THE ACQUISITION OF
LOCATIVE PREPOSITIONS IN
CHILDREN AGED 2 TO 5 YEARS

Thesis presented for the
degree of M Phil by
Elizabeth Anstis BSc (Hons)

Department of Linguistic and International Studies
University of Surrey

December 1994
DEDICATED TO DAI
Studies of locative prepositions have suggested that there are regularities in the order of acquisition. This thesis describes an investigation of whether a general order of acquisition for locative prepositions applies to British children learning English as their first language. In a study involving eighty children aged between two and five years old, both the production and comprehension of locative expressions were tested.

Results confirm a general order, broadly consistent with the hypothesis being tested, but with the prepositions BEHIND and, to a lesser degree, IN FRONT occurring earlier in the hierarchy. These prepositions (in their various featured and non-featured forms) and the errors made with them are looked at in some detail, and the findings give new support to evidence from other studies in this area.

The conclusion is reached that there is a general order for the acquisition of locative prepositions, but that the materials used for testing, especially the nature and orientation of reference objects, are very important. This is particularly so for BEHIND and IN FRONT with featured objects ie those with inherent fronts such as people or houses - the more complex their circumstances, the later their appearance in the acquisition order.
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It seems a long time ago that I first had thoughts of doing postgraduate research on child language. It was, therefore, with some pleasure that I returned to the University of Surrey several years after graduating, to begin work in this area. I was especially pleased to have as my supervisor Gunilla Anderman, who is my initial source of interest in child language acquisition. I am most grateful to Gunilla not just for suggestions and guidance but also for giving me autonomy and being very understanding, particularly of my family commitments (having four babies in under five years plays havoc with work schedules!) I would also like to thank Margaret Rogers and others in the Department of Linguistic and International Studies who have helped or encouraged me.

From the Psychology Department, I am extremely grateful to Sean Hammond for his help and expertise in the statistical analysis and also to Martyn Barrett for his useful advice and input.

A special mention too must go to Mark Ashworth in the Library for his help and patience (particularly with computer searches) and to Shula Chiat (City University) who gave me some early pointers.
In connection with the actual research sessions I should like to thank Marianne Krook for assisting me, the mothers hosting the sessions and those who brought along their children to participate. Not forgetting, of course, the children themselves who took part so happily and willingly in the games and provided me with such fascinating and copious data.

I am also grateful to my mother, Bess Anstis, and to Margery Reynolds for coming up and helping out with their grandchildren whilst I have tried to work on this thesis.

None of this would have been possible, however, without one very special person, Dai. Not only has he given me the most wonderful children, but he has supported me financially, intellectually and emotionally throughout. Without him I would not have been able to start the research, let alone finish it.
There have been many research studies in the field of psycholinguistics including a number which have looked at the specific area of language development and locative prepositions.

My own research study, described in this thesis, looks at the acquisition of the locative prepositions IN, ON, UNDER, BESIDE, BEHIND and IN FRONT by children learning English as their first language. Other studies already published in this and related areas were useful as a background; the cross-linguistic study by Johnston and Slobin (1979) provided a particularly useful base for my own research. This study looked at the development of locative expressions in four languages including (American) English. It confirmed a general order of acquisition determined by cognitive factors which spanned all language groups (and which would be modified by linguistic factors from the specific language concerned).

The research study I undertook was to look at the acquisition of locative prepositions in children from age two to five years. It was, in part, to consolidate other studies done in this area (and confirm the acquisition order for British English as opposed to American English) and also to provide further information and a detailed
data base for a range of locative expressions.

In the event, my research results have provided not only new information on the acquisition order of prepositions, but also some very interesting findings regarding errors made with prepositions, shedding new light on a particular area of linguistic and cognitive development.
The relationship between cognitive development and language acquisition has intrigued and occupied both psychologists and linguists for a large part of this century. It is this complex area of developing psychological processes and linguistic behaviour which will form the basis for discussion in this first chapter, providing a foundation for the subsequent discussion of studies particularly concerned with the acquisition of locative expressions in young children.

1.1 Language and Thought

Initially, language was treated by psychologists very much as a product or consequence of cognitive development, with relatively little attention directed towards the question of how language emerged from the concurrently developing cognitive structures of the child (Moore, 1973). By the middle of this century, language development became recognised as a subject worthy of investigation in its own right and discovering the nature of the connection between linguistic and cognitive ability became crucial to understanding language acquisition.

The study of language acquisition in children is now the
best developed branch of psycholinguistics (Crystal, 1985: 251) and it would seem appropriate here to review some of the main issues and influential authors, before looking in more detail at how a child’s mind develops (section 1.2).

When investigating the relationship of language to other cognitive and social kinds of knowledge, the most influential author in this area is Jean Piaget (1896-1980) whose writings have provided detailed accounts of child development. In 1926, Piaget published a study called "The Language and Thought of the Child". Looking at the speech used by children in a Genevan kindergarten Piaget found, amongst other things, that whilst much of their speech was adapted to the needs of a specific listener, a fair proportion of it was addressed to anyone who happened to be within hearing range and gave no evidence that the child was attempting to take into account the knowledge or interests of a specific listener. This speech he called egocentric speech and he saw it as a reflection of the thought processes of the young child, which he then went on to investigate in considerable detail.

Piaget held the view that language primarily reflects thought and does not shape it. He maintained that the child has to develop into a social being from a stage of being imperfectly socialised and he therefore regarded childhood egocentrism as a cognitive deficit, an intellectual inability to put oneself in another person’s
shoes. I shall question, amongst other ideas, the notion that children are necessarily egocentric later on in this chapter (section 1.2.1).

Piaget believed that the child constructs an understanding of the way the world works largely by his or her own actions. A child’s intelligence at any time is a product both of the environment and of certain mental structures interacting with each other. In tracing the development of these structures, Piaget concluded that the child passes through a series of stages. Each stage is characterised by certain properties of the child’s thought and each child has to pass through the stages in a fixed order, although the rate at which he or she does so may vary from one child to another. The major stages are:

- the sensorimotor stage (from birth to 18 months);
- the pre-operational stage (18 months to 7 years);
- the stage of concrete operations (7 to 11 years); and
- the stage of formal operations (11 years and over).

The ages given are approximate, as some children may take longer than others to pass from one stage to another. For much of the discussion in this thesis about language acquisition in general and prepositional expressions in particular, the children fall into the pre-operational stage (18 months to 7 years).
Language is only one way among others to represent knowledge and one example of Piaget's views can be seen in the area of representation. Representation in general does not appear until the end of the sensorimotor period, when, for example, a move from A to B can be retraced by the child to find the starting point A. Simultaneously and in close connection with this action structure, objects acquire what Piaget calls permanence; that is to say, no longer does the child act as if the objects have ceased to exist when they disappear from his/her field of action, but he/she knows that he can find them again, even if they are successively hidden in different places (as long as he/she has seen the moves) by using the newly acquired action structure.

Piaget has frequently been criticised for underestimating the importance of language in cognitive development (Elliot, 1981:43). In his writings, language appears largely as a source of data rather than as an object of development and often its operation is seen in a negative light.

The Russian Psychologist Vygotsky (1893-1934) had a different interpretation of the egocentric speech of young children. Whilst agreeing with Piaget about its existence and that it was a transitional phenomenon, he saw it as a precursor to verbal thought. For him, it was "speech on
its way inward" (Vygotsky, 1962: 46). He saw language and thought as having independent origins and his work led him to propose the "indisputable fact" that "thought development is determined by language ie by the linguistic tools of thought and by the sociocultural experience of the child" (Vygotsky, 1962: 51).

The conclusions drawn by Piaget and Vygotsky are frequently opposed in discussions of the question "Does language precede thought or thought precede language?" (although it should be stressed that Vygotsky’s views are in no way a photographic negative of Piaget’s).

This concept of "thought being determined by language" is more traditionally associated with the linguist and anthropologist Benjamin Lee Whorf (1897-1941) who proposed that the linguistic categories of our native language affect the way in which we think. In its strongest form, the Whorfian Hypothesis claims that our linguistic categories actually determine our cognitive categories and that, consequently, our language traps us in a fixed mode of thought as far as our concepts and perceptions are concerned.

According to Whorf, therefore, people who speak very different languages perceive the world in very different ways. Much of the evidence cited in favour of this hypothesis is based on vocabulary differences. For
example, English has only one word for snow, while Eskimo has four (Hilgard, Atkinson and Atkinson, 1979). Consequently, speakers of Eskimo may perceive differences in snow that speakers of English cannot. But do these observations constitute strong evidence? Critics of the hypothesis such as Slobin (1973) and Clark and Clark (1977) argue otherwise. According to them, language may embody distinctions that are important to a culture, but it does not create those distinctions, nor does it limit its speakers to them. English speakers may have the same capacity for perceiving variations in snow as Eskimo speakers, but since such variations are more important in Eskimo cultures than in British/American cultures, one language assigns different words to the variations while the other does not.

Also, the mere fact that languages can and are translated from and to each other argues against the strong form of the Whorfian hypothesis and it is now more usual to find a weaker form of it - if this theory is supported at all - whereby linguistic categories predispose us to think in certain ways; predispositions which can, though, be overcome (Atkinson, Kilby and Roca, 1989).

Work on the differences in the perception of colours has added to the evidence against language determining thought: at one time, many linguists believed that
languages differed widely in how they divided up the colour spectrum and that this led to differences in the perception of colours. Later research indicated just the opposite. Of particular importance is the work of two anthropologists, Berlin and Kay (1969) who studied the basic colour terms of many languages and found striking things in common in such terms across languages. For one, every language took its basic colour terms from a restricted set of ten names. In English these are: "black", "white", "red", "yellow", "green", "blue", "brown", "purple", "pink" and "grey". No matter what colour terms a language had, they inevitably corresponded to some subset of the above plus "orange". Furthermore, if a language used fewer than eleven terms, the basic terms chosen were not arbitrary. If a language had only two terms (none had fewer), they corresponded to "black" and "white"; if it had three, they corresponded to "black", "white" and "red"; if it had six, they corresponded to these three plus "yellow", "green" and "blue". Thus the ordering of basic colour terms seems to be universal rather than varying from language to language.

In addition, people whose languages used corresponding basic colour terms agreed on what particular colour best represents a colour term. Suppose two different languages have terms corresponding to "red". When speakers of these languages are asked to pick the best example of "red" from
an array of colours, they make the same choice. Even though their boundaries for what they would call "red" may differ, their idea of a good "red", a quintessential "red" is the same. Their perceptions are identical though their vocabularies are different.

Further work by Rosch (1974) suggests that the Dani, whose language has only two basic colour terms, perceive colour variations in exactly the same way as people whose language has all eleven. Later experiments by Rosch (1975) confirmed the idea of "true colours" for example some reds are redder than others. And the same applied to many other kinds of categories such as birds and vegetables (where the best examples or "prototypes" were robins and peas respectively).

Prototype theory, deriving from ideas put forward by Rosch, has been influential in the study of child language, particularly in connection with children’s early acquisition of referential words (words used to refer to objects, people and events). The idea of ideal examples or prototypes presents itself again in section 1.2.1 relating to the development of visual perspective taking and in section 4.2.3 in connection with a possible prototype for the prepositions BEHIND and IN FRONT. Other hypotheses/theories accounting for the development of word meanings are considered in section 4.5.1.
Knowledge about concepts is fundamental and is one of the most important things children learn. We get some idea of how children acquire concepts by looking at their first use of words. At about age one, children begin to name things, i.e., relate the knowledge that they have already gained about the world to words that adults use. To learn which word goes with which concept, children often appear to pick out only one or two properties of a concept, when a whole cluster of properties is relevant. A two-year-old child might hear "doggie" spoken in connection with the family dog and focus on the fact that it has four legs and moves (Hilgard, Atkinson and Atkinson, 1979). He or she then may hypothesise that these two features define "doggie" and apply the word to cats and other four-legged animals.

Another common overextension at around this age is the word "dada" used to refer to all men. The subject of overextensions (together with underextensions, overlap, and mismatch) is discussed in more detail later on in section 4.4.2.

By age three or four years, a child's overextensions are less obvious, but closely related concepts can still lead to confusion. When told to place one toy below another on a staircase, the child may place it above the other instead. It is as if the child knows "above" and "below"
have some properties in common, since both refer to the same kind of spatial relationship, but he or she does not know how they differ and so maps both onto the concept of "above". Perhaps the concept "above" is the simpler one. Or perhaps the child is using a strategy that says "when you have to place an object, but you're unsure of where, try the topmost part of surface" (Clark, 1977). This is an area which will be explored in more detail later in relation to non-linguistic strategies (section 2.2).

Theories about concept learning vary (see, for example, Joan Lucariello's 1987 paper on concept formation) and perhaps there is no entirely satisfactory account. Jerry Fodor, in the debate between Jean Piaget and Noam Chomsky (Piattelli-Palmarini, 1980) claims that there are no theories of concept learning - for example, no theory can tell us how a concept such as "red and square" is acquired. He maintains that any theories of learning essentially tell us how beliefs are fixed by experiences (inductive logic). Fodor explains that the mechanism which shows how beliefs are fixed by experiences makes sense only against the background of radical nativism. His extreme innatist stance is a stumbling block to those who are in favour of a "compromise" between the ideas of Chomsky and Piaget (see below).

Children do not generate hypotheses about language at
random, and there is good evidence to suggest that children come into the world genetically programmed to look at language in certain ways; that operating principles may be part of our biological heritage (Fodor, Bever and Garrett, 1974). Children progress from simple to complex sentences, acquiring new grammatical constructions in a predictable order, despite large variations in how often adults around them use the constructions and despite what they actually hear, which, as Chomsky points out:

"consists to a large extent of utterances that break rules, since a good deal of normal speech consists of false starts, disconnected phrases and other deviations" (Chomsky, 1967: 441).

Chomsky maintains that there is evidence that language is a special, pre-programmed activity and his belief that humans are genetically imprinted with knowledge about language is often referred to as "the innateness hypothesis". The first enthusiasm for language being an innate capacity came in the 1960s when Chomsky set the scene, and there was a rush to embrace Chomsky’s theories as an instrument for disposing of behaviourism (Pinker, 1994). Then, in the 1970s, ideas about language swung back to the notion of language as something purely cultural and learnt, reflecting the emphasis psychologists
had always put on slow learning mechanisms being the force behind human intelligence (Pinker, 1994).

In the past five to ten years, the claim that language is innate has been strengthened by empirical findings supporting Chomsky, and by renewed interest in the biological nature of language; how language is encoded in genes and in the neural structures of the brain. Whilst it is now generally recognised that something specific to language is innate, opinions still vary as to what this something consists of. Language cannot be explained simply as an offshoot of general intelligence, even though we undoubtedly make use of general cognitive abilities when we speak, in a way as yet undefined (Aitchison, 1989: 267).

The pattern of language acquisition may be much the same for all children. However, if the fixed sequence of language development depends on the orderly development of perceptual and motor skills and language development simply reflects the development of other skills, it could not be considered innate. A crucial point raised by Jaques Monod in the debate between Piaget and Chomsky (Piattelli-Palmarini, 1980) was this: if language development in the child is strictly associated with sensorimotor activities, then children suffering from extreme motor disabilities should not be able to talk, or at most, should develop very poor language. Inhelder
replied (Piattelli-Palmarini, 1980) that although such experiments had not been carried out by the Geneva group, she expected, even in these extreme cases, that language would be fairly complete. She argued, however, that a variety of "actions" could serve the purpose, for example acoustical, visual or tactile.

Another aspect of innate behaviour is that it often depends on exposure to the right cues at the right time period. There is evidence of a critical time period in language development, but it is not conclusive. According to Lenneberg (1967), if individuals are not exposed to any human language before the age of 14 or so (the so-called critical period), then they might be unable to acquire language. For a critique of and suggested modifications to Lenneberg’s proposals, see Elliot (1981: 23-8).

So, we have seen on the one hand, that there are strong claims for children having a tacit knowledge of principles of universal grammar; Chomsky and those who work with him have proposed a task-specific biological programme for language development. On the other hand, there is the view that the rules and structures of language somehow grow out of other aspects of cognitive abilities, innately given perhaps, but not unique to language. The most widely discussed claims for this non-specific basis of linguistic development have been associated with Piaget.
and his followers.

The claim that language development involves an innate capacity that is unique to language is sometimes called innatism (Piattelli-Palmarini, 1980) or specificity (Goodluck, 1991) and the opposing claim, that language development is an outgrowth of other cognitive skills, is often known as constructivism following the terminology of Piaget in various writings (Goodluck, 1991).

However, the perspectives of Chomsky and of Piaget are not necessarily as contradictory as is sometimes made out. Hermine Sinclair, herself a Genevan psycholinguist, suggests that "it is Chomsky's work that is making possible the study of language acquisition within a Piagetian framework" (Sinclair, 1971: 204). It is not impossible that Chomsky and Piaget are both right (Cromer, 1974: 252) or perhaps there is a compromise solution between innatism and constructivism, likened to two faces of the same coin (Piattelli-Palmarini, 1980: 143).

This section has dealt with a range of questions concerning the mechanisms involved in language learning and in many of the areas touched on, there have been important and often unresolved problems. Language development appears to broadly exhibit the properties of biologically programmed behaviour (stages, a critical period and partial independence from input), and the
complexity of what is acquired and the limitations on the nature of the input (the speech the child hears) support the view that the child tackles language learning with the aid of innate knowledge of a universal grammar.

In examining the evidence, Goodluck concludes that cognitive growth may indirectly promote linguistic growth, but the two are distinct phenomena (1991: 168). The fact that linguistic constructs cannot be derived from other constructs or principles is a further argument for the innate nature of linguistic knowledge.
1.2 The Developing Mind: A Child's Way of Viewing Things

This section aims to explore certain aspects of a child's "point of view". A point of view can refer to many different sorts of experience, but I shall outline developments on just the following:

1.2.1 Development of visual perspective taking
1.2.2 The artist's point of view
1.2.3 Conversational role taking and deixis

These topics are useful not only as a general psychological background to the child's linguistic development, but also as particularly relevant to later discussions on deixis and position for viewing (see section 3.4.1) and perspective (section 4.4.5).

1.2.1 Development of visual perspective taking

The ability to understand what people see - i.e. visual perspective taking - is not merely of academic interest; it is part of our interaction with others from an extremely early age. We need to know what other people are attending to and referring to; conversely, we need to be able to draw others' attention to objects or people that we are concerned with. These visual abilities are particularly important in the pre-verbal phase of
development when young children do not yet possess words
to refer to things, but they also continue to be a
fundamental part of our face-to-face interaction with
others.

If an adult does not appreciate that his own view is
simply one of a number of possible alternatives, he might
be regarded as narrow-minded or inflexible or even as
egocentric. However, he would not be regarded as
cognitively incapable of considering alternative views;
he would more likely be taken as lacking the sensitivity
or inclination to do so. When considering young children
therefore, we may think of their egocentrism also as a
lack of awareness of the need to take account of other
views; on the other hand, those supporting Piaget’s ideas
would see children’s egocentrism as a cognitive deficit,
an intellectual inability to put themselves in another
person’s shoes. Whilst this view was first introduced in
Piaget’s book “The Language and Thought of the Child”
(1926) it has now become associated with his investigation
of visual perspective taking (Piaget and Inhelder, 1956).

Many researchers (such as Bower, 1974 and Butterworth,
1981) are opposed to Piaget’s constructivist theory of
perception. Although they would agree with Piaget that
the baby’s "knowledge" is not the same as the adult’s and
has yet to be developed, nevertheless they would not agree
that the newborn baby lives in a chaotic world which can
only gradually be structured through the infant’s own activity. In contrast, they take a "Gibsonian" view (eg Gibson 1950, 1966, 1979) that some properties of objects in space (such as three-dimensionality) are directly perceptible by the sensory system and not dependent on the experience mediated by motor activity.

So, do children realise that other people’s views may be different from their own?

During the infant’s first few years, he or she develops a considerable understanding of other people’s visual percepts. From the beginning, the baby takes considerable interest in the human face and engages in "conversations" with those around him or her. The baby begins to identify the body parts involved in adults’ gestures and can produce imitative gestures himself (eg Meltzoff and Moore 1983 and 1985 who maintain this occurs much earlier than Piaget). The infant can follow another’s line of gaze or pointing and can fixate the object or event the observer sees. Conversely, he can produce particular visual percepts in others by pointing out or showing objects to them. The child can search for and retrieve objects from other people. He comes to understand that the observer may see an object which he himself cannot see, and vice versa. It is well-known that babies below the age of about four months will not search for an object that goes out of
their sight; this fascinating observation illustrated for Piaget (1954) that babies treat these objects as non-existent or "out of sight, out of mind". A number of researchers have subsequently cast doubt on this claim. Bower and Wishart (1972) for example, dangled a toy on a piece of string in front of a baby and when the lights were turned off and the toy was literally out of sight, by using an infra-red TV system they found that the baby would reach towards the toy even after a delay of 1.5 seconds.

There appears to be evidence then that young children below the age of four years have a considerable understanding of other observers and other views, although Piaget and Inhelder dismiss as pointless any attempt to study perspective-taking in children aged four or below because they do not understand the meaning of the questions put to them (Piaget and Inhelder, 1956: 212). The popular interpretation of this position has been to describe young children as totally egocentric and not able to understand anything at all about other people's points of view. For example, Bee (1975: 185-6) says:

"It's not that the child knows that there are other ways of looking at things and just can't visualise them; rather she is actually a prisoner of her own point of view but doesn't know it."
I shall now describe briefly some studies of children's perspective-taking, firstly by Piaget and Inhelder and then more recent work.

