the infants acquired these gestures, mothers' awareness of the extent of their infants' comprehension abilities was heightened.

Gesture changes maternal perceptions of the infant: is this at the core of the gesture advantage? While the qualitative data point towards changes in mothers' views of their preverbal infants, the quantitative data may also be interpreted to reflect this change. In the children's centre study (Chapter Four) infants of mothers who were encouraged to gesture improved in their vocabulary. This may indicate that gesturing to infants supports their word learning, or it may reflect a change in mother's perception of her child's linguistic competencies. Since vocabulary is assessed via maternal report of the infants' ability, this 'gain' may be as much in perceived ability as actual ability.

How might mothers change their perception and why would this impact upon infants' language? Gesturing with infants encourages mothers to view their young pre-verbal infants as communicative partners. In so doing, they utilise 'maternal mind-mindedness' (MM), defined as a mother's "proclivity to treat her infant as an individual with a mind rather than merely as a creature with needs that must be satisfied" (Meins et al 2001. pg 638). Mind-mindedness has been demonstrated to be a better predictor of infant-mother attachment security than maternal sensitivity (Meins, 1998; Meins et al 2001). Links have been demonstrated between maternal MM and children's later understanding of others' mental states, i.e. theory of mind. (Meins, Fernyhough, Wainwright, Gupta, Fradley & Tuckey, 2002). Parents who gesture with their babies may develop greater MM through viewing the infant as a conscious individual with the ability to express wants, needs and desires.

If gesture exerts its effects by changing a mothers' perception of her infant, this explains why an effect of gesture was found for low-SES mother-infant dyads and not higher-SES dyads. Current research has not reported any SES differences in levels of maternal mind-mindedness, however SES related differences have been demonstrated in how mothers perceive their infants (e.g. Tulkin & Cohler, 1973). Higher-SES mothers have greater belief in their infants' communicative abilities than lower-SES mothers. As such, for the higher-SES mothers in the longitudinal study, gesture training may not have enhanced their level of maternal mind-mindedness to any great degree, whereas it may have enhanced the mind-mindedness of the lower-SES mothers in the children's centre study. Thus, the increase in their child's vocabulary may be attributed to an increase in the mothers' mind-mindedness making her more willing to attribute understanding and communication abilities to her infant.

Therefore encouraging mothers to gesture with their preverbal infants may change mothers' minds, and this may account for linguistic advances and bring about wider socio-emotional benefits for mother and baby.

5.4.5. Who Needs Baby Sign?

This body of research indicates that the demographic of mother-infant dyads who are accessing Baby Sign maybe those need it least. However, those who stand to benefit the most from it do not necessarily have access to it or the financial means to obtain it.

For the high-SES mothers who participated in the longitudinal study, adding gesture to their repertoire of communicative behaviours did little to alter the course of their infants' language development. However, encouraging low-SES mothers to gesture did improve their infants' language. This was with a shorter intervention period compared to the intervention with the high-SES mothers, suggesting the potential strength of this effect. If infants from lower-SES families could benefit from gesture what form should these gestures take, or does it even matter?

The mothers who attended the 'Communicating with your Baby' sessions at the children's centre were trained to use a set of Makaton signs. It could be argued that the effect found is specific to Makaton, and that the reason there was no effect in the longitudinal sample was the absence of Makaton. However, Makaton is a simplified version of BSL. There is a high degree of resemblance between Makaton and BSL and many of the gestures are exactly the same. Therefore, the type of gesture is unlikely to account for the difference. Would the same effect of gesture training have occurred in the children's centre sample if they were trained to use symbolic gestures?

The answer is likely to be yes. Low ability baby boys in the longitudinal study improved in their mean ranking if they were gesture trained, regardless of gesture type. While this finding is limited to a small number of infants, this finding does suggest though it is the act of gesturing that is key, rather than the precise form of the gestures. On the other hand, because the rest of the infants did not benefit from gesture training, this lack of effect cannot be attributed to the type of gesture. Symbolic gestures were no more effective than BSL gestures therefore there is no case to say that there is an optimum form of gesture.

If gesture training exerts the same effects on infants' language, independent of the type of gesture to which infants are being exposed and encouraged to use, who needs Baby Sign? Commercial Baby Sign essentially sells parents a package of predefined gestures to use with their infants. In order to access these Baby Signs, parents need to buy classes, DVDs and books. This research calls into question the necessity of teaching infants a particular form of gesture and as such, the need for programmes for sign-instruction.

However, while the infants may not benefit from Baby Sign, attending Baby Sign classes may fulfil other needs for mothers. The classes are sociable and offer an opportunity for mothers to meet other mothers with infants the same age. Since the classes focus on infant language this provides an arena for mothers to discuss their child's development. The very act of attending a class may also enhance a mothers' sense of efficacy in her role as parent, feeling that she is doing something positive for her child's development may add to her confidence in her interaction with her infant and to her belief that she can contribute to her child's process of change. Therefore, the benefits of being taught gestures may be secondary to the other benefits mothers derive from the classes.

Indeed, mothers spontaneously gesture with their infants without instruction or encouragement to do so. Some mothers gesture more than others and this can give rise to differences in infants' language. Specifically, higher-SES mothers (those most likely to attend Baby Sign) have been demonstrated to produce more gesture types (i.e. pointed at more different tokens) than lower-SES mothers. Infants of mothers who pointed more also produced more gesture types and this was directly correlated with their subsequent vocabulary (Rowe & Goldin-Meadow, 2009). This finding is part of a large body of research that indicates how the quality and quantity of maternal interaction varies as a function of SES and this variation accounts for the relationship between SES and infant language (e.g. Hoff, 2003). As such, the input that high-SES infants are exposed to is not likely to be enhanced by Baby Sign because the literature suggest these mothers are already interacting optimally with their infants.

Although infants from lower-SES families benefit from their mothers' gestures, the type of gesture that mothers produce is not deemed important. In essence, mothers could be encouraged to create their own gestures to use consistently with their infants, circumventing the need to purchase a Baby Sign product.

5.5. Future Research

This research can be developed further to increase our understanding of the effects of enhanced gesture in infancy. Two avenues of empirical exploration are proposed. The first narrows the original research question of this thesis to explore further the advantage that gesture afforded lower-SES infants. The second focuses on elucidating the mechanisms underlying the gesture advantage.

5.5.1. Exploring the Advantage

Encouraging low-SES mothers to gesture with their infants is suggested to enhance infants' language abilities. This finding nominates gesture as an accessible means to improve the communication between mothers and infants and warrants further exploration. The impact of this cannot be underestimated, with infants from low-SES backgrounds entering the school system at a disadvantage to their higher-SES peers (Locke, Ginsborg & Peers, 2002) the need for an effective early language intervention is overdue. As described earlier in this chapter, attrition was an issue with the study involving low-SES mothers. Therefore more research is necessary to establish the reliability of this finding. An intervention should be undertaken with a larger sample of mothers, in which infant language abilities are tracked longitudinally to determine the strength and the persistence of a gesture training advantage. Furthermore, maternal and infant use of gesture should be measured to provide information on the level of gesturing that is required to gain an effect. This would also indicate the extent to which the effects of gesture are within-mother or within-child, i.e. whether gesture helps language by generally enhancing maternal interaction or whether it is the act of gesturing that brings benefits to infants' language.

5.5.2. Exploring the Mechanisms

Further research is necessary to determine the mechanisms by which gesture benefits infant word learning. One possibility is that encouraging lower-SES mothers to gesture globally enhances the quantity and the quality of their interaction with their infants. For the higher-SES mothers in the study, interaction is assumed to already be at an optimum level. The impact of gesture on general interaction can be elucidated by an analysis of the way in which gesture training changes maternal interaction. If gesture training encourages more effective general communication, then we would expect to see an increase in positive behaviours known to nourish language development, including an increase in shared attention (Bakeman & Adamson, 1984) and contingent responses to infants' verbal and nonverbal communicative efforts (Tamis-LeMonda, Bornstein & Baumwell, 2001). Whether any change in maternal interaction is contingent upon infants' gesture production would determine the extent to which the effects of gesture are within-mother, within-child, or represent a dynamic relationship between maternal and infant gesturing.

Further work is needed to elucidate how the social interactional process is effected by encouraging gesture within mother-infant dyads. Comments from mothers revealed how they thought communicating with gesture had changed the way that they interacted with their baby. This thesis speculated that encouraging mothers not only changes interaction but alters the way a mothers perceives her child. Mothers were surprised by their infants' ability to communicate with gestures in advance of speech. Their descriptions of their infants resonated with Meins' notion of maternal mind-mindedness; a mothers' proclivity to treat her infant as an individual with a mind (Meins, 2001). Future research should subject mother-infant interaction to intense scrutiny to understand how maternal interaction alters as a function of encouraging mothers to gesture. Meins (2001) has developed a coding scheme which captures key indicators including maternal responsiveness to change in infant's direction of gaze and infant's object-directed action, imitation, encouragement of autonomy and comments on the infant's mental state, mental processes and emotional engagement. This could be used to determine whether gesture training increases maternal mind-mindedness.

If gesturing with babies can be reliably demonstrated to improve maternal mind-mindedness (MM), then this may in some way account for the positive effect that low-SES mothers' gestures had on infant language. By increasing MM, gesture may have enhanced maternal sensitivity, improved interaction and led to verbal language gains. Furthermore, MM has the potential to produce profound and lasting wider non-linguistic benefits. Mind-mindedness has been demonstrated to be a better predictor of infant-mother attachment security than maternal sensitivity (Meins, 1998; Meins et al 2001). Links have been demonstrated between maternal MM and children's later understanding of others' mental states, i.e. theory of mind. (Meins, Fernyhough, Wainwright, Gupta, Fradley & Tuckey, 2002). Understanding the effect of training mothers to gesture with their preverbal infants will have implications for parents and health care workers as this simple intervention may benefit 'at risk' mothers and infants.

5.6. Final Thoughts

"The Average Child is a fiction, a descriptive convenience"
(Liz Bates, 1995, p26.)

Liz Bates, one of the foremost developmental psychologists of the last century, challenged the assumption inherent in so much research that all children are the same. Infant development is variable and rapid and is the product of innumerable biological, environmental and social factors, plus an infinite number of interactions between these factors. Developmental psychologists keen to quantify development are faced with the difficult task of accounting for the aspects of experience that contribute to the infants' process of change. Nevertheless, we are able to identify key variables that contribute to the development of, if not all, then some children.

Probably the greatest task that infants master is the acquisition of their first language. They do so with apparent ease and skill and quickly become proficient talkers. Infants' gestures are an integral part of this process. The observation that infants' accomplishments in gesture presage verbal milestones prompted the question of whether encouraging infants to gesture would bring on language gains.

This thesis addressed this question, remedying many of the shortfalls of previous research (Goodwyn et al. 2000), and in so doing called into question previous claims that gesturing with infants improves their language abilities. Yet, acknowledging that not all infants are equal, this research highlighted that enhanced gesture can assist the language development of some infants. Infants, who because of biological and/or environmental factors have lower language abilities than their peers, stand to benefit from encouraged gesture in infancy.

The findings suggest the claims made by commercial Baby Sign companies regarding the global linguistic and social benefits need treating with some caution.

Implicit in the Baby Sign promise is that all infants will benefit, however this was not found to be the case. In fact, the mothers who access Baby Sign are more likely to be high-SES mothers who have the motivation, as well as the financial and time resources, available to them. Their infants may need Baby Sign the least, although their mothers may derive other benefits. Infants who stand to benefit the most from Baby Sign, i.e. infants from lower-SES backgrounds are those least likely to access it.

Future research must further explore the use of gesture as a vehicle to encourage the development of healthy interaction in lower-SES mother-infant dyads. Through early intervention, gesture has the potential to reduce the disadvantage that children from lower-SES families face from impoverished language abilities. By changing the course of their early development, encouraged gesture could ultimately bring about lasting benefits.

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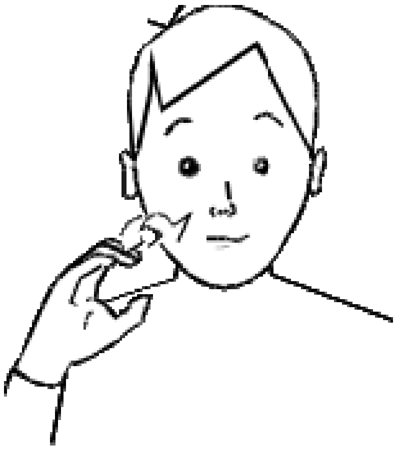
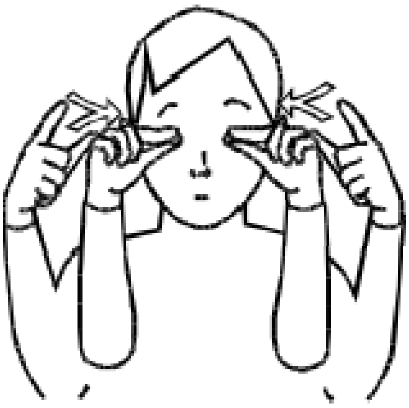
APPENDICES