With a single-object task, Piaget and Inhelder asked children aged four to twelve to imagine what the apparent shape of a needle and a disc would be when placed in a number of different positions. A doll was placed at right angles to the child, looking at the same object, and the child was then asked to imagine how the needle or disc appeared to the doll (for example, a needle seen end-on to the child would appear full-length to the doll). The child was first asked to draw the shape and, to counter possible deficiencies in motor skill, was also asked to choose a shape from a selection of pictures.

Figure 1: Examples of presentation of needle and disc in perspective (from Piaget and Inhelder)

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needle    disc

Piaget and Inhelder also had a "three mountains" task to study the child's representation of a group of objects seen from different viewpoints.
According to Piaget and Inhelder, a full appreciation of the way views differ according to different viewpoints does not develop until at least the age of about eight-and-a-half years. Not only do children up to about age seven behave in an "egocentric" way, but below age four they have no notion of the problem at all.

Rather than dwell on the young child's difficulties with a complex perspective-taking task, Flavell (1974 and 1978) devised a sequence of graded tasks which he used to...
demonstrate children's improvements in perspective-taking as they develop. This may help to explain why the young children failed Piaget and Inhelder's tasks. Flavell proposed the following levels:

Level 0: practical knowledge of space; internal psychological processes like seeing are simply not yet objects of cognition.

Level 1: child can represent which objects each person sees but not which particular view.

Level 2: child can represent how different observers see objects.

Level 3: child can also represent the apparent shape and size of the objects viewed by different people.

No studies are without their problems, and one criticism of Flavell’s account is his idea of what constitutes symbolic representation. This is the main criterion which distinguishes the Level 0 child from the Level 1 child. Since, according to Flavell, a Level 0 child may be able to specify verbally which object the observer is looking at, but cannot represent the view visually, it seems that language is not accepted as a means of symbolic representation. This issue was taken up by Ives (1980) who compared a verbal and a visual response mode. Children had to describe verbally which side of an object
could be seen from a particular position of a camera and select an appropriate picture. Ives found that the results implied that a linguistic response was more accessible than picture selection:

Table 1: Discrepancy between verbal and visual responses

<table>
<thead>
<tr>
<th></th>
<th>correct verbal description</th>
<th>selected appropriate picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 year olds</td>
<td>89.5%</td>
<td>38%</td>
</tr>
<tr>
<td>5 year olds</td>
<td>92.5%</td>
<td>51%</td>
</tr>
</tbody>
</table>

Moreover, Ives maintained that children in the picture selection task first formulated the verbal label, often spontaneously, of what the other person saw, and then searched for the appropriate picture. Perhaps language is functioning here as a mediator, and may even be a necessary part of the process of locating the correct pictorial representation. In this way, it may be that Flavell's levels (including various sublevels) do reflect a developmental sequence, but that this may occur much earlier when a child's verbal description of a view is considered rather than his or her representation using, say, a picture selection task.

Much of the literature on perspective-taking reports that Piaget and Inhelder found that children select their own
view of the objects (needle, disc or mountains) in error (Cox 1991). Because Piaget and Inhelder regard these young children as egocentric, the own-view error has become known as the "egocentric error". But this misrepresents Piaget and Inhelder’s findings and their position. Children selected their own view in error only in the three-mountains task. In the needle and disc tasks, their errors were different: typically, they selected stereotyped or "best" views of the objects, that is a full-length needle and full-circle disc. In the mountains task, the three mountains did not have a familiar stereotype in the same way, so the child adopted his or her own view as the stereotype.

This means that a child may be aware of different views of objects, but he does not represent them, he only reproduces the stereotype. This idea is endorsed by tests using occluded arrays: Liben (1978), Liben and Belknap (1981) and Light and Nix (1983) have all found that children in the three to six year range do not respond with their own view but with a "good view" of the array. These "best views", stereotypes or prototypes are also referred to as "canonical views" and in some tasks, the stereotyped view may coincide with the child’s actual view of the scene.

Some kinds of relationship may be more difficult than others. Piaget and Inhelder claimed that the "before-
behind" relationship is amenable to perspective changes earlier than "left-right". The reason for this, they argued, is that "there is a bigger difference between a background beyond the reach of immediate action and a foreground directly subject to it, than there is between a left and right which are equally near or distant" (Piaget and Inhelder, 1956: 215). Piaget and Inhelder were talking about the three-mountain array, and most of the research comparing the two sorts of dimensions has also used multi-dimensional arrays. According to Cox (1991), rather than reflecting any "real" difference in psychological difficulty between the dimensions, the responses may simply reflect a particular order of processing of the two dimensions: first before-behind and second left-right. Or it may be that account needs to be taken of other confounding variables such as the presence of masking, which is usually present in the before-behind arrangement but not in the left-right.

Before concluding this section on the development of visual perspective taking, I should like to discuss some of the better known experiments Piaget carried out in relation to the pre-school child's understanding of the conditions under which quantity is conserved. A child passing these tests of conservation is known as a "conserver". In a typical test of the conservation of number, the child is shown two rows of counters, with the
same number of counters in each row and placed in such a way that the counters in the two rows are in one-to-one correspondence with each other. Thus the two rows are of the same length and the same density. The experimenter asks the child whether there is the same number of counters in each row and the child generally agrees that there is. The experimenter then spreads out the counters in one of the rows, making that row longer and less dense than the other row. The question about the number of counters in the two rows is repeated. A non-conserving child will then usually judge that there are more counters in the longer row whereas a conserving child will correctly indicate that changing the length of the rows does not change the number of counters in the rows.

Figure 3: Test of conservation

Are there the same number of counters in each row?

Similar tests were designed to test whether the child knows that the length of a piece of string is conserved despite changes in its shape, that the volume of liquid in a glass is conserved despite changes in the shape of the
glass and that the weight of a ball of clay is conserved despite changes in its shape from a round ball into a long sausage. Children do not learn to conserve in all these media at once. They tend to learn to conserve number before volume, and volume before weight (Elliot, 1981: 47). See also the discussion of length as a criterion of quantity (under MORE/LESS in section 4.5.2) and tests comparing the descriptions of different objects by conservers and non-conservers (under SAME/DIFFERENT in section 4.5.2).

1.2.2 The Artist’s Point of View

The idea that an artist should draw only what he or she sees from a particular point of view (the linear perspective system) has become the accepted way of representing the three-dimensional world on a two-dimensional surface. However, it has long been observed that young children typically draw a scene from a variety of different viewpoints. Piaget and Inhelder’s explanation for this is that these children have not yet developed a co-ordinated system of perspectives; they cannot successfully adopt a particular viewpoint, even their own.

It is only in the last 15 years or so that there has been renewed interest in children’s drawings from the cognitive
aspect rather than from shedding light on personality or emotional difficulties or mental maturity.

Research on single objects has shown that children often draw the canonical (or stereotype) view of a particular object rather than their actual view (Davis, 1983). For example, when asked to draw a cup (with its handle turned out of sight), 60% of the four to six year olds being tested included the handle. Davis suggested that the reason why most children included the hidden handle was that they did not realise orientation was important. The juxtaposition of two cups in different orientations made this more salient and most children then omitted the hidden handle. In particular, the naming of the object for or by the child seemed to elicit a canonical view, whereas withholding the name elicited a more visually realistic picture. Most of the research has concerned children over five years of age and less is known of the behaviour of younger children; it could be that canonical views are more prevalent. What defines "cupness" for the young child (having a handle) may tie in with the young child’s understanding of other concepts such as "doggie" (has four legs and moves) which led to the overextensions discussed earlier in section 1.1.

If one object is placed behind another so that it is completely hidden, will children draw only what can be seen (Luquet’s stage of visual realism) or will they
include the hidden object in the same way that they include a handle on a cup (Luquet’s stage of intellectual realism)? Results from a study by Cox and Martin (1988) with five to nine year old children and adults, where a small green cube was placed behind an opaque black beaker, suggested that when there is no necessary structural link between the objects, most children, like adults, will omit the object they cannot see and draw only the one they can see. Perhaps it is because the cube is not part of the mental image or stereotype of the beaker that it is easier to omit it, whereas the handle is part of the stereotype of a cup.

With partial occlusion, where one object only partially masks the object placed behind it and young children are asked to draw the two objects, they tend to separate them and draw the whole contour of each object (up until around age eight with a simple test of one ball behind another conducted by Cox, 1978 and 1981b).

Figure 4: Example of vertical-separate arrangement in partial occlusion study
There are discrepancies between studies, possibly because of the angle from which subjects view the objects, but this does not detract from the question of why children under about eight do draw separate objects. To check that a partial occlusion configuration is not simply too difficult for children to produce, Cox (1985a) carried out a copying task which showed a high rate of accuracy, showing that at least the children do not lack the necessary motor skills to draw a full circle and attach an arc to it.

Figure 5: Example of copying task (partial occlusion)

Maybe it is the case that children cannot draw (rather than copy) a scene "how it looks" - or are the experimenters simply failing to get the message across to them that this is what is wanted? With a request to "Draw exactly what you can see" the child may not realise that what the experimenter is getting at is that it is how each object appears. This can be compared with Flavell's model of which object can be seen by an observer coming before how the objects can be seen, as described in the previous section. There may also be some connection with what
could be termed a "trying to please" factor, where children may be anxious to draw what they think is wanted, for example two balls or a picture of a cup.

More task-specific tests have involved a game where a robber was chased by a policeman and hid, but the policeman could see where he was because his head was visible over a wall (Cox 1981b).

Figure 6: Robber hiding behind a wall (task specific partial occlusion)

The majority of children aged six and over represented the scene (from the policeman's view) with a partial occlusion: 86% at age six, rising to 95% at age ten. Interestingly, even 44% of four year olds drew a partial occlusion too. This then demonstrates that young children, at least at age six and to some extent at four, can draw a view specific picture. They can inhibit any tendency to draw the whole contour of the occluded object and any tendency to separate the two objects on the page. Variations with task materials using two balls as well as the wall and man, and using the terms "hiding behind" as
well as "behind", seemed to show that it is not necessary to present the materials in the form of a game and it is not even necessary to talk about "hiding" at all; simply placing a man behind a wall is enough to elicit partial occlusions, whereas placing a ball behind a ball is not. However, Cox later found evidence that calling something a wall rather than a block made a difference, because people may hide behind walls and that this type of contextualised task was particularly important for the younger children to draw "how a scene looks" (Cox 1991).

Other work by Cox (1985a) has shown that the more similar the two objects in a scene, the less likely the children are to use partial occlusions; instead, they tend to separate the two objects on the page. This emphasises the great importance of testing materials and the caution that must be used when interpreting results from experimental work - a subject that will be raised again later in section 5.1.

Before concluding this section on visual perspective taking, I should like to consider briefly the idea of visual illusions. Psychologists have studied geometric illusions for many years but still do not totally agree on their explanations.

Some illusions are based on relative size in contrast with
the surroundings.

Figure 7: Illusion based on relative size

Other illusions may be understood if we suppose the figures to be projected in the third dimension. For example, with the Ponzo illusion, the two horizontal lines are the same length but the upper one appears longer.

Figure 8: Ponzo illusion

The fact that the Ponzo illusion becomes greater from childhood to adulthood suggests that the illusion depends on learning to use perspective cues in two-dimensional drawings (Parrish, Lundy and Leibowitz, 1968); in the Ponzo illusion the comparison could be a railway track.
There is also the effect of context on perception. Below, the figure in the centre is ambiguous and the way we see it depends on whether we look from left to right or from top to bottom.

Figure 9: Effect of context on perception

A new concept in vision and illusion is that of computer generated 3D images where a hidden image develops before your eyes (once you have mastered the method of "seeing") eg stereograms produced by Kunoh and Takaoki (1994).

The evidence from the illusions I have illustrated suggests that adults are not always able to perceive things correctly - if being tested, they might not always score full marks. We should bear this in mind when testing children against supposedly perfect adult scores.

This subject of adult fallibility is revisited in my study on locative expressions when I disclose the results of adults tested with the same questions as the children in one of the games (see section 4.2.3).
1.2.3 Conversational role taking and deixis

We saw earlier how children can describe verbally another’s view before they can represent that view pictorially. I shall now examine the child’s use of language, not as a means of representing overtly his or her knowledge about a cognitive task but in the communication process itself, in the context of ordinary conversations, which nevertheless reveals the child’s cognitive understandings. In particular, I shall consider the area of deixis.

The words "deixis" and its adjective "deictic" come from the Greek word for pointing and indicating, gestures which commonly accompany spoken language. The referents (person, place, time) of deictic terms will change as the speaker changes. For example, "I" or "me" may change to "you" when another speaker takes over the conversation, and the locations referred to as "here" and "there" by one speaker may become "there" and "here" to another. Thus the point of view shifts from speaker to speaker. This is problematic enough, but it is further complicated in a number of ways. The speaker may not always speak for him/herself: he or she may for instance use "we" to include him/herself and another body or to indicate that the addressee is also included in the term. In some languages there are distinct pronouns for each of these uses (Cox 1991).
Another complication is that many deictic expressions may also be used in non-deictic ways, e.g., in "the ball is IN FRONT OF the doll" the expression IN FRONT OF is used non-deictically if it means the ball is located near the doll's face regardless of the doll's orientation in relation to the speaker. However, if the term is used deictically, it means that the ball is located between the speaker's face and the doll, whether the doll faces the speaker or not. In the non-deictic sense, the description can be used by any speaker regardless of viewpoint. In the deictic sense, it can only be used if the ball intervenes between the speaker and the doll; a speaker in a different location will describe the relationship differently. These situations of deictic and non-deictic uses are illustrated in the following figures:

**Figure 10a: Deictic uses of IN FRONT OF and BEHIND**

---

Speaker 1   <-   0   speaker 2

- Doll
- Ball

"ball is BEHIND the doll"  
"ball is IN FRONT OF the doll"

Speaker 1   ->   0   speaker 2

"ball is BEHIND the doll"  
"ball is IN FRONT OF the doll"
The child's acquisition of deictic terms in English provides a good opportunity for linguists and psychologists to study the ability to decentre and take account of different points of view. As Elliot (1981: 59) states, the correct use of deictic terms "depends on the ability of both speaker and addressee to work out each other's point of view..."

a) Person deixis

Children first understand pronouns referring to themselves (which they hear as "you", "yourself" etc). Later, they understand those used for others ("I", "me" etc). When children come to actually use pronouns for themselves,
they use those which refer to themselves first ("I", "me", "my") and then those which refer to others ("you" etc). However, just because we know what children do say this is not necessarily what they can say. There may be a good reason why children do not use a particular word or construction in a particular context other than they do not understand its use.

b) Place deixis

Whereas "I" and "you" refer to speaker and addressee, "here" and "there" are not necessarily related to a place near the speaker and a place near the addressee: rather they refer to a place near and a place further from the speaker. But whereas "I" and "you" are mutually exclusive (except where "you" is used in the sense of "one"), "here" and "there" may also be the applicable terms for the addressee's position - much depends on the positioning of the two participants in relation to the places being contrasted.

Moreover, there is no clear boundary of when "here" becomes "there", and they also have non-deictic uses for example "there are two books on the table".

Both the terms "here" and "there" appear early in children's speech but are used in different ways. "There" is often used to indicate an action has been completed
(Griffiths, 1974, Carter 1975) and "here" is used more by children with a gesture, usually pointing either to a near location or one further away. Adults also often use gesture as an accompaniment to their deictic terms.

Whereas "I" and "you" are used correctly by about age two to two and a half years, the contrastive use of "here" and "there" is not achieved until around the age of four (according to Clark and Sengul’s study, 1978). However, many studies of the deictic terms have omitted gesture, which is so important for both "here" and "there" (for the sound reason that they wanted to study the child’s understanding of the linguistic terms) and so this may underestimate the child’s abilities in normal interaction.

A study by Charney (1979) found different results from Clark and Sengul – for example she found more correct responses to "there" when the speaker was at the same side as the child. Charney argues that the instructions given in other tests had been too complex (eg "make the horse over here/there jump up and down") saying that if the child has limited processing abilities she may use most of them on deciding which action to perform. Charney’s instructions were simply asking the child "which one is over here/there?". This appears to be another example of the impact of experimental design on results.
c) IN FRONT OF and BEHIND

IN FRONT OF and BEHIND are mutually exclusive in that what is in front of a reference object cannot also be behind it. However, when the terms are used deictically, the point of view to which they relate is not so clear. Whereas "here" and "there" are related to the speaker's viewpoint, "in front of" and "behind" may be related to:

- the speaker's viewpoint
- the addressee's viewpoint
- some other perspective

At times, the speaker may need to be explicit such as saying "it's behind the tree from where you are looking".

Cox and Taylor compared a situation where the experimenter sat next to the subject and shared her perspective, with one in which the experimenter sat opposite the subject. A fence was stretched across the table. The subject was given a small brick and was told to put the brick in front of (or behind) the fence. Overwhelmingly, most subjects aged between four and nine years and a group of adults related the terms to their own viewpoint:

IN FRONT meant near themselves and
BEHIND meant away from themselves

De Villiers and de Villiers (1974) in a production task
also compared conditions where the experimenter (ie recipient of the message) sat beside or opposite the child. This time the child told the experimenter where to place the object. The children used the terms in relation to the experimenter’s viewpoint.

Thus it is the recipient’s perspective, not the speaker’s, to which these terms seem to relate (Cox, 1991: 149).

We might expect that the terms BEHIND and IN FRONT OF would first be used in a non-deictic way since the terms can be tied to a particular feature (eg using the features of a doll). Tanz (1980) found that the non-deictic system precedes the deictic one in her study of three to five year olds.

When "featured" objects (which have an inherent front or back such as people, houses and dolls) are used, since both deictic and non-deictic interpretations of the terms are possible, there is potential ambiguity. These coincide when for instance a doll faces the observer, but conflict when it faces away. When there is no gesture to clarify the terms, most people normally assume the non-deictic rather than deictic sense. This is particularly true of children (Tanz 1980, Cox 1981a) but a minority of adults do take the deictic option.
Since children, at least by age seven, can respond deictically in tasks involving non-featured objects (Kuczaj and Maratsos, 1975; Tanz, 1980; Cox, 1981c), an experiment was carried out by Cox (1985b) to see if children would respond deictically in a featured-object task. Cox wanted to find out if children were actually aware of the possible deictic interpretation of terms like IN FRONT OF and BEHIND even when the non-deictic interpretation of terms may be very dominant. In an experiment with a clocktower (featured object), and clues such as "in front of/behind the clock", subjects had a first and second guess where the treasure was hidden. Four to eight year olds responded randomly on the second guess, ten year olds and adults tended to repeat their first guess.

So, there was no evidence of an understanding of the deictic interpretation of the terms, even among adults. In fact many subjects stated verbally that no other location was possible i.e. they all used a non-deictic interpretation.

In a second experiment, subjects were rewarded by finding treasure first in a non-deictic interpretation location. Then the location of the treasure was changed to a deictic one. The speed with which the subjects switched strategy (measured by the number of trials to criterion) increased with age: most adults were successful but many of the four
year olds continued to use a non-deictic strategy and did not find the treasure even after twenty trials.

It seems very difficult therefore for young children to appreciate that the prepositional terms IN FRONT OF and BEHIND when referring to featured objects could have a deictic meaning, and indeed most adults do not normally interpret the terms in this way either. But this may be true only in certain kinds of tasks.

Cox and Isard (1990) tested tasks equal or even biased towards the deictic response. Five to six year olds and nine to ten year olds were asked to position a little man IN FRONT OF or BEHIND a toy car which pointed either away from them or to the right. When the observer’s viewpoint was not emphasised, both the age groups responded in the predicted non-deictic way, placing the man near the front/back of the car regardless of orientation. Then the observer’s viewpoint was emphasised: "let me see the man standing IN FRONT OF the car" and "hide the man BEHIND the car". Children still responded in a non-deictic way. Then a more contextualised task was attempted by introducing a game format. Children were asked to take a (pretend) photo of the man IN FRONT OF the car and they also had to hide him BEHIND the car. This time the responses were split: half the children in both age groups opted for the deictic and half for the non-deictic
interpretation. So, even in a task in which the observer’s viewpoint is made highly salient, the non-deictic response has not been overridden.

Finally, the spatial terms were taken out and the children were asked where the man should stand a) to have his photo taken and b) to hide. Only under these conditions did most of the children respond in a deictic way.

This shows that although children can respond deictically when non-featured objects are used or when the spatial terms are omitted from a featured objects task, the terms IN FRONT OF and BEHIND with featured objects have a powerful effect: children respond in a non-deictic manner.

A similar piece of work looking at positions in relation to a car was carried out by Durkin (1981), and the results are discussed in the next chapter, which looks specifically at research in connection with prepositions. A more detailed look at BEHIND and IN FRONT OF is also taken in chapter 4 (sections 4.4.3 and 4.6) when these two interesting prepositional expressions are revisited and some of the errors made with them considered.
2 THE ACQUISITION OF PREPOSITIONS

Various studies have been carried out involving the acquisition and/or use of prepositions and these provide a useful background to this work. Whilst I shall consider a selection of them under general headings below, other more specific studies will be discussed where relevant in the text.