Appendix A. Illustration of the Target set of BSL gestures

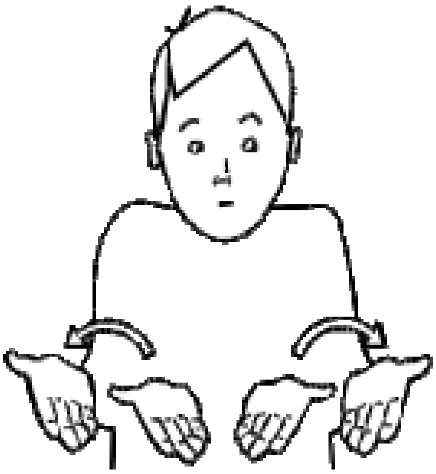


DRINK

HAT



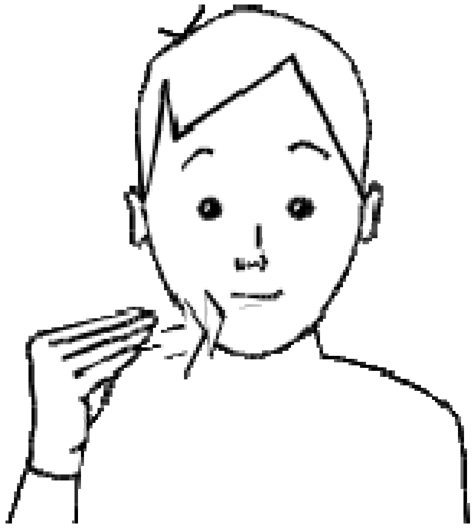
SLEEP



ALL-GONE

HOT

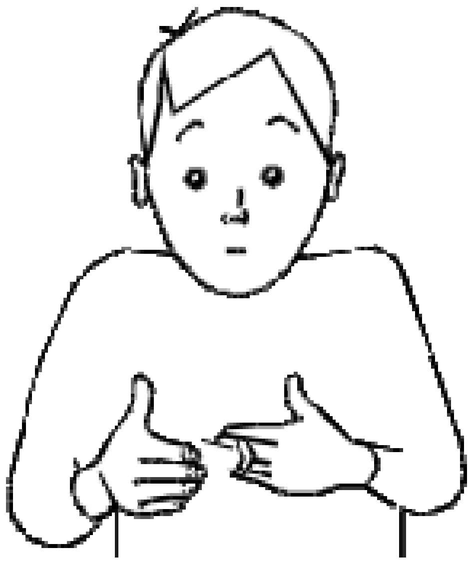
FLOWER



FOOD

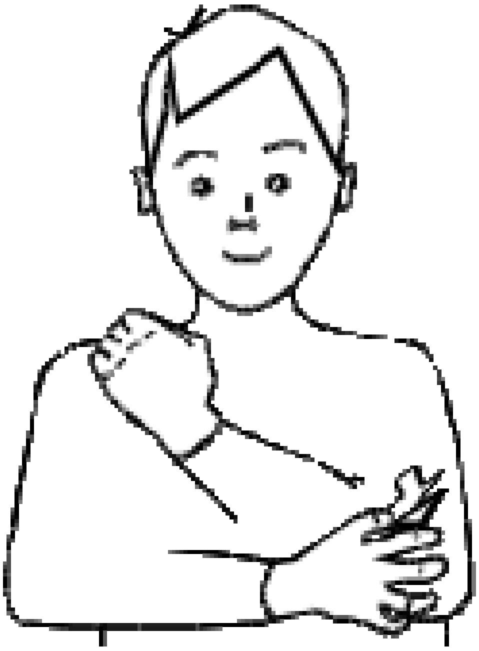
DUCK

WHERE

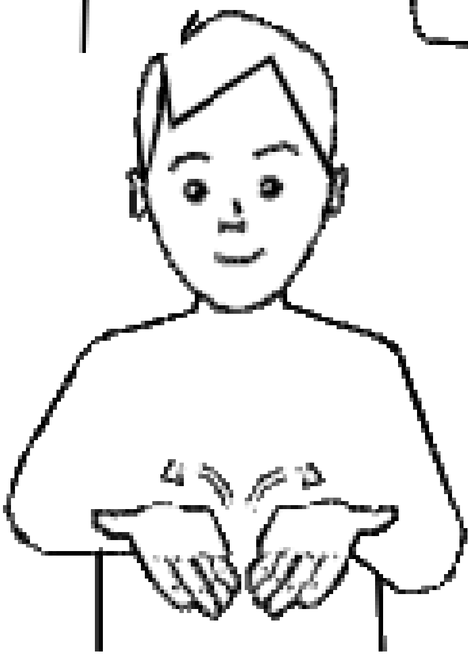


MORE

PAIN

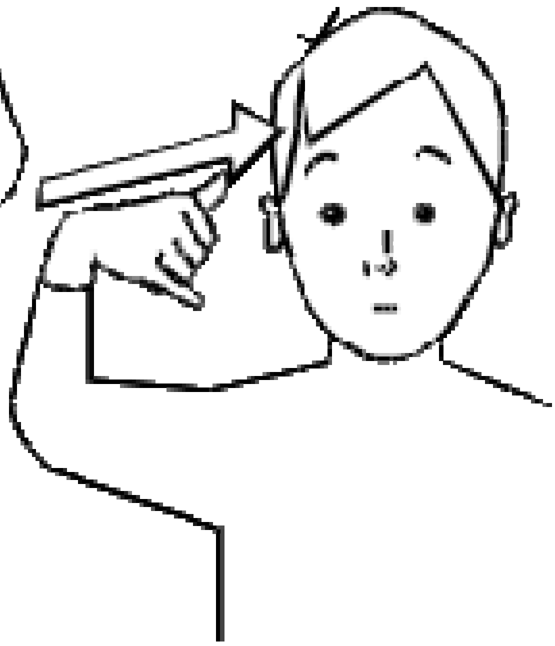


BISCUIT

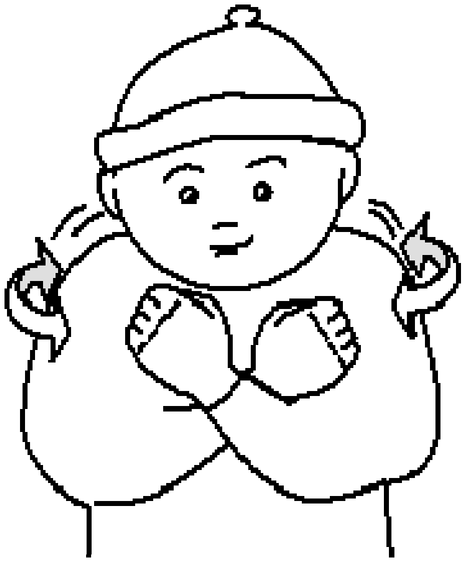


BOOK

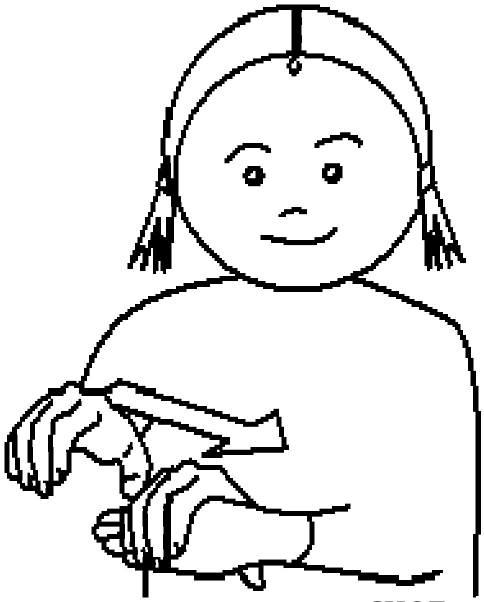
DOG



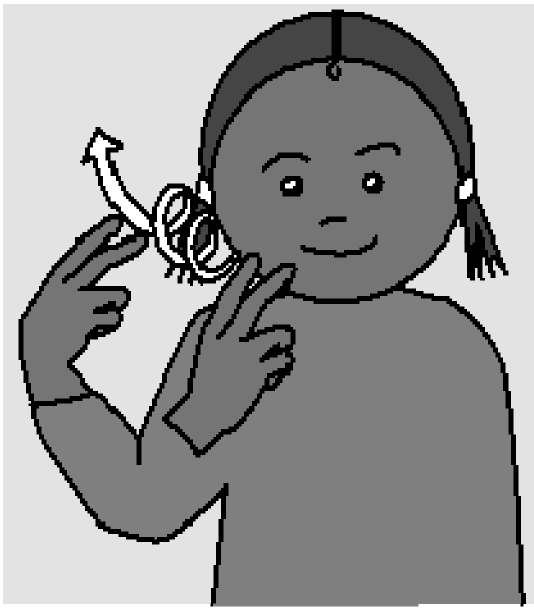
AEROPLANE



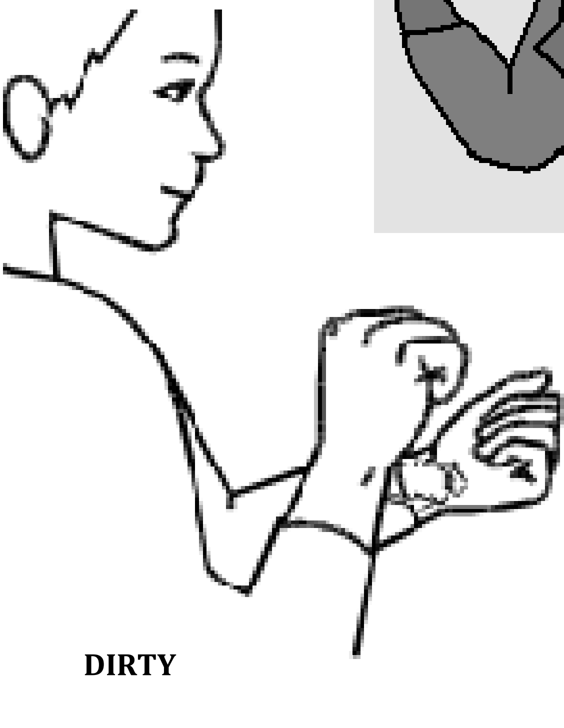
CUDDLE



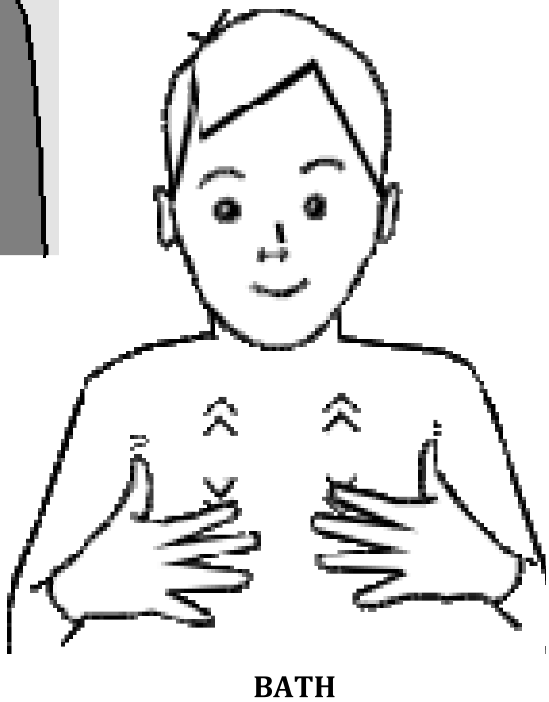
SHOE



SING



DIRTY



BATH

Appendix B. Illustration of the Target Set of Symbolic Gestures[17]

DRINK/BOTTLE
Description:
Thumb to mouth, tilting up
Memory Aid:
Mimics a drinking motion
Possible Situations:
To request a bottle
To request juice or water

HAT/HELMET
Description:
Tapping head with palm of hand
Memory Aid:
Depicts the placement of a hat or helmet
Possible Situations:
To label someone wearing a hat
To ask to put on a hat

FLOWER
Description:
Sniffing (at a distance)
Memory Aid:
Mimics smelling motion
Possible Situations:
To flowers in the garden
To floral patterned fabric

FOOD/EAT
Description:
Fingertips to lips
Memory Aid:
Depicts putting food in mouth
Possible Situations:
To request something to eat
To label food or someone eating

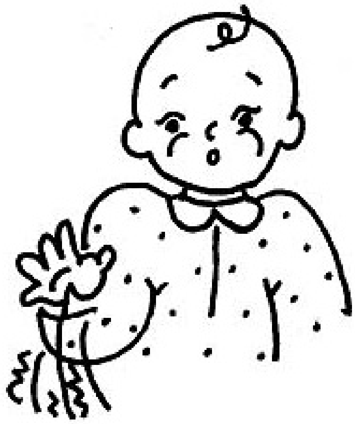
[17] The first ten symbolic gestures are taken from Acredolo and Goodwyn (1997)

WHERE?/I DON'T KNOW
Description:
Palms out at shoulder level and shrug
Memory Aid:
Conventional gesture for "I don't know"
Possible Situations:
To ask where something or someone is
To respond to a question

ALL GONE
Description:
Palm flat, moving back and forth
Memory Aid:
Depicts an empty space
Possible Situations:
To say that food or drink is all gone
To comment that something has gone out of sight

MORE
Description:
Index finger tapping opposite palm
Memory Aid:
Depicts putting something into one's hand
Possible Situations:
Request more food or drink
To ask to do something again (e.g., read another book)

HOT



Description:
Hand out, palm down, retracting
Memory Aid:
Depicts touching something hot
Possible Situations:
To comment on hot food, cooker, bath water, pavement

DUCK

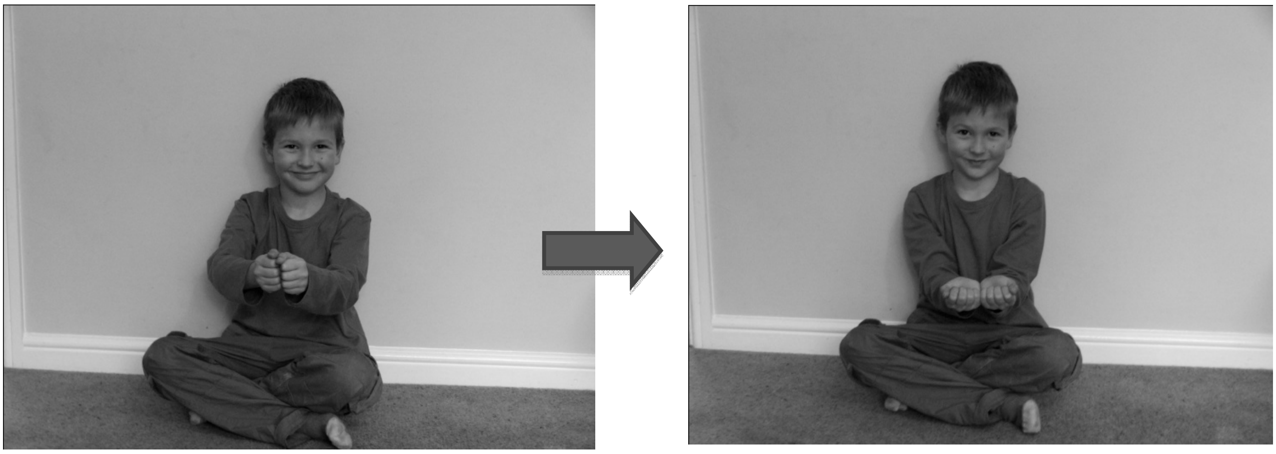
Description:
Fingers to thumb, opening and closing
Memory Aid:
Mimics duck's bill in quacking motion
Possible Situations:
To real ducks in the park
To toys and pictures

SLEEP

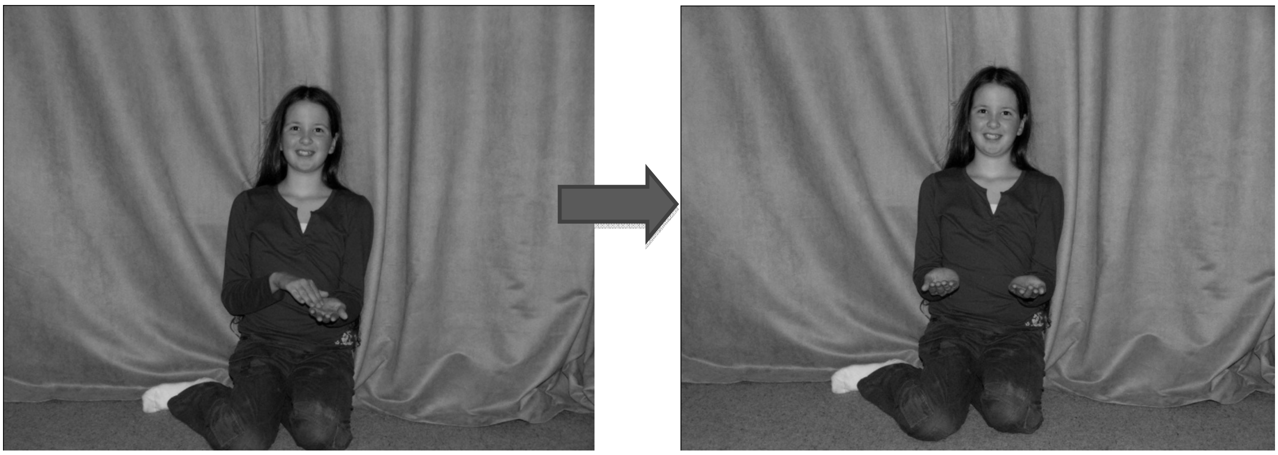
Description:
Palms together to side of cheek
Memory Aid:
Gesture from "Now I Lay Me Down to Sleep"
Possible Situations:
To describe someone sleeping
To request to go to sleep

AEROPLANE

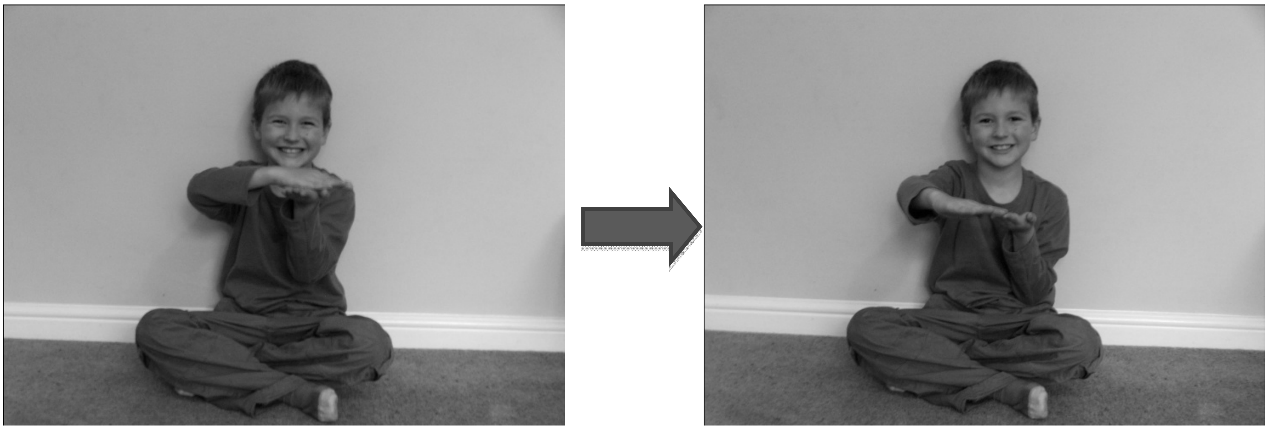
BATH



BISCUIT



BOOK



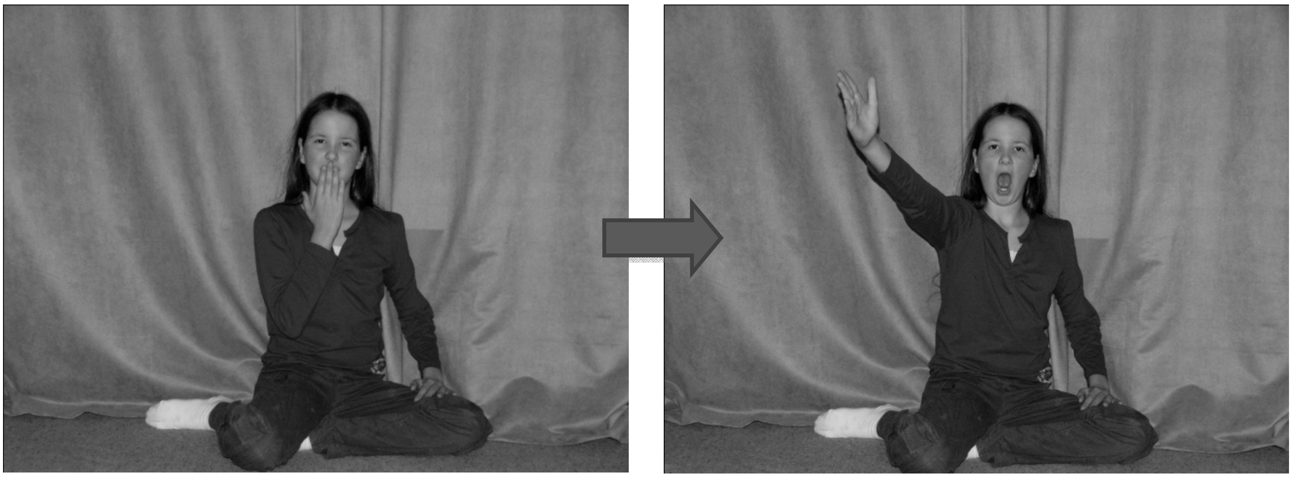
DIRTY

DOG

HUG

PAIN

SHOES



SING

Appendix C. Background Information

Background Information

All information will be kept confidential. Please tick and fill in the blanks where appropriate.

Your name ______________________________

Your child's name__________________________

Date ____________

Does your child have normal vision as far as you know? ❑

Does your child have normal hearing as far as you know? ❑

Is UK English the only language spoken at home? ❑

Has your child had more than five ear infections? ❑

Do you have any other children? If so, please state how many children you have and their ages____

If your child goes to a nursery or a childminder, how many hours in a week does your child spend at the nursery / childminder?

_______ hours

Do you work? ❑

If you do, what's your job title? _____________________________

Can you describe what you do? _____________________________

____

How many hours a week do you work? ____________hours

Are you self-employed? ❑

Do you supervise / manage staff? ❑

Have you any of the following qualifications?

GCSEs or equivalent ❑

(e.g., 'O' Levels, International Baccalaureate, Irish Leaving Certificate, Scottish Highers)

NVQ /BTech ❑ 'A' Levels ❑ Diploma ❑ HND ❑

University degree ❑ PGCE ❑ Masters ❑ PhD ❑

Others ____________________ Professional qualifications ________________________

Does your partner work? ❑

If he/she does, what is his/her job title? ____________________________________

Can he/she describe what he/she does? ____________________________________

How many hours a week does he/she work? _______________hours

Is he/she self-employed? ❑

Does he/she supervise / manage staff? ❑

Does your partner have any of the following qualifications?

GCSEs or equivalent ❑

(e.g., 'O' Levels, International Baccalaureate, Irish Leaving Certificate, Scottish Highers)

NVQ /BTech ❑ 'A' Levels ❑ Diploma ❑ HND ❑

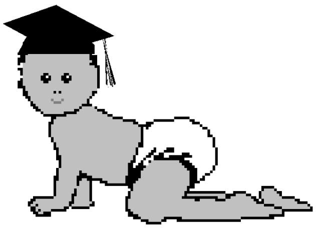
University degree ❑ PGCE ❑ Masters ❑ PhD ❑

Others ____________________ Professional qualifications ________________________

Thank you for your help.

Appendix D. Oxford Communicative Developmental Inventory

OXFORD UNIVERSITY BABYLAB
Communicative Development Inventory
- A UK adaptation of the MacArthur CDI * -



Dear parent,

The following is a list of words that are typical in children's vocabulari

For words that your child **understands but does not yet say**, place a mark in the first column, labelled "**U**".

	U	U/S
crocodile	●	○

For words that your child **understands and also says,** place a mark in the second column, labelled "**U/S**".

	U	U/S
crocodile	○	●

If your child uses a different pronunciation of a word (e.g., 'bickie' for biscuit, or 'telly' for television) - mark the word anyway.

Occasionally we list two alternative forms - please **underline** the one your child understands and/or produces.

	U	U/S
pool/pond	○	●

Please fill in the whole circle exactly as shown above, do not just tick or partly fill the circle.

correct marking - ●   incorrect markings - ✔ or ⊙

This inventory is a comprehensive "catalogue" of words that are used by many different children across a wide age range, so do not worry if your child knows only a few of them at the moment!

If you have any additional comments or information that you think we should consider, please add these at the end of this inventory.

Thank you very much!

* For information and original copies of the MacArthur CDI, please contact the Developmental Psychology Lab, San Diego State University, San Diego, CA 92182, USA.

OXFORD UNIVERSITY BABYLAB

Communicative Development Inventory

Your name: …………………………

Child's name: ……………………… Male/female: ………………

Birth date of child: …..../……/…… Today's date: …../……./…….

Subject code

……………..