2.1 Longitudinal (developmental) studies

Roger Brown's study of the Harvard children Adam, Eve and Sarah, recorded in his book "A First Language" (1973), is still one of the definitive works on the acquisition of much child language. In discussing prepositions generally, Brown points out that the selection of particular prepositions is in part dependent on the particular noun, for example in the sentences:

- the party was ON Monday
- the party was AT noon
- the party was IN May

It is also clear that the selection of prepositions is in part dependent on verbs, as in the sentences:

- he flew TO Bombay
- he approved OF Bombay
In terms of the actual prepositions looked at in his study of child language, Brown himself examined just IN and ON, since these were the only prepositions used frequently enough to yield fairly continuous data in the longitudinal study. The acquisition curve for both IN and ON for Eve showed a sudden increase in the percentage of obligatory prepositions supplied, rising from between 0%–30% up to around 90% at age 1;9 (1 year 9 months). The acquisition curves for the other two children for IN and ON were similar to Eve’s.

Figure 11: The prepositions IN and ON in Eve’s first 12 samples (Brown, 1973: 263)
Unlike Brown, but in common with many of the longitudinal studies on child language development, Ann French used her own child as the basis of the study. In her paper (1987) on early strategies for dealing with function words (words whose role is largely or wholly grammatical eg articles, pronouns, prepositions), she describes her study of Andrew’s language development. He was a somewhat late talker, producing his first word at age 1;4, and he was the elder of two boys. As far as prepositions are concerned, no prepositional contexts could be identified up to 2;1. At 2;2 there were contexts for IN but no prepositions supplied:

    eg man ...... car

The preposition IN first appeared at 2;3, following direct modelling, but its form was [enna] or [nnə], suggesting that "in the" was treated as a unit:

    eg no you [enna] doors meaning "don’t go indoors"

(The schwa [ə] is a neutral vowel heard at the beginning of a word like "ago". It is also the usual pronunciation of the vowel in words like "the", "a", "an" and "and").

Children do often learn stock phrases such as "in there" without being able to segment the phrase and recombine its parts with other lexical items and so produce fresh phrases such as "on there" (Elliot, 1981: 81).
The form [enna] occurred at 2;3 in French's study meaning "in there" (as well as "in the") also suggesting its use as a unit or stock phrase.

At 2;4, UP became separated from "there" and combined with nouns as well:

eg UP tree

A context for ON occurred but was left empty:

eg soap ..... finger

With UNDER [Anŋ] at 2;5 it was not clear whether this was just the preposition or the determiner as well. A similar variant appeared to mean both "on the" and "on".

A sudden expansion of prepositional contexts occurred at 2;7, with omissions occurring for AT and possibly WITH. BY occurred meaning WITH, ROUND occurred correctly and at 2;8 [ə] was used for FROM:

press it BY [ə] foot
peep ROUND [ə] door
bringed it [ə] Shelagh's

A summary of Andrew's development can be made as follows:

a) avoidance of prepositional contexts
b) use of units derived from preposition plus article
c) more prepositional contexts attempted, involving
omission and substitution of prepositions, including replacement by [ə].

One of the problems with this work is that it involves just one child. However, the results of this study can be compared with other studies and a general pattern can be seen to emerge.

Eve Clark (1993) confirms that in English, children often first mark their awareness that there is some term needed where an adult would use a locative preposition by inserting a schwa [ə] in the preposition slot, as in "sit [ə] chair". She also describes some of the difficulties encountered with terms such as BY and WITH, suggesting that although each relational entity conventionally calls for a different linguistic expression in English, children may initially mark them all with the same term FROM (not the case with the examples from French's son Andrew described above). Clark gives the following source expressions which are taken from a number of children's spontaneous speech:

it came FROM my book box (PLACE)
look at that knocked down tree FROM the wind (NATURAL FORCE)
I not tired FROM my games (CAUSE)
you can be a mum FROM two babies (POSSESSION)
this seat is getting too small FROM me (COMPARISON)
Clark maintains that children appear to be marking a category of sources that may at first contain only places. They learn that locative sources can be indicated in English by means of the prepositions FROM, OUT OF, or OFF. But OUT OF and OFF are both restricted, with OUT OF used only for three dimensional sources and OFF for two dimensional ones. As children add other kinds of sources to the conceptual category, they find a consistent marking for them all in FROM. They produce it first for sources that are places; then sources that are agents (conventionally marked with BY); causes (conventionally marked with BECAUSE); standards of comparison (conventionally marked with THAN) and possessors.

An elicitation study carried out by Clark and Carpenter (1989) seems to confirm the generalisation of FROM. Children aged two to six were asked to repeat and repair sentences containing grammatical and ungrammatical uses of FROM, BY and WITH. Two year olds retained ungrammatical FROM for agents and natural forces in sentences like "birds are scared from big cats" (80% of the time) and also substituted ungrammatical FROM for BY in sentences like "the dog was patted by the little girl" (30% of the time). Overall, two year olds assigned FROM to mark locative sources and chose FROM more often than BY to mark oblique agents. They chose WITH for instruments. From age three on, children showed less reliance on FROM to
mark agent phrases and instead repaired ungrammatical FROM 40% of the time when it marked agents. Older children reserved WITH for instruments and BY for agents not in subject position — the conventional assignments for English.

Clark maintains (1993) that children also rely on their conceptual categories as a source of possible meaning in the domain of spatial relations, including containment and support. Some of her work on spatial prepositions like IN, ON and UNDER is looked at in the next section (2.2).

The subject of Michael Tomasello’s study (1987) was his daughter Travis who was the only child in the family and who was relatively advanced linguistically. Her use of prepositions (amongst other things) was documented between the ages of one and two.

Uses and omissions of prepositions were classified according to the semantic/referential context and with regard to the syntactic context. The following case relations were distinguished:

**LOCATIVE:** designation of a spatial relationship eg one object being ON or OVER another, or an object being AT a location.
DIRECTIONAL: designation of a spatial relationship between a source and a goal eg a car headed TO Mexico or FOR Mexico.

COMITATIVE: designation of a relationship of accompaniment in an activity eg someone going WITH someone to the shop.

DATIVE: designation of a relationship between an action of transfer and an animate goal eg someone giving something TO someone.

BENEFACTIVE: designation of a relationship "for the sake of" eg to do something FOR posterity or FOR someone.

INSTRUMENTAL: designation of a relationship of instrumental support eg doing something WITH a knife or BY memory.

GENITIVE: designation of a relationship of possession or "belongingness" eg the day OF the festival.

With regard to syntax, four levels of relational usage were distinguished in Tomasello’s study based on what aspects of the relation were linguistically expressed:
OMISSION: the relational word is not expressed, but the relation is implicit in the utterance and its non-linguistic context eg "bug monkey bars".

HOLOPHRASE: only the relational word is expressed eg "on" (this occurs much more often with terms such as OFF or OUT).

COMBINATION: the relational word and one of the related items are expressed eg "bug on" or "on monkey bars".

PREPOSITION: the relational word and both of the related items are expressed eg "bug on monkey bars".

Travis's early use of words which are prepositions in adult language came exclusively from four pairs of polar oppositions referring to the spatial distinctions:

UP/DOWN
ON/OFF
IN/OUT
OVER/UNDER

Most of the earliest uses were verb-like, that is, were used to request or comment on an activity:

eg "up" meaning "pick me up"

and not to indicate a spatial relationship between objects.
or an activity and an object, which they all came to do later. This could present difficulty in distinguishing use as a preposition from use as what, in adult terms, is a verb particle acting as a verb. However, the syntactic status of verb particles is not a problem in the light of contemporary assumptions; they can be viewed simply as intransitive prepositions. So, for example, "in" could be used transitively as in "in the box" or intransitively as in "go in".

All but one of Travis’s spatial oppositions were preceded by a period when the preposition was bound to another word, for example "up-here" or "get-out" (with reference to the high chair or car seat) and all could be used holophrastically (as a one word utterance standing for a whole sentence) for example "on" as a request for putting clothes on. All the oppositions were used extensively with the prolocatives HERE and THERE, for example "pillow down here". Omissions were rare for all except IN (eg "bug eye") and ON (eg "man cycle") and it is interesting to note that omissions were found with ON even after Travis had seemingly learned its correct use (which does of course beg the question of when something can be considered learned - a subject which is considered later in section 3.2 in relation to the definition of acquisition). With the exception of IN, misuses were nonexistent.
None of the spatial oppositions was distinctly homonymic in its relational usage (where the same form relates to different meanings), although several had non-relational uses, for example ON/OFF as a description of the TV or radio, and OVER to indicate the end of an activity.

The other prepositions Travis used during her second year do not form as neat a group as the spatial oppositions. The remaining, later-learned prepositions were:

WITH
BY
TO
FOR
AT
OF

These prepositions were mostly learned after the spatial oppositions (though several of them had at least one spatial sense) and they revealed a very different acquisition pattern: none could be used holophrastically to request activities and they were mainly used in sentences or phrases right from the beginning. All six were preceded by omissions in at least one sense. For example, BY was omitted in the utterance "Pete hurt car" (after the dog had been injured). Four out of the six later-learned prepositions were distinctly homonymic, that is, had the same form but different meanings. For example, BY had two distinct uses: as an instrument as in "hurt by swing" and in the locative sense of BESIDE as in "put it
up there by the window”.

For two case relations (instrumental and dative) there was a period of substantial confusion. Synonymity (where two words express the same or a very similar concept) seemed to be associated with misuses, for example WITH and BY as instrumentals. This can be seen when, for a while, Travis frequently used the instrumental BY as a preposition, mostly as an inappropriate substitute for WITH as in her question "Can I pick it up by my hands?" Omissions and misuses were considerably more frequent for the later-learned prepositions than for the spatial oppositions. For instance, Travis’s first clear attempt at using TO as a dative was incorrect when she said "Get raisins to me".

Tomasello’s results appear to confirm for (American) English speaking children the findings of Grimm (1975) and Vorster (1984) on German and Afrikaans speaking children respectively, that is, that spatial relations are learned before those designating other relations. It is also plausible, although there is no direct evidence from Tomasello’s study, that the acquisition order can be explained as a more or less direct reflection of the developmental order of the underlying concepts.

However, it is also possible, and there is some evidence for this, that the pattern of Travis’s early learning and use of prepositions is best explained by cognitive and
linguistic factors, using the metaphor of Johnston and Slobin's (1979) "waiting room". According to this view, a linguistic form enters into the "waiting room" when the child discerns, primarily on non-linguistic grounds, a particular concept. The linguistic form leaves the waiting room when the child acquires a means for expressing that concept in the language he or she is learning. Thus a linguistic form might appear later relative to another either because it entered the room later (cognitive development) or because some characteristic of adult use made acquisition more difficult for the child (linguistic factors). The concept of Johnston and Slobin's waiting room will be discussed in more detail later (section 2.3).

While a cognitive hypothesis is possible in relation to Tomasello's study, there is no clear evidence from his work to support it. In fact, there are are two pieces of evidence that seem to argue against it. Firstly, several prepositions designating spatial concepts very similar to those designated by the spatial oppositions were learned later: TO as a directional locative, and AT and BY as static locatives. If the concepts are no more complex than those of the spatial oppositions, their relatively late acquisition must be explained in terms other than pure cognitive ones. Secondly, during the period when the spatial oppositions were first being used prepositionally,
all of the later-learned prepositions designating non-spatial relations were being omitted from appropriate sentences. These omissions indicated to Tomasello that non-spatial concepts were in some sense available to his daughter as early as those designated by the spatial oppositions. In fact, studies of early two-word sentences invariably find attempts to express instrumental, dative, comitative and genitive relations at the same developmental period as attempts to express locatives (Brown, 1973). If it is true that these concepts are available to the child as early as those of the spatial oppositions, then explanations of developmental order should perhaps be sought in something other than cognitive factors.

Tomasello concludes that it seems likely that the concepts underlying almost all of Travis’s prepositions were available at around the age of 1;7 and spatial oppositions were early to appear because they were used by adults either holophrastically or in highly stressed and salient positions such as "Do you want UP/DOWN/IN/OUT" and "Do you want this ON/OFF?". Travis could have learned these as action or location words and used them holophrastically at first. Then, when she needed their use as a preposition, she already had them available for generalisation (cf Slobin 1973 on "new functions are first expressed by old forms"). As a consequence, their stay in the "waiting room" was brief and linguistic expression
came early.

Whilst this type of adult modelling and early child use seems to work well for the spatial oppositions, the situation is not so simple for the later-learned prepositions (with one exception described below). Rather, adults use these words embedded without stress in complex sentences or phrases and Travis would have needed to employ some type of analytic learning strategy to be able to extract them as independent lexical items. The one exception was Travis’s early use of the comitative WITH which was very similar to her early use of the spatial oppositions; she learned it early, using it first holophrastically and then prepositionally. Tomasello argues that adult models for this expression were very similar to the spatial oppositions, eg "Do you want to come WITH me?" and "Will you come WITH me?". This exception thus seems to provide further support for the view that the way Travis learned and used the spatial oppositions was due not so much to the nature of the underlying concepts but rather to the way adults around her used these words. looked at in this way, adult use is an important factor surrounding child language acquisition of prepositions.

This subject of adult use affecting children’s early lexical development is considered by Barrett, Harris and
Chasin (1991). Here, the conclusion is reached that although there is a strong relationship between maternal speech and children’s initial word uses, the relationship between maternal speech and children’s subsequent word uses was very much weaker.

Frequency of adult use with prepositions is mentioned again in section 2.3 in relation to work by Slobin (1985), Moerk (1980) and Mills (1985), but the whole subject of adult input is a controversial one and will not be covered in detail in this thesis.

The related area of prepositions in literature would be interesting to study and although I have not conducted an extensive survey of books for children in the two to five year age group (the age under consideration in my study), it does seem that where books specifically contain prepositional expressions, they are often those frequently used in everyday life when looking for things or doing things (see Appendix 1 for examples). In particular, there is a noticeable absence of the prepositional expression IN FRONT OF (cf discussions in section 2.3 on the development of BEHIND and IN FRONT in connection with cross-linguistic studies).
2.2 Non-linguistic strategies

A key piece of research into the understanding and use of some locative prepositions was undertaken by Eve Clark (1973a). Clark set out to find an order of acquisition for the prepositions IN, ON, and UNDER and tested children aged 1;6 to 5;0.

In the first experiment, children were asked to put a small object (x) such as a toy mouse IN/ON/UNDER a reference point (RP). The six RPs were chosen because each allowed two of the three spatial relations. The box on its side and the tunnel each allowed an object to be placed either IN or ON. The dump truck and the crib allowed either IN or UNDER and the table and bridge allowed either ON or UNDER.

Seventy children were divided into seven age groups of six-month intervals and each child was interviewed separately. The children were asked to put x IN/ON/UNDER the RP for both possible relations with each RP. Clark found that the young children (under 3;0) were nearly always correct with IN items, next most successful with ON items and hardly ever correct with UNDER. The errors showed a very consistent pattern, which indicated the following simple, ordered rules which are based on the child’s non-linguistic knowledge of the usual or expected
spatial relationship between x and the RP:

RULE 1: If the RP is a container, put x inside it
RULE 2: If the RP has a horizontal surface, put x on it

These two rules are strictly ordered in that Rule 1 is always applied and if it fails, Rule 2 is applied next. The use of Rule 1 predicts the error of ON going to IN and of UNDER going to IN while Rule 2 predicts the error of UNDER going to ON. The use of two such ordered rules accounted for 92% and 91% of the errors made in the two youngest groups (1;6-1;11 and 2;0-2;5).

Clark referred to the rules as non-linguistic strategies, where the child supplements his or her partial semantic entry for the preposition (assumed to be something like [+locative] for all prepositions). For example, when a child treats ON as if it means IN, this is done not because he or she thinks ON means [+locative] and [+containment] but because he or she thinks ON means [+locative] and because he or she is using a non-linguistic strategy in conjunction with this partial meaning.

Clark then conducted another experiment, designed to provide independent evidence for the non-linguistic strategies that seemed to be used by the younger children in the first experiment. This tested if the non-
linguistic strategies would be used in situations where no locative words were heard. Children were asked to copy a configuration of x and RP modelled by the experimenter. The hypothesis was that if a child was using a non-linguistic strategy he/she should "correctly" copy any configuration that conformed to Rule 1 or 2, but those not conforming should produce predictable errors. Fifteen of the 20 subjects in the experiment made a total of 40 errors, of which 38 were "predicted errors", eg didn't copy the experimenter's pattern of x beside an upright glass, but put x in the glass. The two unpredicted errors occurred where x was placed on an upside-down glass and both consisted of the child turning over the glass and placing x inside it. One of the children even turned over the experimenter's glass and did the same thing with it!

The results of experiment 2 therefore provided strong evidence for the non-linguistic strategies (the child schema) that appeared to be used in experiment 1. Young children rely on the same non-linguistic strategies in a copying task as they do in a comprehension task using the words IN, ON and UNDER.

Semantic knowledge (the adult schema) and non-linguistic strategies (the child schema) may coincide in the kind of responses given by the child. In the case of the word IN, it may be impossible to find out which basis the young child is relying on for his or her response. However,
both ON and UNDER in experiment 1 allowed some separation of the child and adult schemas and a third experiment carried out by Clark attempted to look at the transition from child to adult schema. In this experiment, each child was presented with a pair of RPs, identical in all respects except orientation. The child was then given an instruction eg "put the x on an RP". The RPs were plastic tubs, plastic glasses and plastic boxes, and they were always presented in pairs (in a previous pilot study efforts to get the children to manipulate a single RP to conform to the instruction had failed, hence the introduction of pairs).

The results of this third experiment provided further support for the existence of non-linguistic strategies and also gave evidence that the transition from use of a child schema (non-linguistic strategies) to use of an adult schema (semantic knowledge) is fairly near to completion for all three locative terms IN/ON/UNDER at age 2;6 to 3;0.

If reliance on non-linguistic strategies is widespread amongst young children during the acquisition of language, then it is possible that these strategies play a role in determining the order of acquisition of certain linguistic distinctions. Slobin (1973) proposed that the main determinant of order of acquisition for linguistic
(semantic) distinctions was their relative cognitive complexity (although it is difficult to know how best to measure the cognitive complexity of different linguistic forms). Clark suggested that the non-linguistic strategies may provide a basis for the child’s linguistic hypotheses about the meanings of words. If so, it is important whether or not the responses based on strategies coincide with those based on semantic knowledge. Where the responses coincide, the child has little to learn, but where they do not, he or she has much more to learn before that meaning is acquired. This would make IN cognitively simpler than either ON or UNDER because it requires minimal adjustment of the child’s hypothesis about its meaning (that is, Rule 1 applies). On this basis, ON should be more complex than IN because the child has to learn that only the second of the two ordered rules applies, and UNDER should be more complex still because neither Rule 1 nor Rule 2 will produce any responses that coincide with the actual meaning of the word. This matter of the cognitive order of difficulty is looked at again in the next section with reference to more locative prepositions.

Following on from Clark’s work, Wilcox and Palermo (1974/5) pointed out that the physical properties of the reference objects were not the only features to be important. Children were also sensitive to whether something was congruent or not. By selecting small
objects carefully, they showed that if a child was asked to put a piece of track in a truck, he/she was likely to incorrectly place the track under the truck (ie where you would normally expect it to go). Thus the child's expectation of which arrangement is more natural is an important factor, especially with two-year-olds. This is compatible with the proposal made by Strohner and Nelson (1974) that, in understanding passive sentences, two and three year olds follow a probable event strategy.

Work done by Grieve, Hoogenraad and Murray (1977) provides further evidence for the importance of probable event strategies, where experiments with blank boxes which were assigned names (eg baby, bath) revealed that children put a lot of meaning into the materials used in experiments.

Macrae (1976) explored the range of prepositions four year olds would use to describe objects vertically aligned and found that while ON TOP OF, UNDER and UNDERNEATH were frequently used, OVER and BELOW were very infrequent and ABOVE was never used. There were virtually no confusions of polarity by children at this stage. Some of them produced interesting composite constructions such as "up beside" and "down beside" during the experiment.

Macrae also noticed that there were some constructions which the children seemed to avoid using. For example,
when asked for the position of a television set in a picture containing a vase of flowers on top of a television, the children would avoid saying "the television is under the flowers" and would either hesitate and then produce the more natural description:

"the television is... the... the flowers are on top of the television" (ie reversing the order)
or they would say things like:

"the television is over in the corner".

When four year old children were asked to point to a picture reflecting a rather strange sentence "the chair is under the cushion" they would in fact point to the picture of a cushion under a chair, despite the fact that this arrangement is less congruent or normal than the picture of a chair with a cushion on (which was the picture that should have been pointed to). Macrae concluded — questionably perhaps, given the strange nature of much of the test — that although nursery children appear to have a good grasp of some of the locative prepositions and rarely use the incorrect word order with them, they do not in fact have a syntactic rule associated with their use. Macrae maintained that what children do is assign the status of referent object to one item (either on perceptual or discourse grounds rather than from the order mentioned) and then use the preposition as a clue to the
relative positioning of the objects. Consequently, the children are using pragmatic rules for comprehension and production which are qualitatively different from those which adults are supposed to use but which, outside psycholinguistic experiments, coincide with the adult rules. There is, however, good reason to suggest that the children in Macrae’s experiment were confused by the strange nature of the questions asked.