Animal sounds	U	U/S		U	U/S
baa baa	O	O	ouch	O	O
choo choo	O	O	quack	O	O
cockadoodledoo	O	O	uh oh	O	O
grr	O	O	vroom	O	O
meow	O	O	woof	O	O
moo	O	O	yum	O	O

Animals	U	U/S		U	U/S
animal	O	O	horse	O	O
bear	O	O	kitten	O	O
bee	O	O	lamb	O	O
bird	O	O	lion	O	O
bunny / rabbit	O	O	monkey	O	O
butterfly	O	O	mouse	O	O
cat	O	O	owl	O	O
chicken	O	O	penguin	O	O
cow	O	O	pig	O	O
deer	O	O	pony	O	O
dog	O	O	puppy	O	O
donkey	O	O	sheep	O	O
duck	O	O	spider	O	O
elephant	O	O	squirrel	O	O
fish	O	O	tiger	O	O
frog	O	O	turkey	O	O
giraffe	O	O	turtle	O	O
goose	O	O			

Vehicles	U	U/S		U	U/S
aeroplane / plane	O	O	bus	O	O

bicycle / bike	O	O	car	O	O
boat	O	O	fire engine	O	O
lorry / truck	O	O	pushchair/buggy	O	O
motor-bike	O	O	train	O	O
Toys	U	U/S		U	U/S
ball	O	O	doll	O	O
balloon	O	O	pen	O	O
block / brick	O	O	teddy bear	O	O
book	O	O	toy	O	O
bubble	O	O			

Food and Drink	U	U/S		U	U/S
apple	O	O	food	O	O
banana	O	O	ice cream	O	O
biscuit	O	O	jam	O	O
bread	O	O	juice	O	O
butter	O	O	meat	O	O
cake	O	O	milk	O	O
carrot	O	O	orange	O	O
cereal	O	O	pasta / spaghetti	O	O
cheese	O	O	peas	O	O
chicken	O	O	pizza	O	O
chips	O	O	sweets	O	O
coffee	O	O	tea	O	O
drink	O	O	toast	O	O
egg	O	O	water	O	O
fish	O	O			

Body Parts	U	U/S		U	U/S
arm	O	O	hair	O	O
belly button / tummy button	O	O	hand	O	O
cheek	O	O	head	O	O
ear	O	O	knee	O	O
eye	O	O	leg	O	O
face	O	O	nail	O	O
finger	O	O	nose	O	O
foot	O	O	toe	O	O
tongue	O	O	tummy	O	O
tooth	O	O	mouth	O	O

Clothes	U	U/S		U	U/S
bib	O	O	dress	O	O
boot(s)	O	O	glasses / specs	O	O
button	O	O	hat	O	O
coat	O	O	jacket	O	O

Clothes	U	U/S		U	U/S
jeans	O	O	shoe	O	O
jumper / sweater	O	O	shorts	O	O
nappy	O	O	sock	O	O
necklace	O	O	trousers	O	O
pyjamas	O	O	zip	O	O
shirt	O	O			

Furniture and Rooms	U	U/S		U	U/S
bath / bathtub	O	O	living room	O	O
bathroom	O	O	play pen	O	O
bed	O	O	potty	O	O
bedroom	O	O	refrigerator / fridge	O	O
chair	O	O	rocking chair	O	O
cooker / stove / oven	O	O	settee / sofa	O	O
cot	O	O	sink	O	O
door	O	O	stairs	O	O
drawer	O	O	table	O	O
garage	O	O	TV / television	O	O
high chair	O	O	window	O	O
kitchen	O	O			

Outside	U	U/S		U	U/S
beach	O	O	outside	O	O
bucket	O	O	park	O	O
church	O	O	party	O	O
flower	O	O	pool	O	O
garden	O	O	rain	O	O
house	O	O	school	O	O
moon	O	O	shop	O	O
sky	O	O	swing	O	O
slide	O	O	tree	O	O
snow	O	O	wall	O	O

spade	O	O	water	O	O
star	O	O	work	O	O
stone	O	O	zoo	O	O
sun	O	O			

Household items	U	U/S		U	U/S
bin	O	O	bowl	O	O
blanket	O	O	box	O	O
bottle	O	O	broom	O	O

Household items U U/S U U/S

brush	O	O	paper	O	O
clock	O	O	penny	O	O
comb	O	O	picture	O	O
cup	O	O	pillow	O	O
dish	O	O	plant	O	O
dummy	O	O	plate	O	O
fork	O	O	purse	O	O
glass	O	O	radio	O	O
hammer	O	O	rubbish	O	O
hoover / vacuum	O	O	scissors	O	O
jug	O	O	soap	O	O
key	O	O	spoon	O	O
lamp	O	O	telephone	O	O
light	O	O	toothbrush	O	O
medicine	O	O	towel	O	O
money	O	O	watch	O	O
mug	O	O			

People	U	U/S		U	U/S
aunt	O	O	girl	O	O
baby	O	O	grandma	O	O
boy	O	O	grandpa	O	O
brother	O	O	lady	O	O
child	O	O	man	O	O
daddy	O	O	mummy	O	O
doctor	O	O	nanny	O	O
friend	O	O	people	O	O
person	O	O	teacher	O	O
policeman	O	O	uncle	O	O
sister	O	O			

Games and Routines	U	U/S		U	U/S
bath	O	O	no	O	O
breakfast	O	O	pat-a-cake	O	O
bye bye	O	O	peekaboo	O	O
dinner	O	O	please	O	O
don't	O	O	shh / hush / shush	O	O
hello	O	O	tea	O	O
hi	O	O	thank you	O	O
lunch	O	O	wait	O	O
nap	O	O	want to	O	O
night night	O	O	yes	O	O

Action Words	U	U/S		U	U/S
bite	O	O	know	O	O
blow	O	O	like	O	O
break	O	O	look	O	O
bring	O	O	love	O	O
bump	O	O	make	O	O
call	O	O	open	O	O
carry	O	O	play	O	O
catch	O	O	pull	O	O
clean	O	O	push	O	O
cry	O	O	put	O	O
cuddle	O	O	read	O	O
cut	O	O	ride	O	O
dance	O	O	run	O	O
draw	O	O	say	O	O
drink	O	O	scratch	O	O
drive	O	O	see	O	O
drop	O	O	show	O	O
eat	O	O	shut / close	O	O
fall	O	O	sing	O	O
feed	O	O	sleep	O	O
find	O	O	smile	O	O
finish	O	O	splash	O	O
get	O	O	stop	O	O
give	O	O	swim	O	O
go	O	O	swing	O	O
have	O	O	take	O	O
hear	O	O	tell	O	O
help	O	O	throw	O	O

hit	O	O	tickle	O	O
hug	O	O	walk	O	O
hurry	O	O	wash	O	O
jump	O	O	watch	O	O
kick	O	O	wipe	O	O
kiss	O	O	write	O	O

Descriptive Words	U	U/S		U	U/S
all gone	O	O	clean	O	O
asleep	O	O	cold	O	O
bad	O	O	dark	O	O
big	O	O	dirty	O	O
blue	O	O	dry	O	O
broken	O	O	empty	O	O
careful	O	O	fast	O	O

Descriptive Words	U	U/S		U	U/S
fine	O	O	old	O	O
gentle	O	O	pretty	O	O
good	O	O	red	O	O
green	O	O	sad	O	O
happy	O	O	scared	O	O
hard	O	O	sick	O	O
hot	O	O	sleepy	O	O
hungry	O	O	soft	O	O
hurt	O	O	thirsty	O	O
little	O	O	tired	O	O
nasty	O	O	wet	O	O
naughty	O	O	yellow	O	O
nice	O	O			

Question words	U	U/S		U	U/S
how	O	O	where	O	O
what	O	O	who	O	O
when	O	O	why	O	O

Time	U	U/S		U	U/S
day	O	O	now	O	O
later	O	O	today	O	O
morning	O	O	tomorrow	O	O

night	O	O	tonight	O	O

Pronouns	U	U/S		U	U/S
her	O	O	my	O	O
his	O	O	that	O	O
I	O	O	this	O	O
it	O	O	you	O	O
me	O	O	your	O	O
mine	O	O			

Prepositions	U	U/S		U	U/S
away	O	O	on	O	O
back	O	O	out	O	O
down	O	O	there	O	O
in	O	O	under	O	O
inside	O	O	up	O	O
off	O	O			

Quantifiers	U	U/S		U	U/S
all	O	O	not	O	O
again	O	O	other	O	O
another	O	O	same	O	O
more	O	O	some	O	O
none	O	O			

Extra words	U	U/S		U	U/S
chase (action)	O	O		O	O
smell (action)	O	O		O	O
	O	O		O	O
	O	O		O	O
	O	O		O	O
	O	O		O	O

Additional Questions:
Does anyone speak to your child in a language other than English (if so, which language)?
Has your child ever had any hearing problems, including glue ear?
Was your child born more than six weeks premature?
Thank you for your help. If you have any further comments, please write them below.

Part B: Gestures, actions and pretend play

This is a comprehensive checklist of communicative gestures, actions and pretend play used by children between 10 and 30 months. Do not worry if some sections do not apply to your child at this time.

For each action/gesture please indicate whether your child: never, seldom or often uses the action/gesture by ticking the appropriate box.

Please feel free to add information in the comments box next to each item if required (for example if your child consistently uses a different gesture than the example given to mean ‘Hot’ please describe your child’s gesture).

If you have noticed your child using a word alongside a gesture please indicate the word in the comments box, along with the context and how regularly you have noticed this. (For example, if your child points to an item (e.g. milk) while saying a word or words (e.g. more) you would write in the ‘point’ comment box points while saying milk to request

Please also add any other gestures your child uses to communicate, along with their meaning in the space at the end of the checklist.

Conventional or Social gestures	**Never**	**Seldom**	**Often**	**Comments**
Waves ‘bye-bye’ on his/her own when saying goodbye				
Hold out his/her arms to be picked up				
Blows kisses				
Shakes head no				
Nods head yes				
Hold finger to lips to say ‘Shhh’				
Requests something by extending arm while opening and closing hand				
Smacks lips in ‘yum yum’ gesture when something tastes nice				
Makes face to indicate ‘yuck’				
Shrugs to indicate ‘don’t know’				
Holds hand up and out to indicate ‘all gone’ or ‘where’s it gone?’				
Beckon with finger or hand				
Uses ‘Thumbs up’ gesture				
Uses ‘high 5’ gesture				

Indicating gestures	**Never**	**Seldom**	**Often**	**Comments**
Holds out an object to show you				

Offers an object to you				
Indicate a place using hand or arm				
Point with index finger to show you an interesting object or event				
Games and routines	**Never**	**Seldom**	**Often**	**Comments**
Plays Pat-a-cake				
Plays peekaboo				
Plays chasing games				
Sings				
Dances				
Joins in with ‘incy-wincey-spider’				
Join in with this little piggy				
Join in with round-and-round-the-garden				
Join in with ‘the wheels on the bus’				
Any other similar games?				

Playing parents using doll/teddy	**Never**	**Seldom**	**Often**	**Comments**
Put ‘baby’ to bed				
Cover with blanket				
Feed baby				
Brush/comb babies hair				
Burp baby				

Push baby in pushchair/pram				
Rock baby				
Kiss/hug baby				
Wash baby				
Talk to baby				
Dress baby				
Change babies nappy				
Imitating adults: does your child…	**Never**	**Seldom**	**Often**	**Comments**
Sweep with mop/broom				
Put key in door/lock				
Pound with hammer				
Attempt to use saw				
Attempt to use other tools				
‘Type’ at typewriter/keyboard				
‘Read’ book				
Vacuum				
Water plants				
‘drive’ car using steering wheel				
Wash dishes				
Dust using duster				
Dig with shovel				
Put on glasses				
Write with pencil/crayon				
Play musical instrument				
Pretend to cook				
Iron clothes				
Shop				
Play doctors				

Symbolic gestures (gestures your child uses to stand for words)	**Never**	**Seldom**	**Often**	**Comments**
Eyes closed, hands together under head to indicate sleepy/sleeping				
Hold hands wide apart to indicate 'big'				
Hold hands close together/fingers close together to indicate 'small'				
Blow to show an object is hot				
Make 'snaking' hand gesture for snake				
Consistently use any other gestures to stand for specific words (describe below):				

Please describe any other gestures you have noticed your child using	Seldom	Often	Comments

Please describe any gesture word pairings you have seen your child use	Seldom	Often	Comments

Appendix F. Pre-school Language Scale-3 UK Sample Score Sheet

Sample page from the Pre-school Language Scale-3 UK. The Psychological Corporation, Zimmerman, Steiner and Pond [1996]

Starting point: Begin testing at the age level one year below the child's chronological age. Exceptions: Begin with task 1 for children under 1 year, 6 months. Begin with task 37 for children over 5 years, 11 months.
To score: Mark "✓" (correct response), "–" (incorrect response) or "NR" (no response) in the blanks. Pass criteria for numbered tasks are shown in parentheses below the task stimulus. Score "1" in the box if the pass criterion is met; score "0" if the pass criterion is not met.
Baseline: Three consecutive "1" scores prior to the first "0" score. (See manual if double baseline obtained.)
Ceiling: Five consecutive "0" scores.

Note: Items with an asterisk (*) can be scored as a "1" if you observe the child performing the behaviour spontaneously.

0 – 0 to 0 – 5 (Birth to 5 months)

Auditory Comprehension

1. * Looks intently at a speaker ____
(Pass: Watches the speaker's face during play)

2. Reacts to the sound of kitchen foil
Materials: Kitchen foil
Keep the foil out of the child's reach _____
(Pass: Reacts to the sound of foil)

3. * Turns head to locate the source of sound ______
(Pass: Turns head to locate any sound)

4. Discriminates one sound from another ______
Materials: Kitchen foil, keys
(Pass: After getting used to and ignoring the foil, reacts to the keys)

Expressive Communication

1. * Vocalizes a variety of pleasure and displeasure sounds
Pleasure: laughs ___ gurgles ___ giggles ___ squeals ___
chuckles ___ other: ___
Displeasure: cries: ___ screams ___ fusses ___
other: ___
(Pass: Vocalizes a minimum of two pleasure or displeasure sounds)

2. * Vocalizes when talked to (vocal contagion) _____
(Pass: Responds to speech by vocalizing)

3. * Laughs
Materials: Teddy
Tickle or play with the child ___
(Pass: Smiles and makes any sound showing pleasure)

4. * Engages in solitary vocal play ___
(Pass: Coos or babbles)

0 – 6 to 0 – 11 (6 to 11 months)

Auditory Comprehension

5. Anticipates an event or a signal
Materials: Teddy
Repeat four times: **"Teddy's going to kiss the baby!"** Move Teddy towards the child. **"Kiss the baby!"** ____
(Pass: Anticipates Teddy's movement)

6. Follows line of regard (joint attention)
Materials: Teddy
Walk Teddy across the table. **"Teddy's going for a walk."**
Drop Teddy off the edge. **"Uh-oh!"**
Look over the edge. **"Is Teddy over there?"** ___
(Pass: Follows your gaze when you look *away* from where Teddy disappeared)

7. * Responds to "No" ____
Materials: Ball
(Pass: Withdraws or pauses before reaching for ball when you say **"No"**)
Note: Observe the child's response to **"No"** if the child's caregiver happens to tell the child **"No"** spontaneously during the testing.

8. * Understands a specific word or phrase (other than "No") ____
Write the word or phrase here:
___
(Pass: Responds to a specific word or phrase)

Expressive Communication

5. * Combines sounds to form syllables ___
Write examples below:
___
(Pass: Produces two different sound combinations)

6. * Approximates sounds made by another person ___
(Pass: Vocalizes similar sounds when someone vocalizes to him/her)

7. * Communicates nonverbally, using gestures or pushing and pulling behaviours ____
(Pass: Spontaneously gestures without a model from you or the caregiver; pushes or pulls someone to communicate a message)

8. * Produces at least four different consonant-like sounds _____
Write the sounds produced below:
___
(Pass: Produces four or more different consonant-like sounds)

Appendix G. Parental Stress Index Questionnaire (Sample Page)[18]

1. When my child wants something, my child usually keeps trying to get it.
2. My child is so active that it exhausts me.
3. My child appears disorganized and is easily distracted.
4. Compared to most, my child has more difficulty concentrating and paying attention.
5. My child will often stay occupied with a toy for more than 10 minutes.
6. My child wanders away much more than I expected.
7. My child is much more active than I expected.
8. My child squirms and kicks a great deal when being dressed or bathed.
9. My child can be easily distracted from wanting something.
10. My child rarely does things for me that make me feel good.
11. Most times I feel that my child likes me and wants to be close to me.
12. Sometimes I feel my child doesn't like me and doesn't want to be close to me.
13. My child smiles at me much less than I expected.
14. When I do things for my child, I get the feeling that my efforts are not appreciated very much.

For statement 15, choose a response from choices 1 to 4 below.

15. Which statement best describes your child?
    1. almost always likes to play with me
    2. sometimes likes to play with me
    3. usually doesn't like to play with me
    4. almost never likes to play with me

For statement 16, choose a response from choices 1 to 5 below.

16. My child cries and fusses:
    1. much less than I had expected
    2. less than I expected
    3. about as much as I expected
    4. much more than I expected
    5. it seems almost constant
17. My child seems to cry or fuss more often than most children.
18. When playing, my child doesn't often giggle or laugh.
19. My child generally wakes up in a bad mood.
20. I feel that my child is very moody and easily upset.
21. My child looks a little different than I expected and it bothers me at times.
22. In some areas, my child seems to have forgotten past learnings and has gone back to doing things characteristic of younger children.
23. My child doesn't seem to learn as quickly as most children.
24. My child doesn't seem to smile as much as most children.

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[18] Sample from the Parental Stress Index, Abidin (1995). Psychological Assessment Resources, Inc.

Appendix H. Overview of Communicating with your Baby Sessions

Session One: How do babies communicate?

Introduction

Singing:	Hello Song
	Wind the Bobbin up
Discussion topic:	How is your baby communicating?
Singing:	Twinkle twinkle
	Goodbye song
Key words/signs:	Drink. Food, Sleep/Bed.

Session Two: Responding to babies

Singing:	Hello Song
	Row your boat
Discussion topic:	Responding to your baby
	Focus on imitation, turn-taking and playing
	Communicating in everyday routines (e.g. meal time)
Singing:	Old MacDonald
	Goodbye song
Key words/signs:	More, Mummy, All-gone/Finished.

Session Three: Music, rhythm and rhyme

Singing:	Hello Song
	Round and round the garden
Discussion topics:	Music, rhythm and rhyme
	Games
Singing:	This is the way we…
	Goodbye song
Key words/signs:	Bath, Ball, Teddy

Session Four: Books

Singing:	Hello Song
	Five little ducks
Discussion topic:	Looking at books together
	Toys
Singing:	If you're happy and you know it
	Goodbye song
Key words/signs:	Book, Car, Duck

Appendix I. Communication Checklist

Communicating With Your Baby
General Questionnaire

Your name: ……………………………………….. Today's date: ………………………………………………

Babies' name: …………………………………… Babies' date of birth: …………………………………

The purpose of this short questionnaire is to find out a bit more about how parents and their babies communicate with one another. I would be really grateful if you would fill this in. This is not a test and no judgement will be made about you or your baby. I'm just interested in finding out the different ways in which parents communicate with young babies and how often.

Below are 12 statements about different activities. Please read each statement and for each one circle the comment that best describes how often you do each activity.

I sing songs and rhymes to my baby	Rarely or Never	Every couple of days	At least once a day	A few times a day
I copy the sounds that my baby makes	Rarely or Never	Every couple of days	At least once a day	A few times a day
We look at books together	Rarely or Never	Every couple of days	At least once a day	A few times a day
I tell my baby what things are called	Rarely or Never	Every couple of days	At least once a day	A few times a day

I talk to my baby about what I'm doing during everyday routines (For example washing and getting dressed)	Rarely or Never	Every couple of days	At least once a day	A few times a day
I use actions as well as words when I talk to my baby	Rarely or Never	Every couple of days	At least once a day	A few times a day
We play with toys together	Rarely or Never	Every couple of days	At least once a day	A few times a day
I make up games to play with my baby	Rarely or Never	Every couple of days	At least once a day	A few times a day
I sing action songs with my baby (e.g. wind the bobbin up, incey wincey spider)	Rarely or Never	Every couple of days	At least once a day	A few times a day
We dance to music together	Rarely or Never	Every couple of days	At least once a day	A few times a day
I point at what I want my baby to look at	Rarely or Never	Every couple of days	At least once a day	A few times a day
I repeat myself when talking to my baby	Rarely or Never	Every couple of days	At least once a day	A few times a day

Please could you write down here the ways in which your baby communicates with you.
For example, how does your baby get your attention? How does your baby tell you what they like and what they don't like?
How does your baby share things with you?

My baby communicates with me by:

Thank you for taking the time to fill this out.

Liz

Appendix J. Sample Transcripts of Interviews With Mothers in the Longitudinal Study

Interview 9

Mother's Age: 35
Infant Gender: Male
Infant Condition: BSL
Siblings: One brother, aged three.

Ok so [mother name] before we started the study had you heard about Baby Sign?

Yes I had

What did you know about it?