I replicated some of Macrae’s work with my own research, using a picture of a clock on top of a television set and asking where the television was (see picture in Appendix 6). As one might predict from Macrae’s results, this did produce problems for the children, but not just for the children. I also tested a number of adults with the picture cards (to check adult use of prepositions) and the television/clock picture was the card which gave rise to the most errors and delays in responding. In some cases I don’t think the adults were listening properly to the question and automatically assumed I had asked "where is the clock?" which is the more natural question; in other cases they would realise their "slip of the ear" and after first replying (incorrectly):

"it’s on top of the television"

would suddenly realise their mistake, usually laugh and correct themselves either by saying:
"it's under the clock"
or by turning round the sentence and saying:

"the clock is on top of the television"

In such situations, nobody would assume that adults do not understand prepositions or syntactic rules, so surely we should not be too hasty drawing those conclusions for children.

In the course of everyday life the child's lack of understanding of certain prepositions normally goes unnoticed, because the combination of non-linguistic and probable event strategies means the child copes efficiently with the normal situations that arise:

eg "let's put the puzzle back in the box"
   "put your beaker on the table"
   "your shoes are under the bed"
   "I last saw your red tractor behind the sofa"

In psycholinguistic testing, however, it becomes apparent that the child does not always fully understand the prepositions (and even adults can be "caught out" if they are not concentrating!)

Kevin Durkin (1981) investigated British children's grasp of prepositions and showed that their acquisition is a
protracted affair, continuing well into the early school years. The children, aged 3;10 to 7;10, showed an increasing willingness to use spatial prepositions with increasing age, as might be expected. Durkin also found that many of the children’s responses contained idiosyncratic deviations from presumed adult descriptions:

eg "quite in"
"halfway at"
"nearly facing to"

Other evidence from Durkin’s research pointed to more specific differences between children’s grasp of the meaning of prepositions and that of adults. It is conventionally held, for example, that the terms IN FRONT OF and BEHIND are opposites. However, there are a number of fairly complex considerations involved in actually using these terms in the real world depending on whether the speaker intends (or is assumed to intend) to refer objectively to the properties of a reference point (RP) or subjectively to the space between him/herself and the RP:

eg "stand in front of the car" could mean
a) stand in the space adjacent to the front of the vehicle: or
b) stand in the space adjacent to whichever side of the vehicle is facing the speaker (or hearer)

When children were asked to place an object IN FRONT OF or
BEHIND a toy car, placed sideways between child and experimenter, very few clearly defined errors were obtained and many responses were correct. But almost 20% of the sample gave asymmetrical responses; that is, in response to IN FRONT OF the child might place the object at the front of the car, but the same child would respond to BEHIND by placing the object on the experimenter's, or his own, side of the vehicle. Although other asymmetrical pairs of responses were recorded, this type with a correct, object-oriented response for IN FRONT OF, but a subjectively oriented response for BEHIND, was the most common.

Durkin concluded that this asymmetry partly reflects the child's uncertainty with the terms, and partly the fact that IN FRONT OF explicitly refers to the properties of the object, while BEHIND does not. This asymmetry of responses contrasts with some American findings, where comprehension of IN FRONT OF and IN BACK OF was tested; for instance, Harris and Strommen (1972) found that 97.5% of their subjects' responses were symmetrical. One important consideration here is whether the experiments were identical (which is unlikely) in order to achieve comparable "asymmetry scores". Another consideration is whether asymmetries are found with adults. If this is the case, then it would call into question the notion of linguistic/semantic uncertainty with the terms which
Durkin refers to. My own testing of adult subjects with picture cards did provide one instance of adult asymmetry where something was described as BEHIND a side-facing featured object yet something else was described as AT THE SIDE OF (rather than IN FRONT OF) another side-facing featured object. Whilst one example (amounting to less than 8% of the adult subjects) hardly provides conclusive evidence, it does suggest that adult patterns and errors should also be considered before drawing too many conclusions about children.

The idea of the child's point of view in terms of deictic/non-deictic responses has already been considered in section 1.2.3 and the issue of subjective/objective viewpoints is considered again in relation to my own research: perspective is considered in section 3.4.1 and asymmetrical responses with featured items facing the side in section 4.2.3.

Durkin also tested children's understanding of proximity prepositions such as NEAR, BESIDE and BY (1978). Although the semantics of these prepositions are relatively less well studied than those of other prepositions, it is generally agreed that they denote a type of spatial relation which is highly context dependent and subjectively evaluated. The children's responses to these prepositions were very interesting, as often they placed object x in contact with object y (when asked to place
NEAR, BESIDE, BY etc). One could argue that the children's interpretations of these prepositions are not awry, as their "meanings" do not necessarily preclude physical contact. Yet it seems to be another area where the child's "point of view" differs somewhat from the adult one.

Other prepositions which seemed to hold problems for young school children in Durkin's (1981) study were ABOVE, BELOW and BETWEEN, where some of the errors were reversal ones (for example the child gave the response appropriate to ABOVE for BELOW) but many appeared to be the result of a failure to make the necessary prior action (such as lifting an object to place another below it).
2.3 Cross-linguistic studies

Judith Johnston and Dan Slobin (1979) looked at the development of locative expressions in English, Italian, Serbo-Croatian and Turkish. This development was viewed in terms of

- non-linguistic growth in conceptual ability
  (COGNITIVE FACTORS)

- language specific differences to the order in which the locative expressions were acquired (LINGUISTIC FACTORS)

On the basis of the cognitive factors, a fairly universal sequence would be expected. However, because languages differ, cross-linguistic differences in the rate and sequence of development of particular linguistic forms should appear.

Seven basic locative relations were examined:

IN, ON, UNDER, BESIDE, BETWEEN, BACK and FRONT

On conceptual grounds, notions of containment, support and occlusion predicted early acquisition of IN, ON and UNDER (Piaget and Inhelder, 1956). Other developmental linguistic studies supported this prediction (eg Brown, 1973; Clark, 1977). BESIDE, encoding a purely spatial
proximity relation, independent of object features or viewpoint of speaker should, argued Johnston and Slobin, follow IN, ON and UNDER, but be conceptually simpler than BETWEEN, BACK and FRONT. BACK and FRONT have two uses: for reference objects with inherent fronts and backs (eg people, cars, houses) referred to as featured (BACKf, FRONTf) and for objects without inherent orientational features (eg trees, blocks, drinking glasses) where the terms encode a projective notion with regard to the position of the speaker ie non-featured (BACK, FRONT). The projective notion, requiring attention to the speaker's point of view, as well as a co-ordination of the relative proximities of speaker, reference object and located object, is conceptually more difficult than the non-projective BACKf and FRONTf and should be acquired later (Piaget and Inhelder, 1956). BACK and FRONT were therefore predicted by Johnston and Slobin to be acquired later, as they were considered conceptually more difficult. BETWEEN requires a co-ordination of two proximity relations and was judged to appear after BACKf/Frontf which require a specification of object features.

There is also evidence (eg Tanz, 1976) that the child is likely to focus on disappearing or inaccessible objects, which together with the improbability of asking where a visible object is, suggests that BACK will be developed before FRONT in both featured and non-featured instances.
The locatives were therefore expected to appear in the order:

IN/ON/UNDER <BESIDE <BACKf <FRONTf <BETWEEN <BACK <FRONT

where f denotes reference to a featured object
< denotes "followed by"

Against this background, a number of factors or predictions were examined which might affect the order:

a) The three Indo-European languages (English, Italian and Serbo-Croatian) are prepositional while Turkish is post-positional. There is some evidence that postpositional systems are more easily acquired than prepositional ones because children reportedly pay more attention to the ends of words (Slobin, 1973), and so an additional advantage for Turkish was predicted on these grounds.

b) Another linguistic factor is lexical diversity in the expression of a particular notion. For example, English BESIDE, BY, NEXT TO, NEAR TO, CLOSE TO compared with the one Turkish word YANINDA. Johnston and Slobin predicted that lexical diversity would delay acquisition of the means for encoding a relation.

c) Some terms have clear etymology eg English BACK which names a body part and makes acquisition easier since
the word relates to something tangible ("at the BACK of teddy" for instance) compared with a locative where the word meaning is not so clear eg BETWEEN. Clear etymology was predicted to facilitate acquisition.

d) Morphological complexity should delay acquisition eg English ON TOP OF and other expressions using numerous adpositions.

e) Some surface forms are homonyms for more than one underlying notion. In the study, the terms for both BACK and FRONT are both homonyms, in that they encode relations to featured and non-featured objects with no difference in surface linguistic form. On the grounds that children prefer one-to-one mappings between semantic concepts and surface morphemes (Slobin, 1977), homonymity should impose a measure of linguistic difficulty on acquisition.

Around 48 children from each language group aged between 2;0 and 4;8 were examined. They were tested twice, the second time four months after the first. The test consisted of a reference point (RP) in front of the child (such as a plate) and a small named object eg a stone was then placed in relation to the RP. The child was then asked where the stone was.
The youngest children often gave deictic responses, in the sense of pointing and saying "there", but the overall results were very positive. Children in all language groups learned locatives in a consistent order. The exact order was language specific, but there was also a general order which spanned all language groups (and which tied in closely with the predicted order). This general order was:

IN/ON/UNDER/BESIDE <BACKf/Frontf/BETWEEN <BACK/FRONT

and was based on the results from the four languages, as set out in the following table:

Table 2: Order of acquisition of locative expressions and % of subjects producing each (from Johnston and Slobin, 1979: 537)

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>Italian</th>
<th>Serbo-Croatian</th>
<th>Turkish</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>90</td>
<td>91</td>
<td>88</td>
<td>90</td>
</tr>
<tr>
<td>ON</td>
<td>83</td>
<td>88</td>
<td>84</td>
<td>80</td>
</tr>
<tr>
<td>UNDER</td>
<td>81</td>
<td>84</td>
<td>82</td>
<td>UNDER</td>
</tr>
<tr>
<td>BESIDE</td>
<td>74</td>
<td>77</td>
<td>UNDER</td>
<td>79</td>
</tr>
<tr>
<td>BETWEEN</td>
<td>49</td>
<td>BETWEEN</td>
<td>57</td>
<td>BACKf</td>
</tr>
<tr>
<td>FRONTf</td>
<td>30</td>
<td>BACKf</td>
<td>42</td>
<td>BETWEEN</td>
</tr>
<tr>
<td>BACKf</td>
<td>21</td>
<td>FRONTf</td>
<td>41</td>
<td>FRONTf</td>
</tr>
<tr>
<td>BACK</td>
<td>14</td>
<td>BACK</td>
<td>23</td>
<td>BACK</td>
</tr>
<tr>
<td>FRONT</td>
<td>3</td>
<td>FRONT</td>
<td>18</td>
<td>FRONT</td>
</tr>
</tbody>
</table>

Note that the order of acquisition was established from the order of difficulty experienced with the locative
expressions, as measured by Guttman scaling procedures (see section 4.2.1).

Italian and Turkish children seemed to learn the locatives more quickly and at earlier ages than the English and Serbo-Croatian ones. They also had a larger repertoire and made few substitution errors as well as learning more terms in the four month re-test period.

It was interesting to see how conceptual and linguistic factors could be interlinked. For example, there was an eleven month age difference between the Turkish and Yugoslav children whose most advanced locative was BACKf. Johnston and Slobin proposed that the young child learning Turkish might acquire featured BACK before becoming aware of its homonymity, because the word is linguistically easy. In contrast, the child speaking Serbo-Croatian, due to morphological complexity and lexical diversity, may still be acquiring featured BACK when he or she develops the capacity for projective judgments. Thus the homonymity of featured BACK would pose additional problems. Homonymity could then have a differential effect upon locative acquisition. Lexical diversity, particularly with English and Serbo-Croatian, often resulted in a guessing strategy, as well as slowing down the child’s search for mapping regularities.
It was the results of this work that inspired Johnston and Slobin's "waiting room" concept, where the key into the room is the underlying notion and the key out is the linguistic form. A linguistic form therefore enters the waiting room when the child learns, primarily on non-linguistic grounds, a particular concept. The linguistic form leaves the waiting room when the child acquires a means of expressing that concept in the language he or she is learning. Thus one linguistic form may appear later relative to another either because it entered the waiting room later (cognitive development) or because a certain characteristic, for example adult use, made acquisition more difficult for the child (linguistic factors).

Figure 12: The "waiting room" concept

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Whilst Johnston and Slobin's work provides a neat explanation for cross-linguistic language acquisition, there are some potential flaws which should be examined.

Firstly, the underlying assumption of universal develop-
ment of conceptual factors is a cause of concern since, as we saw in chapter 1, there are differing theories about how concept learning actually takes place.

The assumption that meanings arise in the child independently of knowledge of the forms with which to express them is an important issue with cross-linguistic comparisons as there is often no check on the assumption that given communicative intentions arise in all children at about the same age regardless of their local language. If, in fact, properties of the language being learned systematically influence the time at which given intentions emerge (a possibility recognised by Slobin, 1982) then time of acquisition per se cannot provide an unambiguous guide to linguistic complexity. A further crucial assumption is that the time of acquisition of a form is influenced by only two factors: the difficulty of the meaning it expresses and its formal complexity for children. Given only these two assumptions, one can reason - as Johnston and Slobin did - that if meaning is held constant and time of acquisition varies across languages, then difficulty of form must be the determining factor. Conversely, if formal difficulty is held constant across a set of forms expressing related meanings, variations in time of acquisition can be attributed to differences in the difficulty of the meanings, as Melissa Bowerman points out (1985).
But are cognitive and linguistic complexity the only two factors that can influence time of acquisition? Looking at cross-linguistic evidence for the language-making capacity, Slobin himself (1985) discusses evidence for the role of two additional factors: the relative pragmatic usefulness for the child of different structures and differences in frequency of modelling. The role of frequency is another controversial area. However, even investigators who consider it relatively unimportant acknowledge that extremely frequent or infrequent modelling probably influences time of acquisition (e.g., Brown, 1973) and frequency also seems to play a significant role in determining which formal devices a child will learn first to express a given meaning when the language provides more than one option (Snow, 1977).

Gentner (1982) found that words for relational meanings are consistently learned later than words for concrete objects. After ruling out various other explanations (e.g., that adults model object words more often than relational words), she argues that this discrepancy reflects differences in the cognitive "naturalness" of the corresponding concepts: objects concepts are more "given", whereas relational concepts are more imposed by the structure of language and so require additional time to be constructed. Bowerman (1978) and Gopnik (1980) proposed that children at the single word utterance stage
generalise words to novel referents on the basis of not only their non-linguistic concepts but also their observations of regularities across situations in which adults use the words.

Soonja Choi and Melissa Bowerman (1991) looked at the relationship between non-linguistic cognition and language input in children’s acquisition of spatial expressions in English and Korean. Their findings challenge the widespread view that children initially map spatial words directly to non-linguistic spatial concepts and suggest that they are influenced by the semantic organisation of their language virtually from the beginning. Language specificity in semantic organization has rarely been considered in studies of the acquisition of spatial expressions as most investigators have assumed that the meanings of spatial words like IN, ON and UNDER reflect non-linguistic spatial concepts rather directly. The results from Johnston and Slobin’s study do, however, appear to show that children acquire English spatial prepositions and their counterparts in other languages in a relatively consistent order and that this order seems to reflect primarily the sequence in which the underlying spatial concepts are mastered. Choi and Bowerman accept, then, that non-linguistic spatial understanding is important in the development of spatial words. But, they suggest, there is reason to doubt whether it directly provides spatial concepts to which words can be mapped.
In their study, Choi and Bowerman (1991) contrasted the way motion is lexicalized by English and Korean children and examined spontaneous speech from the period of single word utterances and early word combinations. They found that although the children learning English and Korean talked about similar motion events in the second year of life, they did not do so in similar ways. English speaking children relied heavily on Path particles such as INTO, OUT OF, UP, DOWN. They started out using some of these in restricted or idiosyncratic ways, but soon extended them to a wide range of spontaneous and caused motion events that share similar abstract Paths. Note that in English, Path is marked the same way whether a motion is spontaneous or caused (cf "The ball rolled INTO/OUT OF the box" vs "John rolled the ball INTO/OUT OF the box"). Korean children did not use words in the same way. Like Korean adults, they distinguished strictly between words for spontaneous and caused motion. They did not acquire intransitive Path verbs for spontaneous motion IN, OUT, UP and DOWN until long after English learners began to use Path particles for spontaneous motion. Once they did learn verbs for UP and DOWN, they never overgeneralised them to posture changes or used them as requests to be picked up and carried, both favourite uses of UP and DOWN by English speaking children.
The children in the study (both nationalities) also made certain errors, even with topological relationships

eg "in" (putting ping-pong ball between knees)

which suggested that some spatial words are more difficult than others, presumably for cognitive reasons (Choi and Bowerman, 1991: 114).

So, in rejecting the hypothesis that children's early spatial words are mapped to non-linguistic concepts, Choi and Bowerman do not mean that non-linguistic spatial cognition plays no role in spatial semantic development. They agree that across languages, children learn words for topological relationships (eg IN and ON) before words for projective relationships (eg IN FRONT OF and BEHIND) and presume that this bias reflects the order of emergence of non-linguistic spatial understanding. They conclude that the meanings of children's early spatial words are language specific and that language learners are sensitive to the semantic structure of the input language virtually from the beginning. By age three, for example, English and German speaking children differ strikingly from Spanish and Hebrew speaking children in how they express spatial information in a story-telling task (Berman and Slobin, 1987). How children figure out language specific spatial categories remains uncertain though.
Whilst claiming that the meanings of children’s early spatial words are language specific, Choi and Bowerman (1991) acknowledge that existing cross-linguistic studies do not show which is more important in very young children’s acquisition of spatial language: non-linguistic spatial knowledge or the semantic organisation of the input language.

Van Geert (1985/6) also questions that the terms IN, ON and UNDER are mapped onto pre-verbal conceptual organisation of spatial relations. He suggests a modular theory: that knowledge of spatial relations is represented mentally in three structurally distinct forms: perceptual, praxic (practical) and linguistic. According to this view, the child must learn which lexical contexts belong with which preposition (he discusses English and Dutch, both of which use prepositions to mark spatial relations). Van Geert argues that there are no theoretical grounds for claiming that IN is less complex than ON or that ON is less complex than UNDER. However, there are praxic differences associated with the terms. In order for an object to be placed UNDER another, the reference object must be lifted, and when an object is IN a container, it is also ON (the bottom of) the object. In addition, van Geert claims that perceptually something that is ON is more salient than something that is UNDER. According to van Geert’s view, the concepts represented by the prepositions are, from the beginning, based in the lexical
distribution rules relating to the three distinct forms (perceptual, praxic and linguistic).

There are also other insights to be gained from looking at the acquisition of prepositions in other languages. How then does the order suggested by Johnston and Slobin (1979) hold up in these languages?

In French, the first preposition to appear is "à" (AT/TO). This seems to appear first in possessive or benefactive settings, as in "à moi" (to me/mine, for me) (Sabeau-Jouannet, 1978). "De" (OF/FROM) also appears early with animate nouns, to indicate possession. However, the line between possessive and locative is somewhat tenuous in the earliest stages, and very young children may equate the two (cf Greenfield and Smith, 1976). The next spatial preposition to appear is "dans" (IN), followed soon after by "sur" (ON), which, according to Sabeau-Jouannet (1978), contrasts with both "à" and "dans" in the two-year-old’s speech. The further contrast of "sur" (ON) with "sous" (UNDER) takes a little longer to emerge. In comprehension, children appear to master terms that contrast on the vertical axis eg "sur" (ON) and "sous" (UNDER), "en dessus de" (ON TOP OF) and "en dessous de" (UNDERNEATH) before those for the horizontal, front-back axis eg "devant" (IN FRONT OF) and "derrière" (BEHIND) (Piérart, 1977) which generally parallels the English data.
(Clark, 1980). Later still, they acquire terms like "entre" (BETWEEN) and "au milieu de" (IN THE MIDDLE OF" (Piérart, 1975).

Although the general order of acquisition in production in French seems to follow that found in comprehension, there are some discrepancies within production when Sabeau-Jouannet’s data are compared with Piérart’s. Such discrepancies could be the result of subtle differences in the varieties of French spoken by and to the children, or the result of the elicitation methods used to obtain production data in some experimental settings (E Clark, 1985).

In Italian, the main data available are observations of early production, some elicited production, and some data on comprehension (E Clark, 1985). The first locative preposition to appear is "a" (TO/AT) at around age two and then, as seen in the previously described cross-linguistic study by Johnston and Slobin (1979), the equivalents to IN ("in", "nel", "dentro"), ON ("sul", "sopra"), BESIDE ("vicino a"), UNDER ("sotto"), BETWEEN ("tra", "in mezza a"), BEHIND ("dietro") and IN FRONT ("davanti"). Like English, the Italian terms for BACK and FRONT are sufficiently complex linguistically to retard the emergence of these terms in relation to terms for BETWEEN, even though BETWEEN is a conceptually more advanced notion (Slobin 1985). In English we have two terms for BACK
rather than one (BEHIND and IN BACK OF) and in Italian, the expression "dietro a" is also morphologically complex and does not correspond to the word for the body part "back". As Johnston and Slobin put it: "Wherever conceptual complexity fails to predict actual order of acquisition, we find some pocket of relative linguistic difficulty" (1979: 541).