I suppose I knew more about it in terms of the classes and I thought it was quite a middle class kind of mum thing to do with their child, I didn't know of any classes round here, I don't think I would have done it, But erm yeah I'd just heard about it and since having children really

Why don't you think you would have done it?

Erm because I suppose I always….. I never really thought there would be any advantage to doing it. I kind of feel like I talk to my children quite a lot anyway and language will come naturally. Erm never really noticed any frustration in my older son, you know in terms of erm well I suppose I didn't associate it as something that I think Baby Sign would have helped with erm obviously kids between one and two do tend to get quite frustrated but I didn't feel knowing the odd sign would be that helpful, I thought gestures or whatever would help as much as being able to sign

Yep ok, so when we started the study, you started to use some of the signs, did you have any expectations of how it would effect [child name] or you communicating with [child name]?

I didn't really have very many expectations of it helping, I think I did notice that it did help with certain words

Ok

You know they were obviously words that I was focusing on more with him but I think that I was quite surprised that he did do things like, drink and all-gone and aeroplane before he would you know be able to say those words and he got a lot of pleasure out of using those signs

Oh really, so he enjoyed using them?

Yes I definitely think he very much enjoyed using the ones that we've kind of naturally used more. I think you know he kind of chose which ones I focused on in the end you know

How long before saying the word did he use the signs for things like all-gone and aeroplane?

How long after I started using them?

After [child name] did the signs did he then start to say the word?

Erm some of them I noticed that he said about the same time, so just was a bit like the all-gone is a good example, that I just noticed that he did all-gone when he started saying all-gone, so it wasn't before, but certain words that I think are more difficult, like aeroplane erm he's definitely does the sign and the noise. Instead of saying the word he's only just getting to the point where he says plane after but so he's had kind of three months of being able to indicate it to me without actually using the word which I think he's really enjoyed

Erm how easy or difficult did you find it to start using the signs?

Erm I think I found it fairly difficult, I haven't got a very good memory for things like that and I did find in the early days I kept having to go back to the book and remind myself erm and that's why I think naturally some of the more abstract ones I haven't you know, its been the more concrete words

Like drink and food

Yeah, things like where and things I imagine they would be very useful but I just couldn't remember them

They just didn't stick

Just didn't stick and I think maybe if I hadn't, if I'd done this with my first child and had more time I would have been able to concentrate a bit more but you know usually I'm dealing with two kids at the same time, and I think that probably meant that I've had less time and energy to focus on this and only the ones that really did come very naturally are the ones I've ended up using

Erm, how did your family feel about you using the signs?

Absolutely fine, but not interested
(both laugh)

so dad didn't use them?

No, no he didn't
And it was interesting because dad hasn't really noticed me using them either and I think probably that's because I've incorporated ones that are a bit more logical so maybe I would have used those signs anyway

Yep, so ones that are quite natural like all-gone

Yes and aeroplane, you know I suppose [husband name] does do a little bit of that with [child name] but he's taken the lead from [child name] so now [child name] does that he does that too, but he certainly wasn't interested in sitting down and looking at the book and I think you know, he's not here through the week and at the weekend I suppose you don't want to concentrate on things you have to do you want to just enjoy

Yes enjoy them

And erm I'm surprised that tom didn't get more interested but he hasn't really

Did [older brother] do any of the signs

No I don't think he has, erm again, because I think he's seen [child name] do things like aeroplane he knows what he's doing and he might do it occasionally but erm certainly not things like all-gone he hasn't but then maybe that's because that's a bit more natural he hasn't kind of even noticed us doing it, but no there certainly hasn't been an overwhelming interest in it, [name] who looks after [child name] has tried to learn the signs that [child name] uses as well, so erm she's done a little bit, she'll try and use the ones she's [picked up from me when she has him on those days

Oh that's great. Erm you've mentioned some of the advantages that you've seen from [child name], the fact that he could communicate some words to you before he could say them, would you say there has been any other advantages

Erm I think, I think the main advantage of it and I you know I do a fair amount of this anyway, but I think it improves interaction, mother-child interaction, I definitely think its made me take time to take a step back and think about getting his eye contact, and engaging him and I think it's a very useful tool for that and I definitely think if you're a mother that rushes around and doesn't settle down and play its

It reminds you

It's a reminder to do that so erm I think, I didn't really consider that before I started it, you know I thought it was something a bit like teaching your children to read early, something that was a bit unnatural, that's how it struck me before I started, that it was one of these kind of trendy American things that probably doesn't have any advantage and I think I've changed my mind slightly because I can see that certainly by encouraging certain groups of parents I could imagine it having quite a lot of advantages actually

Yep

In terms of improving interaction and communication between mothers and children

Yep ok, any disadvantages

No I don't think there's any disadvantage at all. I think anything that improves communication between you and your child is an advantage
I think the only, I think some of them are a bit complicated, that's all I'd say, I'd be more interested in looking at baby sign, because obviously I did the British sign language sign and I think some of those erm were quite complicated and not very natural, I would, I would prefer kind of the more instinctive ones
(Interruption)
erm yes so I think , I think I would be more likely to use more signs if they'd been more obvious and easier

yes baby signs are a bit more symbolic and a bit more adapted to baby's hands

yes but the only thing, on the other hand, I see the advantage to using BSL is that they're going to see it throughout life, things like, so there'll be certain signs he will always now understand and be able to communicate with deaf people who are using those signs and I've noticed him watching, there's a programme, Mr Tumbles

oh yeah Something Special

yes, something special and I've noticed him really observing that and I don't know if he would have done that anyway but I think maybe he's got used to observing hand signs more carefully because I've been doing this so maybe he'll be more interested in using gestures and learning more about sign language and communication when he's older

yep, anything else you can add

No I don't think so, it's been fairly easy to do because, I think what's been good, if you'd kind of said I have to do all of them I probably would have dropped out at some point to be honest, I think it would have been impossible for me to of, to of remembered all of them and it was quite a big relief when you said don't worry if there's one that can't remember just pick the ones that you can and I think, if

I'd been involved in a long term study that expected me to use all of them I would have dropped out so I think so I think the way you've done it has made it very easy for me to continue

Oh good, and you've enjoyed using the signs?

Yes, yes I did

Fantastic

I probably will carry on using certain ones as they've just become quite natural between us

Good good, that's all, so thank you very much

- END OF INTERVIEW -

Interview 6

Mother's age: 40
Infant condition: Symbolic gesture
Infant gender: Male
Siblings: One brother, aged 5

So before we started the study had you heard of Baby Signing?

Yes

What did you hear about it?

I've heard about it through friends and read an article at babycentre.com about Baby Signing

Yeah

And then with my first baby I hadn't heard about it and he's was six and then to the point when he was over a year old

Yeah

And then when my second baby was born I was more interested in it, cause I certainly thought and I tried to look up certain signs and a friend of mine in South Africa was using it with her baby

Oh okay

Yeah, so she was using it, she was using a couple of signs but she made up the signs herself

And what did she say about it? What things did she say

She had signs for milk

Yeah

She used the milk sign for breast feeding

Yeah

And umm… and she found it really useful and that's when I became aware of it and was interested in it

Alright

And I think I looked it up online and then learned a couple of simple ones and one of them was milk

what did you hope to gain from it with [child name]?

Well! I just, well there was a whole thing about you think about the kind of, ummm… that it helped with language and you get, obsessed with the latest fact that what's going on and then, I just thought if it could help him communicate with me, that he's not just crying

Uh huh

That I could be more sensitive

Uhmm

Although I think, I'm very intuned with kids sometimes its easy if they, if they have a little bit and we can get to the result quicker

Yeah

Not very well articulating about it

(both laugh)

oh! No that's fine, you're making complete sense, it's fine. Ummm.. so did it live up to what you thought you would get from it?

With [child name]?

Yeah

Yeah definitely. I think, I think it really had an impact, I don't, I don't know if its necessarily was the signing whats ummmm… made him more… you know his vocabulary bigger but, the attention to being specific about certain words

Uhm

has made him communicate better

yeah, so you are focusing on certain words

yes, so yeah it could slow me down to focus on take the time, especially with the second child, so I would take the time to teach him the signs

yeah

and involve the rest of the family and, and he really responded to that

yeah

And we got a lot of umm.. joy, especially his father, we got a lot of joy out of seeing him using them back

Yeah

It was fun, and in that sense, I think [child name] really benefited from them and I think his language is quite advanced for, compared to when his brother was that age

Yeah

[older brother] would do a lot of pointing and “ahhh! Ahh! Ahh!” and [child name] you know, I can actually get him calm down and go.. more food or drink you know you wanna watch tv or you wanna go in the garden or do you want daddy and he he would take a moment as opposed to just spinning around and you know

Yeah

Just screaming

And what he used the sign to tell you what he wanted

Yes yes

Oh okay. What do you think that without the signs would he have just kind of pointed and got frustrated

Yeah more frustrated and he he is not a frustrated child

Yeah

When he’s teething a little bit but he very kind of, I think because he can be more specific about what he wants, not just to me whereas I might be more intuned with him, but he could do that with his brother and other people

Yeah

You know, it’s much easier

So, he did the signs with the family?

(to father) do you think the signing has improved his actions?

Father: yeah, yeah

Compared to [older brother], he didn’t have signs

Father: well, yeah, he’s speaking more quicker, I think

You’re on tape

Father: he’s started to talk more quicker

that’s fantastic, because you know usually the younger ones are much slower because they have someone else that can talk for them so they don’t need to say as much

Yeah

So, you said that you found it fun

Yeah, I really enjoyed it, really enjoyed it

So did [older brother] use the signs as well?

[older brother] still uses the signs

Does he?

Yeah, he was the one who was quite ahhh… strict about using the signs

Hm

And he allowed more time into [child name]'s space

Yeah

He'd go do you want more juice, do you want more food and he'd make up more signs, like he made up brother, and [child name] recently started saying brother

Aw, I see

And yeah he did, he signed a couple of times

Oh nice

Yeah

Yeah, I think that's one of the good things about signing, it does encourage you to get eye contact with them

Yeah and that's what I mean, and it's kind of especially with this, with the second child that you take that time and you don't feel rushed over

Yeah

And you just , I think they both benefited from sharing these moments where we look eye to eye

Yeah. Did you find the signs easy to remember?

Yeah, there's only a few which I didn't remember

Yeah which ones are those, if you can remember! (both laugh)

I think "shoes" and "sing" and ahhh I can't remember now. Yeah most of them were quite, ummmm, they made sense, the well, well sensible signs

Okay. We started at 8 months, do you think that was a good time to start?

I think we'd start a bit earlier

Earlier, yeah

Yeah because I think so like even if he wasn't able to do the sign, he'd be more familiar with them by the time he could use them

Absolutely

Yeah

Also you'd be more used to using them

Yeah, as opposed to, yeah, my vocabulary, my actions I think he was receptive earlier and he would have benefited from it even more

I would have loved to have started earlier but I only had a year to follow up all the babies and

Oh, alright

And once you have to follow them to this age you know when they're talking and maybe some of them have started to put their words together which [child name] is and its really hard to decide what stage you want to go to

Yeah yeah

But yeah, I agree it would be a good idea to start earlier as they would be able to understand so much when they are younger

Yeah

So lots of benefits, would you say there are any negatives of using the sign language?

Ummm… I think… I think the negative is that not everybody is doing it so he might be in a situation where I'm not there and people with who he is using the signs wouldn't know and that can be quite frustrating and that can be quite confusing for them. So its almost like, you know, if more people used it, it would be more helpful

Yeah

Because I also found that my mother or my sister in south Africa they'd just make-up signs and you know, they see it's funny, and not that they're being nasty but because they couldn't remember all the signs, uhmmm. So

It becomes confusing….

Yeah it becomes confusing and frustrating for me because I want to be quite diligent, but I don't think other than that there is no negative, because I was, I was worried that it would stop him from speaking and that he would use signs instead of words

Yeah

But you made it very clear that the signs were to be placed with the words to support the words

Exactly

And I think… that was the only thing I was worried about and concerned in terms of having a negative effect and that hasn't happened, he has never replaced a sign, speaking

Signs

Yeah, he's always done it with the sign even if he hasn't been able to do it with the proper word, and his language is what his father developed and I expected him to repeat. He also copies a lot, he seems to be

That's fantastic

He'd hear a word, he's not scared to

Experiment

Experiment, yeah

Yeah, I know its easy when you're playing and you're distracting yourself to just to hear it again, yeah

Yeah

Um, I think that's all we need to cover, have you got anything else about your experience

I really enjoyed it. I think it was really really positive in terms of [child name] and the family him being really drawn, drawn back into the, he really is a member of the family

I'm so pleased that you've enjoyed it and it's been a good experience for you

Yeah truly.

-END OF INTERVIEW-

Appendix K. Sample Transcript from Interviews with Mothers who Attended the Communicating with your Baby Sessions in the Gesture Group

Interview A

I'm just going to ask you really like a few things about the er (pause) the sessions and how you found them and how you found the signs and things like that um, first of all er what did you know about babysign if anything before you started the sessions?

nothing, never sort of looked into it or anything

yeah, had you heard of it

um (pause) sort of I mean sort of on the kid's programmes they sort of incorporate it with the, you know like when they have people presenting it they often do a lot of it, but I hadn't really taken much notice before to be honest

yeah, yeah ok, so why was it you decided to do the sessions?

um, I mean he was sort of starting to um sort of be a bit more receptive to things I was doing and because it was something that was offered here I thought it would be good to give it a go and see if it um (pause) it helped in any way to sign to incorporate it into what we were doing day to day so

yeah cool um, and so what did you kind of expect, I suppose, to get out of the course did you have kind of ideas?

um, to be honest honestly I didn't expect there to be much difference, cause it's, I mean cause I didn't know much about it I didn't expect him to all of a sudden by signing everything and for him to be this genius child but yeah, yeah I just sort of thought whatever happened happens, there was no sort of cause I never knew anything about it I didn't know I didn't have any level of expectation really, to be honest

yeah did you have any hopes then, you know?

oh yeah, obviously that he'd sort of pick a few things up and it'd be easier for us to communicate with each other sort of before he started speaking and everything like that so

cool um, and so since you've done the course, or while you were doing the course um have you been using the signs together at all?

um, we tried to but sometimes it's just it's easier to make your own ones up, just the small sort of gestures whilst you're saying things like um, some of them might not be exactly as was told just before but you sort of, you become a lot more aware of the hand gestures even though I'm talking now, doing it, (laughs) hand gestures that you use when you speak do you know and become maybe a lot more aware of what you do with your [interruption – talks to baby] yeah, you become a lot more aware of what you do with your hands and stuff when you speak, more than what I was before so *yeah, so you so you haven't really been using particularly any of the signs you were taught?*

nothing I can specifically say I used this on this occasion

yeah

but stuff like when um (pause) like you talk and say everything sort of bedtime or if if it's like time to eat or have a drink or something like that, just sort of the basic ones that you use really sort of regularly throughout the day

yeah, so kind of natural ones that you you've developed yourself, rather than the ones that you were taught

yeah [interruption – talks to baby]

so with the ones that you were being taught

yeah

did you start to try and use them in the first place?

yeah

and find they didn't work and then move on or

no, it wasn't that they didn't work, it's just sometimes when you've got things to do it's hard to remember to do that as well

yeah

so that's why it came easier to sort of find ones that came more naturally

yeah

instead of ones that sort of textbook, um they were similar but maybe not sort of bang on to what she she told us to do

yeah, and er what about um other people that you know, like support from like family and friends, did they what did they think of the baby sign?

yeah I mean I I do it with [name], she's got her [name] her little boy and we come here together and we see eachother a lot in the week so we used to sort of, when you've got someone there who's doing it as well it's easier to remember to do things and then you've got two people doing it instead of just one

yeah

so it becomes a lot more familiar for them [interruption – talks to baby]

um, so I can gauge this a little bit from what you've said already, did you find that it was easy to kind of make the signs part of day to day activities, or was it that you felt it was a separate thing to do on top of that?

some were, some weren't, but I'd say that some of the signs that you got were weren't relevant do you know what I mean so I wouldn't do the I wouldn't do them all the time, whereas stuff like food related or bedtime related and things like that I'd use

yeah

more, more regularly

yeah, that's ok, and how did you find the sessions and things, were they quite easy to follow and understand?

yeah, we got a lot of literature as well to take back with us and it was very clear, I mean there weren't sort of too much at once and it was spread out nice, so yeah they were nice as well, yeah

is [name] talking now, a little bit?

um yeah, real he's he says um a few words but he just makes the rest up as he goes along in between (pause) but um yeah, he's very chatty

yeah

very very chatty

and do do you find that that means you're stopping using signs really or carrying on?

I think, um (pause) I with some things I actually use them more now because I sort of try and [interruption – talking to baby] I I try and emphasise certain words so that I know he's picking words up

yeah

emphasising words and obviously automatically with that I sort of do a, I sort of make it a little bit more interesting, a little bit more so he notices it with signs and stuff

so you match a word and a sign

yeah

together, ok

yeah

and er, when you use when you were using signs, or when you use the signs now, do you think he understands them

um (pause) I think some of them he does, yeah, whe when he's hungry he puts his hand to his mouth

ok

if he's um, say if he wants a drink he sort of does the thing for drinking, if something's gone he does the sort of all gone thing, he does nur nursery rhymes we sort of have about five or ten minutes before he goes to bed, and we do the nursery rhymes so he can see me and we do, cause we sing the signs with the nursery rhymes as well, and he sort of does them along with it so um yeah, some of the ones he uses regularly and responds to

so he understands them and he's producing them as well?

yeah, he see I think he sees it as more of a dance with the nursery rhymes

yeah

cause he likes dancing more, yeah the er ones we use regularly he is um he is um copying and it makes me think maybe if I carried the other ones on as much

yeah

then he'd know them as well do you know cause obviously he doesn't know the difference between what's routine and what's not routine so

yeah, yeah um, so do you think there's been any real effect of baby sign like on you, on him, on your relationship, or not really much of an effect?

um I think (pause) I think there probably has been in that he's a lot more, that he does a lot more gestures, he's a lot more, cause he's very active anyway so he's always moving he's always doing things with his hands expressions with his face and I mean, I I haven't had anymore children so I do haven't got anything to compare it to but if anything's to go by by personality the child's crazy so (laughs) he's very, hands everywhere, he's very sort of he does a lot of gestures with them everything he does so

yeah, yeah um and, so what would you say your like overall impression of like baby sign is, do you think it's positive, negative, neither?

oh no, it's definitely positive because even if they don't you know pick anything up directly you you sort of you get to interact more, even if it's not a long term sort of effect they have and they don't know all these signs off the top of their head, there's times you spend together and the signs you do and you you sort of get it gets it's it's interesting, but you get more of a sort of bond if you know what I mean

ok

yeah, so even if there's no sort of long term effects

yeah

there's this you still enjoy it and they still enjoy it, so

yeah so more of a bonding thing than a communication learning thing

well, yeah, I mean some people might be different if you carry it on more, I know I, from my experience I believe there would be there would be more of a communication side (pause) but yeah it's definitely a positive and quite, no negative aspects to it [interruption – talks to baby]

so um, would you recommend it then to other people?

yeah, definitely definitely, like I say, even if not even if you're not going to carry it on the whole communication thing, it's definitely a good thing to to experience [to baby: we had fun didn't we? yes we did, yes]

(laughs) and um, that's all of my questions really, just if there's anything else you want to add anything else, any of your thoughts on it?

no no, like I say [interruption – talks to baby] yeah, no, it was it was good but there was um, it would've been nice to carry it on for a little bit longer

yeah, so you think if there were more ca more, a longer course and more, that's what you'd go for that?

yeah, I think yeah we probably would've we probably would've carried it on more and would've been [interruption – talks to baby] yeah, a couple more classes would've been nice

ok

apart from that it was good though [interruption – talks to baby]

yep, shall we wrap it up?

yeah I think before he [talks to baby]

ok, that's fantastic, thank-you very much

[END OF INTERVIEW]