The data for Spanish are not as extensive, but show a similar pattern with "a" (AT/TO) and "en" (IN) amongst the earliest prepositions used. Taking the available Spanish data with those for Italian and French, we can see that in the Romance languages, the earliest spatial prepositions acquired are terms for AT or IN, followed very quickly by ON, UP and DOWN, and by OUT or OFF. These forms enter during the second year, from age 2;0 to 2;6 onwards. Children then also begin to acquire the various verbs of motion that contain directional information. In the Romance languages, such verbs typically combine notions of motion with those of direction, eg Spanish "subir" (to go up), "entrar" (to go in), or French "entrer" (to go in), "sortir" (to go out). This is in contrast to English, where verbs usually combine motion with manner rather than direction eg run, scramble, crawl (Talmy, 1975) - see (1).

(1) The baby is running/crawling (around) in the kitchen.
Directional information in English is provided by locative particles like IN, OUT, ON, or TOWARDS added to the verb:

(2) The baby ran/crawled into the kitchen.

In German, case markings are important to show general location (dative case) or change of location (accusative case):

(3) Das Baby krappelte in der/die Küche.
   (The baby crawled in/into the kitchen.)

In contrast, in the French equivalent showing a change of location (4), the main verb (est entré) combines motion with path, while manner is expressed by other means ("courant"/"en rampant"):

(4) Le bébé est entré dans la cuisine courant/en rampant.
   (The baby entered in(to) the kitchen by running/crawling.)

Other recent research has examined children’s use of spatial devices in discourse across languages, showing that typological differences (i.e., differences in the type/structure of language) affect what spatial information adults and children focus on and how they organise the flow of information in discourse (Hickmann, forthcoming). For example, static locations must be
inferred from Paths in English as in (5) below, whereas Paths must be inferred from Path verbs and static locations in Spanish (6):

(5) The boy put the frog down into a jar.
(6) El niño metió la rana en el frasco que había abajo.
(The boy inserted the frog in/on the jar that was below.)

In the acquisition of German, prepositions are frequently omitted by children under 3;0 (Grimm, 1973) and when they are used, certain ones predominate, leading to incorrect use in locative and temporal expressions. According to the data reported by Grimm (1975), the prepositions most frequently used in locative expressions by children aged 2;6 to 6;0 are "in" (IN), "auf" (ON), "zu" (TO) and "bei" (AT). "Unter" (UNDER) is far less frequent, although it has a level of conceptual complexity similar to IN and ON. It is possible that "unter" (UNDER) is not produced so often by children because it reflects adult use, as the prepositions most frequently used by the children in Grimm’s study (1975) match those which are most frequent in adult German speech (Meier, 1964). Moerk (1980) also concludes that the relationship between input frequency and the acquisition of the grammatical morphemes is worth another look and that Brown (1973) was wrong when he dismissed it as an insignificant variable.
Although frequency of usage may be a factor explaining which prepositions are first acquired, cognitive simplicity of the relations to be expressed does appear to be relevant in German too (Mills, 1985). As far as the acquisition of prepositions in German is concerned, more data would be needed to disentangle the influence of linguistic and cognitive factors.

Hebrew-speaking children appear to acquire spatial prepositions in an order consistent with that noted for other languages - a study by Kolman (1979) with children aged 1;6 to 4;6 revealed the following order in both comprehension and production tasks: ON, IN, UNDER, NEXT TO, BEHIND and IN FRONT OF (with the terms dividing up into two developmental groups - IN, ON, UNDER and then NEXT TO, BEHIND and IN FRONT OF) while Yif'at (1981) found that four to five year olds still had difficulty with the preposition "beyn" (BETWEEN, AMONG). These findings are highly consistent with those of Johnston and Slobin (1979) and together with developmental patterns for the acquisition of pairs of dimensional adjectives such as BIG/SMALL in Hebrew, indicate clearly that a cognitive grasp of spatial and dimensional relations dictates developmental order and that conceptualisation of these relations precedes the linguistic encoding of such distinctions (Berman, 1985).

Although Japanese data on locative expressions are rather
sparse and unsystematic, there is some evidence that Japanese children acquire locatives in a stable sequence (Clancy, 1985). Usually the first locative to be acquired is "ni", which covers the semantic range of English IN and ON, as well as AT and TO. In Clancy’s data, after several simple post-positions had emerged, locatives which are linguistically and cognitively more complex began to appear, such as the Japanese equivalents of BESIDE, INSIDE etc. Since these forms are constructed in a manner similar to the corresponding Turkish locatives, Japanese would provide an interesting test case for the tests of acquisition carried out by Johnston and Slobin (1979).

The data from many languages for the early stages of locative expressions therefore show strong parallels in which notions are expressed first. These parallels suggest that the conceptual complexity of many spatial notions is a primary factor in determining when children learn expressions for them in their first language. Children first look for linguistic expression of those notions which they have already mastered conceptually. Complex notions take longer to grasp and so are available only later in the development.

In this domain, then, the pace set for the acquisition of spatial terms appears to be largely determined by children’s cognitive development. We should not forget,
however, that there may be other factors at work too, such as the frequency of input (adult use) and the semantic structure of the language itself, as we saw earlier in this section when considering the work of Bowerman and Choi (1991).

Some other work looking at the influence of language specific properties in the acquisition of locative expressions was carried out by Edith Bavin (1990) who studied children speaking Warlpiri, a Pama-Nyungan language spoken by about 3,000 people in central Australia. Bavin proposed that if there was a universal tendency for "support" and "containment" to be the concepts which are first mapped onto linguistic forms, then young children from very different language backgrounds would be expected to use their language to express these concepts before others. If, on the other hand, she found that children do not distinguish between these, but that observations of their acquisition are correlated with the way their language divides up spatial relations, one could argue that children do not just search for ways to express these pre-linguistic concepts; rather that the development of the concept may be influenced by language experience (as suggested by Choi and Bowerman, 1991).

In Warlpiri, locative terms are nominals and are used in combination with a locative case marker on the reference
object; directional affixes may be added to them. There is no one-to-one correspondence of Warlpiri lexical items with English ones. Bavin’s studies involved 33 children aged 3;11 to 8;0 years. It is interesting to note that preliminary work had shown that younger children were not able to complete the tasks and that Warlpiri children are not expected to be capable of following explicit verbal instructions nor question-answer routines until they are exposed to the school system (although Bavin does not say at what age this is).

Four main tests were conducted to look at the following locative terms:

- **kankarla-rra** "up-thither" meaning **ON**
- **kanunju-mparra** "down-across" meaning **UNDER**
- **kaninja-rni** "down-hither" meaning **IN**
- **kulkurru** **BETWEEN**
- **kamparru** **FRONT**
- **pirdangirli** **BEHIND**

a) **Test 1 (placing task)**

This looked at comprehension - children were asked to place objects in a particular location in relation to a reference object. The materials were later used as a production test with some of the children.
b) Test 2 (selection task)

Three months later - the IN, ON, UNDER locations were examined in more detail and with different tasks. Children were presented with five arrays, one at a time and subjects were asked to choose which of four identical objects was in a particular location. Production data were also collected from some of the subjects.

c) Test 3 (production)

This test was to try to elicit further production of terms for IN, ON and UNDER using a round styrofoam container with no handle or design as the reference object (which could be inverted to allow the ON location).

d) Test 4 (selection task)

Fifteen months later - the FRONT/BACK dimension was investigated in more detail using featured, non-featured reference objects and placed objects to test which item would be picked for the location term being tested.

For example, the arrays in the following figure (amongst many others) were used for Test 4:
Figure 13: Examples of arrays used in Bavin study

\[ \begin{align*}
\text{\(\uparrow\)} \\
\text{\(\uparrow 0 \uparrow\)} \\
\text{\(\uparrow\)}
\end{align*} \]

where 0 is a non-featured reference object (RO)
eg a round featureless can
\[ \text{\(\uparrow\)} \text{ is the direction of a featured placed object} \]
\[ \text{eg a dog} \]

and

\[ \begin{align*}
\text{\(+\)} \\
\text{\(+ \rightarrow +\)} \\
\text{\(+\)}
\end{align*} \]

where \(\rightarrow\) is the direction of a featured reference object (FRO) eg an animal
\[ \text{\(+\) is a non-featured placed object eg a stone} \]

Results from the tests showed that the order in which Warlpiri children acquire the means available in the language to express locative concepts showed some similarity with other studies, but also some differences. ON/UP was an early acquisition and was contrasted with DOWN. However, there was no linguistic evidence that IN was a separate concept for the young child to be mapped onto an expression. In contrast with previous studies on
other languages such as Johnston and Slobin (1979), it was found that "kulkurru" (BETWEEN) was acquired before "pirdangirli" (BEHIND) and "kamparru" (FRONT). Warlpiri children did not use an early deictic strategy in determining locations for "pirdangirli" (BEHIND). This could be interpreted as RIGHT, LEFT or FRONT of the reference object. "Space close to self" appeared to be the most general understanding of "kamparru" before the children started to use features of a reference object for orientation at around age six (although it was found that orientation of the reference object as well as features of the placed object affected interpretation).

"Pirdangirli" (BEHIND) and "kampurruru" (FRONT) were not considered opposite poles of one dimension for the youngest Warlpiri children (aged three and four) and even after age six the Warlpiri child did not assume that they represented opposites on a line between two points. There was also evidence that the case marker and locative nominal could be interpreted independently, for example in test 4 where a featured reference object (FRO) was facing away from the child and four placed animals were facing towards the child: some subjects resolved the conflict arising because the back of the FRO and the backmost animal were not in the same position by choosing to interpret the sentence "which dog is at the back of the cow" as "the back dog".
That the language structure itself influences the acquisition of forms to express locations was also illustrated by the fact that the Warlpiri child first uses the locative case marker on a reference object or the locative nominal alone before the case marker and nominal are used in combination. In Warlpiri, the case marker on a reference object is the only marker of location that is necessary; the use of specific nominals allows for more specific information, but it is the speaker's option to add these.

Bavin's studies appear to support the idea that the child acquires locative expressions gradually based on linguistic input. This lends support to the views of Choi and Bowerman (1991) on the importance of semantic organisation of the language being learned and contrasts somewhat with Johnston and Slobin's view of the paramount importance of conceptual factors in the acquisition of prepositions, the order of which is then modified by linguistic factors.
3.1 Hypothesis/aims of research

Following on from the research on prepositions and prepositional expressions already carried out (and detailed in the previous chapter), I decided to conduct my own research to investigate the area further and to try to confirm Johnston and Slobin’s (1979) findings for British English speakers (rather than American English ones). I wanted to test the following hypothesis:

"There is a set order for the acquisition of locative expressions in first language acquisition which is consistent with comprehension and production."

The order of locative concepts to test was:

IN/ON/UNDER/BESIDE <BEHINDf/Frontf/BETWEEN <BEHIND/Front

where < means "is followed by"

f denotes BEHIND or IN FRONT OF a featured object eg a teddy bear which has a distinct front and back (compared with a non-featured object eg a round, featureless tin)

This is the general order described by Johnston and Slobin
(1979) which spanned all language groups and tied in closely with the predicted order on the basis of conceptual factors. The American preposition BACK has been replaced by the more frequently used English BEHIND.

A secondary aim was to use the opportunity of testing the children to collect details of any errors which they might make during the course of the sessions. These could then be examined to see if they would provide any information on the acquisition process or on the mental representations children have of locative expressions.
3.2 Definition of acquisition

It is difficult to determine the exact time of acquisition of a form in any language. It is also difficult, if not impossible, to identify the time of "first intention" to express a given meaning. Children's initial appropriate uses of a form are often based on relatively superficial knowledge; "acquisition" beyond this point may be a drawn-out process in which the child discovers successively deeper levels of structure and regularity at the levels of both form and meaning (Bowerman, 1985).

One can therefore make a distinction between emergence (the first appearance of a form) and acquisition (its reliable use). How does one define "reliable" though, and how should "acquisition" be defined for the purposes of my study into prepositions and prepositional expressions?

In the case of grammatical morphemes, something is considered acquired if it occurs in at least 90% of the contexts in which it is required (Brown, 1973: 258). Clearly in my research study there would be a limited number of required contexts so it would be difficult to apply the same criterion. In other research projects with prepositions, acquisition has been measured by allocating credits for expressing a particular locative notion if the
child produces it more often in appropriate contexts than in inappropriate ones (the "more often right than wrong principle" seen in Johnston and Slobin, 1979) or if the target lexicalisation was used at least twice during the testing session (Johnston, 1984). I decided to adopt an approach similar to Johnston and Slobin's for my definition of acquisition - a term would be considered acquired in each test if it was used in the correct context and not used more often in an inappropriate context (the "more often right than wrong" principle).
3.3 Method

3.3.1 Subjects

In all, eighty children between the ages of 2;0 and 5;0 were tested for the study. This age range was chosen so that at the lower end, children would just be starting to acquire the locative prepositions to be tested, and at the upper end, most of them would have been acquired (based on Johnston and Slobin's 1979 results). There was a fairly even number of boys and girls (53% boys compared with 47% girls) and a good distribution of ages. The age range 2;7 to 3;3 was well represented, and this range proved particularly interesting from the point of view of results. Full details of ages and sexes are shown in Appendix 2.

There was a fairly homogeneous child profile: mainly white, middle-class and from southern England, since all groups were held in or around Guildford, Surrey. To begin with, this worried me slightly when planning the research as I had been used to much larger research projects. However, I realised that not only would it be impossible to obtain a representative sample of the child population from a geographical/social/family structure point of view within the limitations of the project, but it was also not necessary. The important thing to be tested was the
acquisition order of prepositions and prepositional expressions in British children. I wasn’t looking for specific deviations depending on social or cultural group. The homogeneous child profile should, of course, be kept in mind when judging the results.

3.3.2 Location and profile of children

The testing was carried out in homes familiar to the children so that they were as relaxed, co-operative and forthcoming as possible. This was achieved by recruiting "volunteer" homes with children in the target age groups. These homes then acted as hosts for the research sessions, to which three to five other children (normally friends and neighbours) were invited. Children were seen individually, at staggered intervals throughout the morning or afternoon, normally in a fairly quiet room without too many toys or other distractions. As well as the child being on familiar ground, the child’s mother was also present in the room if needed. Mothers were asked to observe rather than actively participate with their children in the "play sessions".

Bearing in mind the relative homogeneity of the children studied in terms of social and geographical background, I could use this to some advantage if I wanted to look at other factors which might contribute to any differences observed. For example, would there be a difference in the
acquisition order or speed of acquisition between the sexes? Did the child’s position in the family have any impact on his or her linguistic development?

I therefore took details of the following at the beginning of each session:

a) Position of the child in the family (first born, youngest, only child, twin etc) i.e. how many and what ages were any brothers or sisters. In a number of instances two children from one family attended the same session if they both fell into the 2;0 to 5;0 year age range.

b) Did the child attend a nursery school or playgroup and if so for how many mornings/afternoons a week? Was the child cared for primarily by the mother or was there a significant amount of time spent with a childminder or other carer?

c) Were there any other details like hearing problems (which might have been rectified by the time of testing but which could still have affected speech development)? Details of the nationality of the parents were also taken where necessary (one little boy had a Japanese father and a number of Japanese words in his vocabulary).
3.3.3 Timing and set-up details

Most of the research was carried out in June 1989 and I allowed half an hour for each child (which included an introductory session). I also did a small "second round" of four children a year later (hosted at my house when my oldest son and some of his contemporaries were around 3;0). My son’s results were recorded for interest only, since I did not want to include results that might have been subconsciously biased by my own particular interest in prepositions.

For the research testing (known as "play sessions" to the children) I had the help of a research assistant to make a note of results as well as using a tape recorder throughout. Examples of the forms used for annotating results are given in Appendix 3. Since I was interested in both the production and comprehension of prepositions, I devised games which would test both of these. The games followed a short introductory session so that the child could get used to me. During this time I made a note of the child’s name and age etc, and explained briefly that we were going to play some games. The child then helped me unpack my bag; all the children seemed curious to see what was in there and it was also a good opportunity to make sure that each child was familiar with the vocabulary of the items.
The three games I used to elicit responses are described in detail in section 3.4. At the end of the session each child was given a small packet of raisins to take away, a great incentive for the next child to come and participate!

3.3.4 Order of testing

Following a pilot study, I decided to carry out the three games in a fixed order. The first game would test which prepositions and prepositional expressions children could produce before they had heard any from me, the second would test comprehension and the third would look again at production (and the children might possibly achieve higher scores here because they would have heard the prepositions used in the second game and this might act as a reminder).

Methodologically, it is unsound to conduct the studies in a fixed order and ideally there should perhaps have been subgroups with each subject being put through the tests in one of the possible six orders. However, this would have complicated the design considerably and if combined with rotating the order of the prepositions themselves would, I felt, have not only been very time consuming but would also have made the experiments far harder to carry out and not nearly as flowing and natural (if, for example, I had to keep checking which preposition was to be tested next).
In addition, it would have been much more time consuming tabulating and analysing the results.

My decision to maintain a fixed order for the testing of prepositions was not, however, based predominantly on ease of execution and a desire to keep the tests simple, but more so out of a desire to build confidence in the children. By starting off with (purportedly) the easiest preposition (IN) and gradually moving on to the harder ones, I felt that the children would be encouraged to progress better if they had made a confident start. An incident in the pilot study had suggested that if asked a "difficult" question which the child was unable to respond to, he or she might be reluctant to participate in any further questions, regardless of their relative ease or difficulty linguistically. This isolated instance could well have been due to obstinacy on the part of the child, (ie refusing to co-operate with the easier question had nothing to do with it coming after the harder one) but the confidence issue remains nevertheless a valid one in my opinion. An analogy can be made with having two puzzles for a child to try and complete: a hard one and an easy one. If the child is asked to do the hard one first and cannot, he or she may not even want to attempt the second one because of prior experience. Any advantages gained from the confidence point of view do not of course obviate the necessity or desirability of a sound testing method.
One concern I had which was allayed by the pilot test was whether the attention span of the young children would be long enough to last the full length of the session. On this I needed to have no worries, as the variety, fun and short length involved in each task meant that even the youngest children had no problems staying the course. If attention span had proved a problem, I would have changed the experimental design, since I did not want children scoring badly because they had "switched off" towards the end of the session.

One thing I did change after the pilot test was some of the testing materials: I had tried using small gold chocolate coins as placed objects in one of the games, thinking that these could be given to the children at the end as a reward. However, one or two of the children were more intent on whether they could eat the coins there and then than telling me where they had found them! I subsequently chose a small soft red ball as the placed object.

I thus concluded that the research design I had chosen was best within the constraints of the project, despite the methodological drawbacks of a fixed testing order. It is also interesting and perhaps pertinent to note that other analyses of prepositional data have found no significant effect for task order (Johnston and Slobin, 1979; Johnston, 1984).
3.4 Games to test production and comprehension

Production and comprehension abilities are not the same, particularly where children are concerned, and young children often do understand forms well before they can produce them. Infants under one year old, for example, can understand some words for many months before they try to produce them, and older children usually understand comparative word forms long before they try to use them (Clark, 1993: 245). This asymmetry between production and comprehension has been documented in a number of studies (eg Clark and Berman, 1984) and so I thought it would be useful to test for both production and comprehension of locative prepositions and prepositional expressions. If acquisition is charted from production data only, there is the chance that what children understand about locative prepositions (or language in general) may be seriously underestimated.

I wanted therefore to look at both production and comprehension and so I devised three basic games to elicit responses when testing locative prepositions and prepositional expressions:

3.4.1 Hide-and-seek

The aim of this game was to see how many prepositions
formed a natural part of the child's vocabulary and if there was a distinct order in which they were used (ie the production of prepositions was being tested). If my hypothesis was correct, and the prepositions were acquired in the predicted order (broadly based on cognitive factors) then the children would only be able to use the "harder" prepositions like BEHIND or IN FRONT correctly once they were in command of the "easier" prepositions like IN and ON.

I devised a simple game of hide and seek to encourage the children to use the target prepositions. The game used a hand puppet called Gordon (Gordon the Gofer from Children's BBC) who needed to find a soft coloured ball (about the size of a tennis ball). I would hide the ball with one hand in various locations (see below) and the child then had to tell Gordon where it was. Gordon (on my other hand) would then make an excited squeak, pick up the ball in his mouth and return it to me to hide again.

The hide-and-seek locations were:

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>a bucket</td>
</tr>
<tr>
<td>IN(SIDE)</td>
<td>a round biscuit tin</td>
</tr>
<tr>
<td>ON</td>
<td>a child's chair</td>
</tr>
<tr>
<td>UNDER</td>
<td>a blanket</td>
</tr>
<tr>
<td>BESIDE/NEXT TO</td>
<td>some bricks</td>
</tr>
<tr>
<td>BEHIND</td>
<td>a teddy bear</td>
</tr>
<tr>
<td>IN FRONTf</td>
<td>the same teddy bear</td>
</tr>
<tr>
<td>BETWEEN</td>
<td>a book and the tin</td>
</tr>
<tr>
<td>BEHIND</td>
<td>the tin</td>
</tr>
<tr>
<td>IN FRONT</td>
<td>the tin</td>
</tr>
</tbody>
</table>

Please see Appendix 4 for a photograph of the items used
in the hide-and-seek game.

Following the pilot test I had done with a group of preschool children, I decided, somewhat reluctantly at first, to place a small scarf over Gordon’s eyes. The reason for this was that one of the main obstacles to competent execution of the hide-and-seek game was the children’s natural instinct to point and say "there" (deictic responses) when telling Gordon where the ball was instead of giving more precise instructions such as "in the bucket" etc. I was initially reluctant to use the scarf because it seemed incongruent with the idea of Gordon looking for something and also because there had been criticism of Carol Chomsky’s use of a blindfold on a doll (Cromer, 1970). However, in the testing by Chomsky (1969), the blindfold was central to the question "is this doll easy to see or hard to see" and was more likely to affect the children’s responses. Chomsky’s results were in any case confirmed by Cromer using different testing methods (Cromer, 1970). In my research, the scarf (which was not very obvious anyway) was simply there if needed to give a reason for giving fuller responses if deictic ones were being used eg "yes, but can you tell Gordon with words because he can’t see exactly where you’re pointing". This also helped to get over the potential problem of looking for the ball when it was not concealed eg when IN FRONT of the teddy or tin.
Since it was the prepositions and not vocabulary that I was interested in, I accepted responses such as "in there" or "behind there" as equally valid. That is, a "behind there" would score a correct point just as well as a more detailed "behind the brown teddy bear sitting on the carpet".

In order to avoid any potential confusions with subject/object orientated responses, I made sure that the child would see the teddy face on (so that BEHIND the teddy would be BEHIND from the point of view of both the child and the teddy and not potentially at the side). I also made sure that the child and I viewed things from the same angle to avoid any possibility of the child giving information to me/Gordon that had been specially adapted for us. In effect this simplified things compared with many real life situations and, indeed, compared with other testing situations. Recall, for example the discussion of deictic and non-deictic uses of BEHIND and IN FRONT in section 1.2 where "the ball is IN FRONT OF the doll" could be used non-deictically if it meant the ball was located near the doll's face regardless of the doll's orientation in relation to the speaker, or, if used deictically, it meant that the ball was located between the speaker's face and the doll, whether the doll faces the speaker or not.
Figure 14: Some positions used/avoided with BEHIND

where o is the ball being hidden

↑ and → are the teddy (featured RP) with the
arrow indicating the direction teddy faces

0 is a featureless RP (eg tin)

CH is the child

T/G is the tester/Gordon (puppet)

a) o

CH T/G

ball is BEHIND teddy

for both child and
tester. This is the
configuration I used
to test BEHIND

not b) o →

CH T/G

ball is BEHIND teddy’s

back but might be
considered NEXT TO from
child and tester’s
viewpoint (although
unlikely)

not c) T/G

CH

or d) T/G

CH

in c) and d) child and tester would be at opposite
sides of ball and teddy/tin so BEHIND could refer to
the space BEHIND the tin from the tester or the
child’s point of view, ie it could be ambiguous.
3.4.2 The "putting" game

The aim of this game was to test the comprehension of prepositions by asking each child to put a small object in various positions. Positions similar to those used in the hide-and-seek game were ruled out, since they would have encouraged a considerable degree of "probable event" strategy (see chapter 2 of this thesis) and it would have been difficult to assess whether the child had put the object on the chair because he/she understood the preposition ON or whether it was just a logical guess.

Since children do assign great importance to the materials used (Wilcox and Palermo, 1974/5; Grieve, Hoogenraad and Murray, 1977), I devised a game whereby the small object (a yellow toy key) could be put in various positions in relation to the same reference point. In this way, I tried to minimise the children's reliance on probable event strategies and assigning roles to the materials. For the reference point I used a plastic Duplo box (see Appendix 5) which had a front opening (facing the child and myself) and which was raised slightly on Duplo "legs" (to facilitate the UNDER location). The box was placed on the flat seat of the child's chair used in the previous game so that it was a convenient height for the children to work with.

Since the box had an interior, a surface and an underneath
there were of course several "options" for the children
and so, of course, I could not rule out the non-linguistic
strategies described by Eve Clark (1973a) being used. By
using the plastic box on legs, I was able to ask each
child to put the toy key in the following positions:

<table>
<thead>
<tr>
<th>Position</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>the box</td>
</tr>
<tr>
<td>ON</td>
<td>the box</td>
</tr>
<tr>
<td>UNDER</td>
<td>the box</td>
</tr>
<tr>
<td>BEHIND</td>
<td>the box</td>
</tr>
<tr>
<td>IN FRONT</td>
<td>the box</td>
</tr>
<tr>
<td>BESIDE</td>
<td>the box</td>
</tr>
</tbody>
</table>

To test the location BETWEEN, an additional item was
needed on the chair seat, and for this I decided to use a
very small teddy bear. I could then not only test the
BETWEEN preposition but also check BEHIND and IN FRONT
with a more featured object (the teddy) to see if there
was any difference in comprehension. Thus the following
positions were also tested:

<table>
<thead>
<tr>
<th>Position</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETWEEN</td>
<td>the box and the little bear</td>
</tr>
<tr>
<td>IN FRONT</td>
<td>of the little bear</td>
</tr>
<tr>
<td>BEHIND</td>
<td>the little bear</td>
</tr>
</tbody>
</table>

Finally, out of interest and to vary the game a little at
the end, I introduced a second, identical toy key and
placed one IN and one ON the box. The children were then
asked to take a key

<table>
<thead>
<tr>
<th>Position</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT OF</td>
<td>the box (ie remove the one IN the box)</td>
</tr>
<tr>
<td>OFF</td>
<td>the box (ie remove the one ON the box)</td>
</tr>
</tbody>
</table>
The immediate reaction of some of the younger children in the pilot study was to take the key OFF the top of the box and put it IN the box with the other key. Another response was to pick up both keys and hand them to me. For these reasons, I had to stress to the children that I only wanted one key and that they had to listen carefully to see which one it was.

For detailed results of the OUT OF/OFF test please see section 4.2.4.

3.4.3 Cards

The card game was really a supplementary game to add to the information on production which had been gained in the earlier hide-and-seek game.

I had produced a series of large white cards with pictures by cutting out and sticking on pictures from a children’s book (please see Appendix 6). Most of the cards showed two items and the child would be asked to describe where one of them was

eg Q: Where’s the cat?

A: In the basket.

There were, however, some important differences in the
information gained from the cards game compared with that from hide-and-seek. Firstly, the child would already have heard the prepositions being tested (in the putting game) which might have acted as a reminder if the words had not been forthcoming when playing hide-and-seek.

Secondly, the cards were by their very nature more abstract and sophisticated than the physical game of hide-and-seek and so they tested a slightly different kind of perception (eg what were the pictures representing rather than the physical side of things ie the answer to "where's the cat?" was not "stuck on the card").

Thirdly, using pictures enabled me to test a whole range of ideas relating to the area of prepositions, including using incongruent situations and featured animals facing to the side with another animal either behind them (not at their rear end) or in front of them (not at their head end).

To help facilitate answers to the card game, I introduced it by giving one or two examples which I had prepared on additional cards.

For example, I would say "where's the egg? ..... in the egg cup" or "where are the matches? ..... in the matchbox".

The cards tested the following:
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where’s the...</td>
<td></td>
</tr>
<tr>
<td>cat</td>
<td>IN the basket</td>
</tr>
<tr>
<td>teddy bear</td>
<td>ON the chair</td>
</tr>
<tr>
<td>ball</td>
<td>UNDER the table</td>
</tr>
<tr>
<td>tractor</td>
<td>NEXT TO the tree</td>
</tr>
<tr>
<td>teddy bear</td>
<td>BEHIND the piano (f)</td>
</tr>
<tr>
<td>car</td>
<td>IN FRONT of the house (f)</td>
</tr>
<tr>
<td>hat</td>
<td>BETWEEN the shoe and the sock</td>
</tr>
<tr>
<td>guitar</td>
<td>BEHIND the drum</td>
</tr>
<tr>
<td>balloon</td>
<td>IN FRONT of the bricks</td>
</tr>
<tr>
<td>lion</td>
<td>BEHIND the crocodile (fs)</td>
</tr>
<tr>
<td>goat</td>
<td>IN FRONT of the horse (fs)</td>
</tr>
<tr>
<td>television</td>
<td>UNDER the clock (i)</td>
</tr>
<tr>
<td>umbrella</td>
<td>OVER the duck (i)</td>
</tr>
<tr>
<td>ball</td>
<td>at the TOP of the ladder</td>
</tr>
<tr>
<td>ball</td>
<td>at the BOTTOM of the ladder</td>
</tr>
<tr>
<td>what’s the ball doing now? (moving it)</td>
<td>... going UP the ladder</td>
</tr>
<tr>
<td></td>
<td>... going DOWN the ladder</td>
</tr>
<tr>
<td>basket</td>
<td>it’s AROUND/UNDER the cat (i)</td>
</tr>
<tr>
<td></td>
<td>(same picture on first card)</td>
</tr>
</tbody>
</table>

**Notes**

(f) is a featured object facing the child/tester
(fs) is a featured object facing the side
(i) is an incongruent question ie it would be more natural to ask "where’s the clock?" rather than "where’s the television?"

So that I could compare the children’s responses to the cards with the "target" prepositions which would be expected from an adult (particularly where the more unusual arrays using featured animals and incongruent items were concerned), I asked a number of adults to "play" the card game (for results please see section 4.2.3).
4.1 Introduction

As mentioned before, the main purpose of the study was to look at the order in which locative prepositions are acquired rather than other factors such as the age of the children when they manage to use a certain preposition correctly. Statistical procedures in themselves cannot tell us exactly how we acquire prepositions, but all errors, omissions and substitutions were important in trying to build up a picture of how the prepositions were learnt and how sure the child was of each one.

It was apparent at the actual time of testing that the same "mistake" was being made by a number of children. This was an interesting finding and one which seems to relate to errors in other areas of child language acquisition (and which will be discussed later on in this chapter). The analysis subsequently carried out brought to light a lot of information that was not immediately apparent from conducting the sessions with the children.

Detailed notes had been taken on the responses given at the play sessions, for example, whether the prepositions were used correctly at the first attempt or not. If not, it was noted whether prompting helped to elicit the target
response (e.g. an initial response of pointing or saying "there" could sometimes be converted to a preposition with a little coaxing). A note was also made as to whether there was a delay in retesting, that is, whether the child was asked the question again straight away or at the end of the game when it would be relatively "fresh" and more detached from any previous response.

I looked at each child's results and, as mentioned before (section 3.2), considered a preposition acquired if it was used in the correct context in the games individually, provided it was not used more than once in an inappropriate context (the "more often right than wrong" principle).

There was, in effect, only one obligatory context per preposition per game (as the various forms of BEHIND and IN FRONT were being considered as separate notions).

In most cases, children either got the preposition correct or made a deictic response (by pointing or saying "there"). If, as a result of a repeated question or prompting following:

a) a deictic prolocative (it's "there");

b) a non-verbal response (pointing); or

c) no response at all
a child subsequently improved on the initial response by producing the correct response then a credit was given for the preposition. I felt this was comparable to what happens with adults (who have acquired prepositions but may not always use them unless asked to be explicit), for example:

Adult 1: Where's the butter?
Adult 2: Over there (nodding in general direction)
Adult 1: Where?
Adult 2: Over there by the toaster.

There was, in all, a whole mass of information available to analyse or refer to if more details were needed on a particular point. On the whole, I have tried to concentrate my analysis on

- testing the acquisition order of prepositions (section 4.2) which is the main focus of the study;

- examining the influence of other variables such as age and sex (section 4.3);

- looking at the most significant errors and other substitutions (section 4.4);

- comparing the results with other studies on relational terms (section 4.5);

- considering the locative expressions BEHIND and IN FRONT in other studies (section 4.6).
4.2 Order of acquisition

My study of prepositions and prepositional expressions was a cross-sectional one, effectively taking a snap shot of the linguistic abilities of a number of children of different ages at a certain point in time. From this, I wanted to try and extrapolate developmental trends to test the hypothesis that prepositions are acquired in a set order.

As a reminder, the order of prepositional concepts being tested was as follows:

IN/ON/UNDER/BESIDE <BEHIND/FRONT/BEHIND/FRONT</FRONT

Essentially, my data provided an indication of the difficulty experienced with various prepositions and prepositional expressions (ie whether the child could produce/understand the locative expression or not).

Guttman scaling

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I needed a systematic way of looking at the data in order to come up with an order or scale of difficulty (which could then be equated with an acquisition order). Implicational scaling (often referred to as Guttman scaling) is a good way of combining individual case study
data to show similar patterns and is useful for studies like mine on first language acquisition as well as for second language acquisition. It is the method used in other, perhaps more complicated studies on prepositional acquisition and was deemed the most appropriate one for my research data by several statistical advisers.

To give a rough idea of how implicational scaling works, I have compiled a simple "ideal" model based on eight children and eight language features (prepositions), where the presence (1) or absence (0) of correct usage of the relevant preposition is marked.

Table 3: Ideal model for Guttman scaling

<table>
<thead>
<tr>
<th>Prepositions</th>
<th>Easy</th>
<th>Difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
<td>P2</td>
</tr>
<tr>
<td>Subject</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>S2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>S3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>S4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>S5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>S6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>S7</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>S8</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

From this "ideal" table we can see that subject 1 is the most advanced - he or she has credits for all the prepositions being tested. The preposition P1 would be the easiest, since everyone got this one right and P8 would be the hardest, since only subject 1 accurately used
it. If the results from a set of data do give such a nice neat chart, it is possible to make predictions about individual learners. For example, we could predict that if a subject has P4 correct, then this subject would also have P3, P2 and P1 correct.

Obviously, it is not the case that every given piece of data will fit or match such scaling, but there must be a relationship among the items as far as difficulty is concerned and there must be a range of proficiency in the subjects. If all items are of equal difficulty and all subjects of equal proficiency there is no scale at all. For example, if my subjects were all too young and the prepositions too difficult then the table would be full of zeros. On the other hand if the subjects were too advanced and all the items easy, again there would be no scale because all the entries in the table would be ones. Also, if P1 were difficult for S1 but not for anyone else; P2 difficult for S2 but not for anyone else; P3 difficult for S3 but not for anyone else etc; again there would not be a scale.

If we have the "ideal" model as set out in Table 3 above, we can then compare this accuracy order with the observed acquisition order and see if they are the same. Of course, the "ideal" table above contains only hypothetical data and a complete match would not be expected, especially with a much larger number of subjects and
prepositions being tested.

A sample of actual data from my study ready for statistical analysis is given in Appendix 7.

4.2.1 Assumptions for analysis

I had to apply strict and consistent criteria when carrying out the statistical analysis for the acquisition order of prepositions. The following assumptions applied to the analysis of data for games 1 and 3 (which tested the production of locative expressions):

a) The child's first verbal response was taken, unless this was deictic ("there") in which case the next response was taken.

b) A credit was given if the response was the correct one or an equally acceptable alternative (see Table 4 below).

c) The credit could be withdrawn if that particular preposition was used more often in inappropriate contexts than in the appropriate one during the course of the game (details of overextended uses and the withdrawal of credits are given in section 4.4 which looks at substitutions: errors and alternative prepositional expressions).
The table which follows gives the prepositions and prepositional expressions which were considered acceptable alternatives for the locative notions being tested:

Table 4: Equally acceptable alternatives

<table>
<thead>
<tr>
<th>INSIDE</th>
<th>for IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNDERNEATH</td>
<td>for UNDER</td>
</tr>
<tr>
<td>ON TOP OF</td>
<td>for ON</td>
</tr>
<tr>
<td>NEXT TO</td>
<td>for BESIDE</td>
</tr>
<tr>
<td>AT THE SIDE OF</td>
<td>for BESIDE</td>
</tr>
<tr>
<td>BY</td>
<td>for BEHIND</td>
</tr>
</tbody>
</table>

Unlike Johnston and Slobin (1979), I have not included IN THE MIDDLE as an acceptable response for BETWEEN. Not only is there a significant difference between the two notions (MIDDLE incorporates a sense of enclosure) but it could also be argued that there is no justification for crediting the child with the prepositional expression BETWEEN solely if he or she uses the preposition IN and noun phrase THE MIDDLE. Having said this, the two expressions do appear to express similar locative notions, even if they are not as interchangeable as, say, UNDER and UNDERNEATH.

The assumptions for the analysis of data for game 2 (comprehension of locative expressions) were very similar to that for the other games, in that the first response
was taken and a credit given if the item was placed in the correct location. However, I did not withdraw credits already allocated for understanding a certain preposition (eg BESIDE) if an item was subsequently inappropriately placed in a similar position, since it was impossible to say where exactly the child saw the item as being. For example, a single incorrect positioning could be described variously as:

a) BESIDE the box
b) somewhere NEAR the box
b) ON the little chair

and it would be inappropriate, I felt, to allocate an "assumed understanding" in these instances. In actual fact, many of the incorrect positionings were of the type predicted by Eve Clark (1973a) ie Rule 1: if the reference object is a container, put x INSIDE it.

I shall now examine the Guttman scaling results of the tests individually, looking first at the games testing production of locative expressions (games 1 and 3) before considering those for comprehension (game 2). An assessment can then be made as to how consistent the results are between the different games and comments made on any potential problems arising from the Guttman scaling technique. A further statistical technique (Mokken's homogeneity model) will then be applied to the games.
4.2.2 Results of the hide-and-seek game (game 1)

There was a good distribution of ability in the hide-and-seek game, with a total of 78 children co-operating and giving responses. Just under 7% of these children showed they had acquired all the prepositions being tested, a few showed they had not acquired any, and most came somewhere in between.

As discussed earlier in the introduction to this chapter, the Guttman Scalogram was considered the most appropriate analysis method for scaling to achieve an order of difficulty for prepositions. Any missing data meant that no data would be used from that child for that particular game (if, for example, there was no response at all for one or more questions) which effectively reduced the number of cases read to 71 for this first game.

Appendix 7 gives full details of the Guttman analysis for the individual games, but I shall summarise and discuss the key results for game 1 here. In the following table (Table 5), the prepositions are listed in order of increasing difficulty. A score of 1.00 in the column marked "difficulty" would equate to a situation where all the children included in the analysis got a particular preposition correct and a 0.00 would mean that none did.
Table 5: Guttman scaling results for game 1

<table>
<thead>
<tr>
<th>Item order</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>0.986</td>
</tr>
<tr>
<td>ON</td>
<td>0.817</td>
</tr>
<tr>
<td>UNDER</td>
<td>0.775</td>
</tr>
<tr>
<td>BEHINDf</td>
<td>0.563</td>
</tr>
<tr>
<td>BEHIND</td>
<td>0.521</td>
</tr>
<tr>
<td>IN FRONTf</td>
<td>0.324</td>
</tr>
<tr>
<td>IN FRONT</td>
<td>0.296</td>
</tr>
<tr>
<td>BESIDE</td>
<td>0.239</td>
</tr>
<tr>
<td>BETWEEN</td>
<td>0.141</td>
</tr>
</tbody>
</table>

Coefficient of reproducibility = 0.937

We can see from the table above that there is a good spread in terms of difficulty, with the easiest preposition (IN at 0.986) reflecting the fact that all but one child managed to obtain a credit for this preposition and the hardest (BETWEEN at 0.141) indicating that 10 of the 71 children managed to achieve this.

The overall measure of the total errors in the scale matrix is referred to as the Guttman coefficient of reproducibility (C rep) and is defined by the formula:

\[
C_{\text{rep}} = \frac{\text{total number of errors}}{\text{total number of responses}}
\]

This formula helps to determine whether a given set of data is reproducible. The coefficient of reproducibility should be above 0.90 for us to feel that the subjects’ performance can accurately be predicted. In the case of the data from game 1, the coefficient of reproducibility
is 0.937 which suggests that the results are significant and that children do learn to express these various locative notions in a predictable order.

The scale given by the Guttman analysis of the data for game 1 is similar in some respects to that of the order of locative notions being tested; for example, the prepositions IN, ON and UNDER appear to be acquired first. The results also confirm the prediction that featured objects are easier to relate to than non-featured for both BEHIND and IN FRONT. This is shown by the higher scores in the table above for BEHINDf and IN FRONTf compared with their non-featured counterparts, and reflects several examples where a child had acquired BEHINDf but not BEHIND (eg child number 12 and 16) or IN FRONTf but not IN FRONT (eg child number 58 and 64).

The main differences between the order implied by the Guttman analysis and the original predicted order are the appearances of BEHIND and IN FRONT (both featured and non-featured) at an earlier stage in the hierarchy, effectively pushing both BESIDE and BETWEEN to lower positions. This has, I believe, much to do with the simpler testing method I adopted compared with that used by Johnston and Slobin (1979) and has important implications for the significance of testing materials, a subject which will be considered later in chapter 5.
4.2.3 Results from the card game (game 3)

The card game tested the production of prepositions again and so provided useful information to supplement that gained from the hide-and-seek game. It introduced the concept of a featured item not facing the child/tester, which I predicted would be harder than both the featured items facing the child/tester and non-featured items in the hierarchy and so I put the new notions at the end of the predicted acquisition order for game 3. BEHINDfs and IN FRONTfs therefore stand for behind or in front of a featured object which is facing the side - for reference please see the pictures in Appendix 6 which show the lion standing behind the crocodile (BEHINDfs) and the goat standing in front of the horse (IN FRONTfs).

The incongruous items proved difficult for the children (for example, "where's the television?" for the card with a picture of a television with a clock on it), but these were items which were difficult for the adults tested too. As mentioned, several adults answered "on top of the television" before they had even stopped to think. Some of the older, more linguistically advanced children adopted one of the adult strategies of turning the answers to the questions round with the incongruent items

eg Q: Where's the basket?
A: The cat's sitting in it.
A detailed analysis of the incongruous items (UNDER, OVER, AROUND/UNDER) and the locative nouns (TOP, BOTTOM, DOWN, UP) has not been made, since although it is of interest, it falls outside the main remit of the study.

It is relevant here perhaps to record the results of the adults tested on the card game. As mentioned earlier in the description of the games (section 3.3.3), I asked a number of adults to "play" the card game, so that I could compare the children's responses with those of the adults. This was a useful exercise, since it showed that adults do not always score 100% when tested in the same games as the children. This does not mean that the adults tested have not all acquired the locative expressions being looked at, but is perhaps more a reflection of the fact that different people may respond in different ways to the same situation (all four "errors compared to target" involved using other very plausible descriptions eg describing the balloon as being "just by the bricks" rather than the target of "in front of the bricks"). This "failure rate" of just under 3% amongst those adults tested should be borne in mind when assessing some of the children's failures to meet the target preposition - perhaps we shouldn't categorically assume that a child hasn't yet acquired a certain preposition just because he or she hasn't used it.
As far as evidence for analysis is concerned though, whether child or adult, if a particular prepositional expression has not been used then no credit can be allowed for it.

The results for the adults tested on the cards for game 3 given in straightforward % terms are as follows:

<table>
<thead>
<tr>
<th>Preposition being tested</th>
<th>% responding with target preposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>100%</td>
</tr>
<tr>
<td>ON</td>
<td>100%</td>
</tr>
<tr>
<td>UNDER</td>
<td>100%</td>
</tr>
<tr>
<td>BESIDE/NEXT TO</td>
<td>92%</td>
</tr>
<tr>
<td>BEHINDf</td>
<td>100%</td>
</tr>
<tr>
<td>IN FRONTf</td>
<td>100%</td>
</tr>
<tr>
<td>BETWEEN</td>
<td>100%</td>
</tr>
<tr>
<td>BEHIND</td>
<td>100%</td>
</tr>
<tr>
<td>IN FRONT</td>
<td>85%</td>
</tr>
<tr>
<td>BEHINDfs</td>
<td>100%</td>
</tr>
<tr>
<td>IN FRONTfs</td>
<td>92%</td>
</tr>
</tbody>
</table>

Number of subjects = 13

There also remains the possibility that a child might have knowledge of a preposition, but not be able to put it into use in the testing games because the cognitive (or other) demands were too great. A parallel for adults for this would be where a person understands well the meaning of the expressions "more" and "less" yet is unable to complete a brain teaser along the lines of "if A has more apples than B, and D has more than C but less than B....".
Similarly, in an IQ test, someone may fully understand all the various elements and the question but still not be able to work out the answer eg "How many minutes before noon is it, if one hour ago it was three times as many minutes after 8 am?" Again, this does not mean that there is no linguistic knowledge of the concept or the form of any of the words, just that the mathematical ability is not up to the task.

The tasks in my study were made as simple as possible for the children in order to try and eliminate as many extraneous demands as possible (although this is still no guarantee). The question of extra dimensions is also considered later on in this section, after the children’s results have been examined.

The results from the Guttman scaling analysis for the children from game 3 were similar to those for game 1 in many respects:

A good distribution of ability was recorded, with a total of 77 children co-operating/giving responses. Of this total (which included those participating by pointing and/or saying "there"), only 3% managed to successfully complete all the prepositions being analysed, a slightly lower figure than for the first game, but perhaps to be expected since there were an extra two locative notions
being looked at. As with the first game, a few children participated but did not manage to say anything.

Appendix 7 gives full details of the Guttman analysis for game 3 but the table below summarises the key points:

Table 7: Guttman scaling results for game 3

<table>
<thead>
<tr>
<th>Item order</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>0.935</td>
</tr>
<tr>
<td>ON</td>
<td>0.805</td>
</tr>
<tr>
<td>UNDER</td>
<td>0.727</td>
</tr>
<tr>
<td>BEHINDf</td>
<td>0.545</td>
</tr>
<tr>
<td>BEHIND</td>
<td>0.364</td>
</tr>
<tr>
<td>BEHINDfs</td>
<td>0.325</td>
</tr>
<tr>
<td>BETWEEN</td>
<td>0.247</td>
</tr>
<tr>
<td>IN FRONTf</td>
<td>0.208</td>
</tr>
<tr>
<td>IN FRONTfs</td>
<td>0.195</td>
</tr>
<tr>
<td>IN FRONT</td>
<td>0.195</td>
</tr>
<tr>
<td>BESIDE</td>
<td>0.130</td>
</tr>
</tbody>
</table>

Coefficient of reproducibility = 0.835

The coefficient of reproducibility for game 3 came out as 0.835, which is below the target level of 0.90. In order to see to what extent the reproducibility had been affected by the increase in the number of variables, the Guttman scaling procedures were repeated excluding results for BEHIND and IN FRONT for the side facing featured items. This reduced the number of possible profiles considerably from 2048 to 512 and resulted in an increase in the coefficient of reproducibility, bringing it up to 0.882.
Full details of the Guttman analysis with and without the side facing featured results for \textit{BEHINDfs} and \textit{IN FRONTfs} are given in the statistical appendix.

As far as the additional side facing featured items introduced in game 3 are concerned, we can see from the table of Guttman scaling results above that \textit{BEHINDfs} takes its position in the Guttman order of difficulty after \textit{BEHINDf} and \textit{BEHIND} (as I had predicted). \textit{IN FRONTfs} is scaled equal in terms of difficulty with \textit{IN FRONT}, both coming after the featured \textit{IN FRONTf}. All variants of \textit{BEHIND} are seen as easier to acquire than those for \textit{IN FRONT}.

One interesting feature of the results of the card game was the considerable confusion between all the different forms of \textit{BEHIND} and \textit{IN FRONT}, a subject which will be looked at in greater detail in section 4.4 on errors and alternative expressions. This section also looks at the interesting perspective interpretation for \textit{BEHINDfs} (which children gave to the picture of the crocodile with the lion standing behind it).

The featured items facing the side are worthy of specific mention now, since they provide additional information on the locative prepositional expressions \textit{BEHIND} and \textit{IN FRONT} and also introduce a more complicated test configuration.
Featured items facing the side

Only the responses "behind" and "in front" were accepted for the side facing featured items testing the configurations BEHINDfs and IN FRONTfs (the lion standing behind the crocodile and the goat standing in front of the horse - see pictures in Appendix 6), yet responses such as "AT THE SIDE of the horse" instead of "IN FRONT of the horse" and "NEXT TO the crocodile" for "BEHIND the crocodile" could arguably be considered valid alternatives (see also section 4.2.5 on reservations with the analysis method). In several cases, asymmetrical responses were given by the children to the following questions:

Q: Where's the lion?
Target A: Behind the crocodile

Q: Where's the goat?
Target A: In front of the horse

eg of asymmetry by child 23 (aged 4;9)
"behind the crocodile" for BEHINDfs
"at the side of the horse" for IN FRONTfs

eg of asymmetry by child 58 (aged 2;9)
"behind the crocodile" for BEHINDfs
"next to the horse" for IN FRONTfs

In these cases, credits were only given for BEHINDfs in the analysis.
These asymmetrical results replicate those obtained by Durkin (1981) on asymmetrical responses (in British English) with an object oriented response for IN FRONT and a subjectively oriented response for BEHIND (discussed in section 2.2).

It should be noted that the configurations for Johnston and Slobin (1979) were, for featured BEHIND, a small object placed

a) at back side of laterally placed featured object [truck, house] and 

b) at opposite side [truck, house].

Similarly, for featured IN FRONT, a small object was placed

a) at front side of laterally placed featured object [truck, house] and 

b) at the near side [truck, house].

Thus Johnston and Slobin’s work included the complex idea of a featured item not facing the speaker/hearer (such as the laterally placed truck) and responses were only accepted which said at the BACK OF or BEHIND (and not, say NEXT TO) for the object placed behind the laterally placed featured object.
In the configuration below, therefore, the expressions BEHIND/BACK OF would be accepted for the positions of "o" but not AT THE SIDE OF the truck for the "o" at the opposite side to the child/tester.

```
    o
<--- truck -- o
   child/tester
```

The test configuration for BESIDE was

a) at right side of nonfeatured object [block, glass]

b) at left side [block, glass].

Effectively, the results then measured whether the child took account of the fact that the reference object was featured (ie had an intrinsic front) and then, if so, whether this fact would alter their response.

Johnston and Slobin’s tests for BEHINDf and IN FRONTf were therefore more complicated than mine, because I made sure that the featured objects (eg the teddy in game 1, the piano and house in game 3) were always facing both the child and tester. Where I introduced the side facing featured animals as reference objects in the card game (the crocodile and horse), there was a mixed response of BEHIND/IN FRONT and NEXT TO, with well over two thirds of
the children opting for BEHIND/IN FRONT. As seen in Table 6, the adults all responded BEHIND for the BEHINDfs (featured side facing) situation and nearly all (92%) said IN FRONT for IN FRONTfs (featured side facing), which was actually slightly higher than the number who said IN FRONT for non-featured IN FRONT! Yet by inference from the Johnston and Slobin study, there are two possible positions for BEHIND/IN FRONT for a side facing featured animal: at the rear/head end of the animal and at the far/near side. We saw earlier in chapter 2 when looking at Johnston and Slobin's (1979) study how complexity and diversity were predicted to make acquisition harder.

Children have been shown to move from self-oriented responses to more object oriented responses with age (Bavin, 1990: 65). Bavin suggests around age six for her Walpiiri subjects (which is older than the subjects for both Johnston and Slobin's 1979 and my research). The fact that my research showed that most adults described the "featured side" situation as IN FRONT of the horse (subject oriented) rather than NEXT TO the horse (object oriented) does not, I think, suggest that they are still in an egoistical, self-oriented phase (!), but rather that much depends on the individual situation as to the extent to which reference objects are used for prepositional orientation. For example, my items to be described in relation to the featured side facing animals were other
(side facing) animals and not small non-featured objects. This matter will be discussed further in section 5.1 on the importance of testing materials.

If the results of the responses to the side facing featured items are included with the front facing featured objects (that is, BEHINDfs and IN FRONTfs incorporated with BEHINDf and IN FRONTf and an average taken) then the accuracy score falls:

Table 8: Correct responses for BEHIND and IN FRONT in game 3 (adapted from Table 7)

<table>
<thead>
<tr>
<th>Correct responses as a % of total number of children responding</th>
<th>Adapted scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEHINDf</td>
<td>55</td>
</tr>
<tr>
<td>IN FRONTf</td>
<td>21</td>
</tr>
<tr>
<td>BEHIND</td>
<td>36</td>
</tr>
<tr>
<td>IN FRONT</td>
<td>20</td>
</tr>
<tr>
<td>BEHINDfs</td>
<td>33</td>
</tr>
<tr>
<td>IN FRONTfs</td>
<td>20</td>
</tr>
</tbody>
</table>

I think this must be an important contributory factor as to why particularly BEHINDf and, to a lesser extent, IN FRONTf performed so well in my results; if I had included more complicated test configurations with featured items facing different directions, I would have had lower scores.
This also raises the question of whether there is perhaps a prototype or "best example" for BEHIND and IN FRONT (cf Rosch, 1975) If "something hidden behind a featured object facing the speaker and hearer" is the prototype for BEHIND, then one may expect higher results from using a method of testing which achieves this. This again could explain why my results for BEHIND and IN FRONT were higher than for Johnston and Slobin (1979).

So, how does the Guttman order of difficulty for game 3 compare with the predicted order? As with the results for game 1, there are many similarities such as the initial order of IN, ON and UNDER and presence of BEHINDf and IN FRONTf before their non-featured counterparts. However, unlike the results for game 1, where the higher scores for BEHIND and IN FRONT seemed to "oust" BESIDE and BETWEEN and put them further down the hierarchy, the Guttman scores for game 3 contain an order of difficulty for BETWEEN coming after the various scores for BEHIND and before those for IN FRONT, leaving BESIDE effectively as the hardest prepositional expression to acquire.

Looking retrospectively at the test material to elicit the response of BESIDE for game 3 - the picture of a tractor next to a tree - I can't help but wonder if the results for this prepositional expression might have been considerably different with another picture, for example a picture of a boy sitting next to a girl (which might be a
situation the children were more familiar with). There were several instances where children described the card I actually used with the picture of the tractor next to the tree as having the tractor BEHIND or IN FRONT of the tree (and in some cases the preposition NEXT TO was actually used later on in the game to describe something else like the goat being "next to the horse"). To my mind this calls into question the validity of making assumptions on any order of acquisition based on responses from certain, limited test materials.

One further point from the Guttman scaling results for game 3 is the relevance of the coefficient of reproducibility (0.835 and 0.882) coming out at below the significant level of 0.90. A coefficient of reproducibility of less than 0.90 can mean:

a) the Guttman model is too rigid - for example children's varied attention results in random errors; the model may therefore be inappropriate but the theory fine, in which case a further statistical analysis could be made which allows for random variation. This possibility is addressed later in section 4.2.6.

b) the scale is all right but something interesting may be going on; a figure for the coefficient of
reproducibility of less than 0.80 implies that some items might not be ordered. Perhaps extra dimensions are involved in some of the test items. For example, if the test was a mathematical one with questions including additions (2+2=?), subtractions (17-4=?), multiplication and division and one question asked "X has 3 apples, Y gives him 3 more - how many does X have altogether?" we might expect children to equate this to 3+3=? However, the question involves an extra dimension ie reading ability and so might not produce the same scaling results as a question put as 3+3=? This possibility suggests close scrutiny be made of the test items (see section 5.1).

A Guttman coefficient of reproducibility of less than 0.90 therefore does not invalidate the Guttman scaling results, and in fact may not be too serious. Indeed, in Johnston and Slobin's cross-linguistic study of locative expressions (1979), the Guttman coefficient of reproducibility was only over 0.90 for two of the four languages studied (English = 0.93; Turkish = 0.91; whereas Italian = 0.89; Serbo Croatian = 0.86).
4.2.4 Results from the "putting" game (game 2)

This game of comprehension, involving placing a toy key in various positions in relation to a plastic box, proved easier to play than the games testing production, with 40% of the children completing all the tasks correctly. This confirms that COMPREHENSION of prepositions occurs before PRODUCTION, as might be expected, since a child may have the conceptual resources for a preposition but may not be able to express it yet, ie the term would be in the "waiting room" suggested by Johnston and Slobin (1979) - see Figure 12 in section 2.3. Higher scores would therefore be expected for the comprehension test (game 2) compared with games 1 and 3.

As we saw earlier in section 3.4, if we chart language acquisition only from production, we may seriously underestimate what children know both about the lexicon and language in general. For a child to be successful in the "putting" game, he or she must have access to both the phonological form of the preposition and the meaning of the preposition. That is, the child's mental representation must be effectively adult-like. From this perspective, any mismatch between comprehension and production data is not so much linguistically interesting - it reveals something about differential difficulties in using linguistic representations, but tells us nothing about those representations. It could be argued that
comprehension data, where available and reliable, provide a more accurate reflection of linguistic capacities.

Helen Goodluck points out that tests of comprehension may underestimate children’s ability for a variety of reasons, including the difficulty of the task and the complexity of sentences confronting the child (Goodluck, 1991: 174). It is, of course, also possible that production tests may underestimate children’s ability for similar reasons.

Another thing to bear in mind is whether in fact children are aware of their shortcomings. In comprehension tests, children may readily assign interpretations to the structures presented to them - but they are often the wrong ones. As Carol Chomsky pointed out:

"They do not, as they see it, fail to understand our sentences. They understand them, but they understand them wrongly" (Chomsky, 1969:2)

With the comprehension of locatives in game 2 scoring higher than production in games 1 and 3, what remained to be seen was whether the same order of acquisition applied, albeit at an earlier age.

The following table, Table 9, gives the key results for the Guttman scaling analysis for children achieving the
correct configurations in game 2 (for full statistical
details please see Appendix 7):

Table 9: Guttman scaling results for game 2

<table>
<thead>
<tr>
<th>Item order</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>0.100</td>
</tr>
<tr>
<td>ON</td>
<td>0.878</td>
</tr>
<tr>
<td>BEHIND</td>
<td>0.743</td>
</tr>
<tr>
<td>IN FRONTf</td>
<td>0.716</td>
</tr>
<tr>
<td>BETWEEN</td>
<td>0.689</td>
</tr>
<tr>
<td>BESIDE</td>
<td>0.676</td>
</tr>
<tr>
<td>UNDER</td>
<td>0.676</td>
</tr>
<tr>
<td>IN FRONT</td>
<td>0.676</td>
</tr>
<tr>
<td>BEHINDf</td>
<td>0.662</td>
</tr>
</tbody>
</table>

Coefficient of reproducibility = 0.799

A glance at the figures above shows that there is not much
spread between the "easiest" and "hardest" prepositions
and that there is very little difference in difficulty
between seven of the nine prepositions (with scores
ranging between 0.65 and 0.75); in fact, BESIDE, UNDER and
IN FRONT all have an equal difficulty rating.

The coefficient of reproducibility at 0.799 is the lowest
yet, suggesting that there are no significant differences
in the ordering of many items and that it might be
difficult to replicate the results with exactly the same
scale ordering. As we saw in the discussion of the low
coefficient of reproducibility in connection with game 3,
this might reflect random reasons why children do not fit
into the model, e.g. because of attention slips. A model could then be looked at which allows for random variation (see Mokken's analysis in section 4.2.6).

The comprehension data did not provide such a good distribution of ability as that for production, but further analysis of the data can still be made to remove, for example, the non-discriminating item (IN) which all subjects correctly achieved (see Mokken's analysis in section 4.2.6).

One interesting thing to note from the results from game 2 is the relatively good performance of NEXT TO compared with the two production games. This endorses the view that the cognitive comprehension is there (manifested by the ability to put something in the correct position) but that production is somewhat harder, maybe because of the lexical diversity.

The preposition UNDER did not fare so well in the analysis of data for game 2, scoring well below the difficulty rating for both IN and ON. In most cases where an error took place with UNDER the key was put IN the box instead (in line with the non-linguistic strategies discussed in chapter 2). I did wonder whether one reason for the relatively poor performance of UNDER was a difficulty in placing the key under the box, but those with confidence in what the preposition meant had no problems (and there
were even some instances where the configuration UNDER was made in error for other prepositions.

With BETWEEN, the item to be placed was often put NEXT TO the box, suggesting that the child could only take in one set of instructions such as "location + relationship with box" and had not managed the concept of BETWEEN yet. I did not use the expression MIDDLE when asking the children to put the key BETWEEN the box and the bear, as it was not the locative expression being tested and would also not have been right in that context, yet perhaps it is locative expression which they are more familiar with. For example there is often talk of the middle seat at the back of a car, a position which seems to hold a great attraction for children in this age range who often plead "I want to sit in the middle!"

There did not appear to be any great distinction in the accuracy of placing something BEHIND or IN FRONT of a featured compared with a non-featured object, since BEHIND scored highest, followed by IN FRONTf, IN FRONT and finally BEHINDf. With hindsight I wonder if BEHINDf (behind the little bear) was maybe harder for the children to reach to. Also, the box itself was not strictly non-featured since it had an opening at the front which allowed the configurations IN and ON. This could well explain why the featured positions did not score
significantly higher.

OUT/OFF Results

As described earlier, the "putting game" concluded with my placing a small yellow key IN the box and an identical one ON the box. Children were then asked to remove a key from OUT of and then from OFF the box. This was not strictly speaking part of my research study, but I thought it might be interesting to see if there were any great differences in comprehension relating to the two items IN and ON the box. There was also the possibility that a non-lingistic strategy could be in operation (would more children take the key OUT of the box than OFF?)

As can be seen from the table below, slightly more children did take the key OUT of the box when asked to take the key OFF the box than vice versa, but I do not think the evidence is sufficient to draw any real conclusions from the exercise.

<table>
<thead>
<tr>
<th>Action request</th>
<th>Correct %</th>
<th>Wrong key taken %</th>
<th>Both keys taken %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Take the key...&quot; OUT of the box</td>
<td>86</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>&quot;Take the key...&quot; OFF the box</td>
<td>79</td>
<td>15</td>
<td>6</td>
</tr>
</tbody>
</table>

Number of children co-operating = 66
It is also interesting that a number of children insisted on taking both keys (despite the request for a key being made in the singular). Again there is not enough evidence to know whether this response was made because the words or concepts relating to OUT/OFF were not understood or whether the question was too difficult to interpret. Perhaps taking both keys could be a non-linguistic strategy for the younger children when faced with this particular situation, regardless of what the request is (the average age of those children taking both keys was 2;6).

This is an area which although outside the main one concerning the acquisition of certain locative expressions, is nevertheless of interest and is one which could be investigated in a future study.

In their study of English and Korean children learning to express motion events, Choi and Bowerman (1991) pointed out that in English it is often obligatory to spell out Path even when it can be readily inferred from context e.g. "John threw his keys TO the desk/TO the drawer" sounds rather odd: ON and IN are needed before the TO. Even when it is grammatical to specify Path less completely, fuller information is often given, especially in everyday speech; compare "John took his keys FROM his desk/FROM the drawer" (a bit formal or bookish) with "John took his keys OFF his desk/OUT of the drawer" (completely colloquial).
4.2.5 Reservations about the analysis method

Whilst the Guttman scaling technique lends itself nicely to developmental work and is undoubtably the most appropriate one to apply to my research data, there are a few problems which I shall consider in this section.

The major problem with Guttman scaling is in identifying any given feature as correct/incorrect or, as in the case of the locative expressions examined in my study, acquired/not acquired. For example, if looking at the acquisition of articles in English by eliciting free speech and using a definition of acquisition as "90% correct in obligatory instances" (see section 3.2 on the definition of acquisition), then all the scores above 90% are converted to 1 for the Guttman analysis and all the scores below 90% to 0. The question though, is whether a subject might "know" the article if he or she got it right in 8 out of 10 obligatory instances instead of 9 out of 10. This problem is important because it seems quite unreasonable to consider a 90% to be a perfect performance but an 89% a completely inaccurate performance. Although my definition of "acquired" is not based on the 90% criterion but rather on the use of a correct prepositional expression in the appropriate context (with a credit withdrawn if it was used more often in an inappropriate context) the same "all or nothing" cut-off point problem arises.
There were, for example, cases where a child would give a response that wasn't the target preposition (or one of the equally acceptable alternatives), yet it wasn't entirely wrong; for example, when children described the position of the ball in game 1 as "WITH teddy" rather than "IN FRONT OF teddy" (child number 1 and 73) or "NEAR the bricks" instead of "NEXT TO the bricks" (child 6).

In game 3 there were several instances where children described the teddy as sitting "IN the chair" rather than the target of ON (child numbers 3, 42, 54) and a further 8 instances where IN THE MIDDLE was given for BETWEEN (child numbers 23, 33 and 37 in game 1 and child numbers 6, 9, 12, 22 and 73 in game 3).

Obviously in these circumstances the child could not be credited with acquiring the target preposition, since this was not actually used (although Johnston and Slobin would have included IN THE MIDDLE as an acceptable alternative to BETWEEN in their 1979 analysis). However, it still felt harsh that children had given good answers and were very "close" in terms of accurately describing a locative notion, yet received no recognition in the analysis of the locative expressions. It is here perhaps that a distinction could be introduced as to whether the child has the appropriate "concept" in circumstances where he or
she does not use the appropriate preposition. For the purposes of the Guttman analysis, however, it was necessary to set the most appropriate criterion level for the definition of acquisition and then adopt the correct/incorrect identification labels.

Another potential problem with Guttman scaling is what to do with missing data. This is more a problem when gathering data in natural settings as there may not be data on one of the features you are trying to scale for the subjects. If the missing feature is put in as either a 0 or a 1 then scalability will be influenced. For my results, if there was any missing data, then all the data for that particular game was left out of the analysis.

A final problem has to do with context. The context in which the feature occurs may be a determining factor in the scalability of certain factors. This means that the three different environments for the different games may have an effect on the actual prepositional notions being tested, thus making comparisons more difficult to make.
4.2.6 Further analysis of the data

Without detracting from the validity of the results already obtained by the Guttman scaling technique, the opportunity was taken to carry out a short supplementary analysis of the data by looking at probabilistic scaling which would allow more flexibility than the rather deterministic Guttman method. This was done using Mokken’s Homogeneity Model, which looks more at the probability of obtaining correct responses (rather than the strict Guttman "all or nothing" approach). The Mokken analysis would allow for more random variation, which, as we saw earlier in section 4.2.3, may be a factor contributing towards a poor Guttman coefficient of reproducibility.

Mokken’s Homogeneity Model was therefore applied to the data from all 3 games with the following summary results (for full details please see Appendix 7):

<table>
<thead>
<tr>
<th></th>
<th>Scale Reliability</th>
<th>Homogeneity</th>
<th>Significance of Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game 1</td>
<td>0.99</td>
<td>0.24</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Game 2</td>
<td>0.99</td>
<td>0.26</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Game 3</td>
<td>0.97</td>
<td>0.31</td>
<td>P &lt; 0.001</td>
</tr>
</tbody>
</table>

The scaling orders used were the same as for the Guttman
analysis. In essence, the Mokken results show very good reliability for the results from all three games (99%, 99%, and 97% respectively) which shows that the scale is very good at discriminating between individual children. The homogeneity figures show how well the overall spread of items fits the Mokken model, and although there seems to be room for variation, the significance levels of the homogeneity indices are all very high (with $P < 0.001$) which indicates reasonable scales.

As a high skew was apparent on items A1 and B1 (relating to IN scoring very high for games 1 and 2), this was omitted to give the following revised Mokken analysis:

Table 12: Adjusted Mokken results (games 1 and 2)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Reliability</th>
<th>Homogeneity</th>
<th>Significance of Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game 1</td>
<td>0.97</td>
<td>0.24</td>
<td>$P &lt; 0.001$</td>
</tr>
<tr>
<td>Game 2</td>
<td>0.99</td>
<td>0.26</td>
<td>$P &lt; 0.001$</td>
</tr>
</tbody>
</table>

The figures do not improve by taking out the non-discriminating items and we see again the very high reliability estimates and somewhat lower homogeneity figures (there is no hard and fast rule but a figure of 0.3 is often aimed at).
The Mokken analysis was particularly relevant for looking at the results for game 2, the comprehension test, since this was the game which recorded the lowest Guttman coefficient of reproducibility score (0.799). What we see from the Mokken analysis is that the high reliability estimates indicate good discrimination between individual children: that is, although there is a poor range shown by the Guttman scale, there are still fine distinctions between children and that the range is sufficient to show a cumulative order for the acquisition of prepositions.

Overall then, we see that there is a reliable order for data from all three games on the acquisition of prepositional expressions.
4.2.7 Consistency of results between games

As we saw in the discussion of the results earlier, there was a very good relationship between the implicational scaling data for the two production games (the Guttman results for games 1 and 3) and a scale with limited range for the comprehension game (game 2). The graph below shows the consistency of the results from the production games (excluding the additional side facing featured items in game 3) based on the Guttman difficulty scores and the scaling order for game 1.

Figure 15: Consistency of results from different games

Guttman difficulty score

![Graph showing consistency of results from different games](image-url)
The comprehension data from game 2 shows that the children had much less difficulty in using the prepositions correctly than in the other two games (as had been expected). Also, as we saw in the discussion of the results of game 2, the data did not provide an adequate basis for producing a good scale, although the subsequent Mokken analysis indicated that the range was just sufficient to show a cumulative order. The main anomaly from comparing the Guttman results for game 2 with the other two games was that even though the spread of difficulty is not great, UNDER still does not come a clear third in the hierarchy as in the other two games.
4.2.8 New order of acquisition

As a result of the remarkably good consistency of results between games, particularly the two production ones, a new acquisition order for locative expressions emerges, using information from the following summary table:

Table 13: Summary table of acquisition based on Guttman scaling results (%)

<table>
<thead>
<tr>
<th></th>
<th>game 1</th>
<th>game 2</th>
<th>game 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>99</td>
<td>100</td>
<td>94</td>
</tr>
<tr>
<td>ON</td>
<td>82</td>
<td>88</td>
<td>81</td>
</tr>
<tr>
<td>UNDER</td>
<td>78</td>
<td>66</td>
<td>73</td>
</tr>
<tr>
<td>BEHINDf</td>
<td>56</td>
<td>66</td>
<td>55</td>
</tr>
<tr>
<td>BEHIND</td>
<td>52</td>
<td>74</td>
<td>36</td>
</tr>
<tr>
<td>IN FRONTf</td>
<td>32</td>
<td>72</td>
<td>21</td>
</tr>
<tr>
<td>IN FRONT</td>
<td>30</td>
<td>68</td>
<td>20</td>
</tr>
<tr>
<td>BESIDE</td>
<td>24</td>
<td>68</td>
<td>13</td>
</tr>
<tr>
<td>BETWEEN</td>
<td>14</td>
<td>69</td>
<td>25</td>
</tr>
</tbody>
</table>

This produces the following general acquisition order based mainly on the production data from games 1 and 3 (since the comprehension data exhibited such a narrow range) and excluding the side facing featured data from testing for BEHINDfs/IN FRONTfs in game 3. This new general acquisition order is broadly consistent with the predicted order but with earlier positions for featured and non-featured BEHIND and IN FRONT:

IN <ON <UNDER <BEHINDf/BEHIND <FRONTf/FRONT/BESIDE/BETWEEN
4.3 Influence of variables such as age and sex

A further statistical analysis was carried out to look at the influence of variables such as age and sex on the acquisition of prepositional expressions. This took the form of a multivariable test (ANOVA) using an SPSS windows package.

4.3.1 Influence of age

Firstly, the children were divided into 3 groups based on their age at the time of the test:

- Group 2: age 2;0 - 2;11 (47% of sample)
- Group 3: age 3;0 - 3;11 (32% of sample)
- Group 4: age 4;0 - 5;0 (20% of sample)

Number of valid cases = 74

Running the analysis package through the data resulted in the following mean scores for each age group i.e. how many locatives were correctly expressed/understood on average for a child from each age group for each game:

Table 14: Mean scores by game and age group

<table>
<thead>
<tr>
<th></th>
<th>game 1</th>
<th>game 2</th>
<th>game 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 2</td>
<td>4.36</td>
<td>6.09</td>
<td>4.08</td>
</tr>
<tr>
<td>Group 3</td>
<td>4.86</td>
<td>6.62</td>
<td>4.46</td>
</tr>
<tr>
<td>Group 4</td>
<td>5.27</td>
<td>8.57</td>
<td>6.33</td>
</tr>
</tbody>
</table>
As we can see, there is an increase in the number of locative expressions acquired with an increase in the age of the child for all three games, as would be expected in a developmental scale. For game 1, there is a gradual increase, and for games 2 and 3 there appears to be a larger increase in the number of prepositions acquired between age groups 3 and 4. This is perhaps best illustrated in graphic form:

Figure 16: Increase in mean number of locative expressions acquired by age and game

---

Figure 16: Increase in mean number of locative expressions acquired by age and game

---
Supplementing the ANOVA tests with Scheffe post hoc comparisons (with a significance level of 0.05), we find that there is no major discontinuity in game 1 and there are no significant differences between any of the age groups. In games 2 and 3 a significant difference can be found between the oldest and youngest groups. The data thus indicate that children in successively older age groups produce more locatives than those in the younger groups.

Appendix 7 gives full details relating to the analysis of the age data including the post hoc Scheffe tests.

Whilst it may not be surprising to see that there is an increase in the mean number of locatives produced by successively older age groups, it should be remembered that age per se is not necessarily a good indicator of linguistic ability, and that a widely used measure is that of the Mean Length of Utterance (MLU) which computes the length of an utterance in terms of morphemes (Brown, 1973). Despite a considerable amount of critical discussion (eg Crystal, 1974; Peters, 1983), because of its apparently general nature and the ease with which it can be calculated, the MLU continues to be used as a baseline measure for carrying out studies, for example, on the developmental complexity of sentence structure.
### 4.3.2 Influence of sex

The gender details for all three games were run through the ANOVA test to examine whether the sex of the child had any influence on preposition acquisition.

The breakdown of the total sample of children was as follows:

- **Code 1**: boys 53%
- **Code 2**: girls 47%

The results of a "t" test analysis of the data showed that the girls consistently performed slightly better than the boys; that is, they produced a higher number of average locatives per game, but that the differences were not significant (at the 0.05 level).

<table>
<thead>
<tr>
<th></th>
<th>game 1</th>
<th>game 2</th>
<th>game 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>boys</td>
<td>4.50</td>
<td>6.68</td>
<td>4.56</td>
</tr>
<tr>
<td>girls</td>
<td>4.94</td>
<td>6.82</td>
<td>4.77</td>
</tr>
</tbody>
</table>

It is interesting, if not statistically significant, that the girls consistently produced or understood a higher number of locative expressions than the boys, since this can be seen in context with the widespread view of girls' superiority with respect to almost all aspects of language.

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development (and can also be seen in conjunction with the recent debate on girls’ intellectual superiority compared with boys - see Grant, 1994). Reviewing the literature on the subject of girls’ linguistic superiority back in 1954, McCarthy wrote:

"The vast accumulation of evidence in the same direction from a variety of investigators working in different parts of the country [USA], employing different situations and methods of observation, and employing different analyses and linguistic indices, certainly is convincing proof that a real sex difference in language development exists in favor of girls ... "
(McCarthy, 1954: 580)

However, only a few years later, Templin, summarizing her own findings, wrote:

"When the performance of boys and girls is compared over the entire age range, girls tend to receive higher scores more frequently than the boys, but the differences are not consistent and are only infrequently statistically significant."

and she went on to suggest that:

"It may be that the differences which have appeared in the literature have been
overemphasised in the past. It may also be that over the years differences in language ability of the two sexes have actually become less pronounced in keeping with the shift towards a single standard in child care and training in the last few decades." (Templin, 1957: 145-7)

Similar conclusions are reached in more recent reviews by Cherry (1975), Macaulay (1978) and research by Wells (1986), supporting the view that what differences there are between the sexes are in the rate rather than in style of acquisition, but that they are rarely significant and do not consistently favour either girls or boys.

The results from my data concerning the acquisition of locative expressions by sex are therefore in line with results on sex differences from other linguistic areas in that there is no statistical significance.
4.4 Substitutions: errors and alternative expressions

This section looks at some of the prepositions and prepositional expressions used in place of the target ones and discusses whether they tell us anything about how prepositions are acquired.

4.4.1 Classification and outline of section

The overall classification of responses in the study can be seen as:

1. CORRECT (ie the target preposition is used); a credit is allocated in line with the assumptions for analysis given in section 4.2.1. This is termed an "appropriate" use of the preposition.

2. A SUBSTITUTION for the target preposition is made which may be either an ERROR or an ALTERNATIVE prepositional expression. These cases are deemed an "inappropriate" use of the preposition from the point of view of the analysis.

3. NO PREPOSITION is given either because there is no response at all, there is a deictic response (pointing and/or saying "there") or the preposition is omitted.
I had envisaged that there would be more prepositional omissions (for example, "chair" instead of "ON the chair"), particularly by younger children, since both French (1987) and Tomasello (1987) reported omissions in their studies. There were in fact hardly any "noun only" errors; on the whole, if a child was unsure, then the response was a deictic one (pointing and/or just saying "there") which, if this could not be converted into a full verbal response, would be treated as no preposition given for the purposes of my analysis.

The main part of this section will therefore be concerned with substitutions for the target prepositions.

I shall first consider overextensions, where a preposition is used correctly in all its appropriate contexts but is also used in other, inappropriate contexts. A detailed analysis will then be made of the most outstanding errors, which involve confusion between the polar pair of oppositions BEHIND and IN FRONT. Other topics to be covered in this section include consistency (how consistent children are on retesting), perspective (how children view things in a different way from adults) and some case studies which illustrate avoidance strategies and problems with certain prepositions. This will be followed by a discussion of the consistency of results between games before comparing the results, particularly with BEHIND and IN FRONT, with other studies.
4.4.2 Overextensions

As we saw in the first chapter of this thesis on cognitive and linguistic development, an overextension in first language acquisition occurs when a child uses a word to refer to an object, action, state or property where an adult would not judge it appropriate, in addition to using the word to refer to all appropriate referents. For example, my own son John aged nearly 2 would excitedly shout "dada" at any passing male adult (!) as well as using the word to refer to his own father. Other examples are when John used "cuppa tea" to refer to an empty cup and a cup of coffee as well as to a cup of tea, and sang out "tea time" loudly first thing in the morning (meaning he was hungry and it was time for breakfast).

Underextension consists of the child using a particular word to refer only to a subset of the full range of referents which are properly labelled with that word in the adult language. An example of underextension would be use of the word "shoes" to refer to a particular pair of shoes and not shoes in general.

In the case of overlap, a word is overextended to refer to inappropriate referents, but is only used to refer to some and not all of the appropriate references. It may be very difficult to distinguish between overlap and overextension in practice. An example of overlap is when the word
"umbrella" was used to refer to open umbrellas, a large green leaf and kites, but not to closed umbrellas (Anglin, 1983).

Young children’s words may occasionally display a complete mismatch with the adult word, where there is no overlap at all between the referential scope of the child’s word and that of the adult word. True mismatches are only rarely reported, probably because observers are unable to work out what the child is attempting to say and may not even recognize any consistency in the form being produced (Bloom 1973). One reported example of a mismatch is where "TV guide" was used to refer to television sets but not the programme guide (Reich, 1976). My daughter Louisa consistently uses the word "ponytail" to refer only to elastic hair bands and not to the hairstyle itself (if a ponytail is made using a plastic clip she describes this as "clip"). This misunderstanding may have come about because of the way the word "ponytail" is often used: I ask her "Would you like a ponytail?" and if she does, we select a band and I put it in her hair. Adult use of the word "ponytail" may therefore be ambiguous, if not misleading. This would seem to be confirmed by the fact that Louisa’s twin brother also refers to hair bands as ponytails.

The four types of extensional error made by young children
can be represented as follows:

**Figure 17: Different types of extensional error**

- a) overextension
- b) underextension
- c) overlap
- d) mismatch

Of the four types of extensional error defined by Barrett (forthcoming) and described above, it is overextensions and to a lesser extent, underextensions which have received the most attention. Overextensions are classified by Clark (1993) as falling into two main categories: **over-inclusions**, where children extend a term to other entities from the same taxonomy (e.g., "dada" for all men, or calling a cow "pig"); and **analogical extensions**, where children use a term for objects from other taxonomies on the basis of perceptual similarity (e.g., when the word "ball" is applied to onions, doorknobs and the moon. In Rescorla's work (1980) the most common analogical extension was "ball" used for round objects,
and Bowerman’s daughter used "ball" to refer to a variety of objects which were rounded and of a size suitable for handling and throwing, e.g. a round red balloon, an Easter egg, a small round stone and a round canister lid (Bowerman, 1978).

Overextended words do not necessarily have any features in common with each other; however, each referent does usually have at least one feature with the initial referent of the word. For example, one child used the word "clock" to refer to clocks, a circular bracelet and the sound of dripping water, amongst other things (Rescorla, 1976).

The fact that a young child overextends a lexical item can be interpreted in different ways. It may mean that the child believes that all the objects which he or she names with that item belong to a single category and that the lexical item provides the adult name for all these objects. Thus, when the child refers to both a pig and a cow by the word "pig", we can interpret this as indicating that the meaning of "pig" for him has to do with whatever a pig and a cow may have in common, and we would then expect him to use "pig" to name other animals sharing these properties - for example, a sheep or a horse may also be called "pig" since they are all farm animals. Another interpretation is that a child may overextend a lexical item, not because he thinks it is the correct
name, but because he has no better word in his vocabulary for the occasion, or because he is unable to remember the correct name. Thus, when he calls a cow "pig" it may be that this is equivalent to an utterance such as "like a pig" or "is that a pig?" If this is the case, we would expect him to be able to choose a picture of a pig in preference to one of a cow if he was asked "where's the pig?" Indeed, Thomson and Chapman (1977) found that two year old children could often point to the picture appropriate to a word which they had used on other occasions to name an object depicted in the alternative picture. However, Kuczaj (1982) showed that the situation is more complicated, and that if the child is allowed to continue choosing from a number of referents, then with each successive choice, progressively less typical referents are chosen until overextended referents are selected by the (previously overextending) child.

In addition to overextension resulting from categorical errors and deliberately stretching the use of an acquired word to fulfil a communicative purpose, there may also be accidental retrieval of the wrong word from memory eg "horse" instead of "donkey"; or the child may make an object recognition error eg mistakes a donkey for a horse. Misapplication of a word may be made deliberately for a humorous effect or in the course of symbolic play (eg calling a waste-paper basket put on the head a "hat").
Barrett (forthcoming) also describes using a word in a metaphorical manner in order to draw attention to a perceived similarity or analogical relationship between two objects eg producing "train" when perceiving a bridge. A child may mispronounce a word (either because of an articulatory slip or because of a systematic phonological transformation of that word) such that in its child-produced form it sounds similar to another word which therefore appears to be overextended (eg producing the name Martyn as "Mama"). Overextension may also occur when a phonologically simple word is substituted for a phonologically complex one which the child has difficulty in producing eg my son referring to breakfast time as "tea time".

Underextension, as we have seen, is the use of a particular word with too restricted a range of reference and it is much more difficult to observe than overextension, since usage in the former but not the latter case is a correct usage in the adult system. Griffiths (1986) argues that underextension, though difficult to spot, may be a quite normal and frequent stage in learning the meanings of words. In fact, Griffiths suggests that the characteristic early path is for nominals to be underextended first and only later to apply to a wider range of entities, perhaps then going as far as overextension (Griffiths, 1986: 300). The opposite phenomenon, the contraction of referential scope, has also
been noted (Rescorla, 1981; Barrett, 1982).

According to Clark (1993), children aged one and two typically produce both underextensions and overextensions and these may involve up to one third of their production vocabulary.

Some overextensions seemed evident in the results of my study, for example a preposition could be used correctly (the target preposition) and then used inappropriately elsewhere in the same game. If used more often in inappropriate situations, a credit would be withdrawn from the correct use. However, there were also occasions (particularly with BEHIND) where the preposition would not be used in the target situation, but would still be used elsewhere inappropriately and sometimes elsewhere appropriately (cases of overlap). This suggests that the children may not always be confident about using a preposition in the correct circumstances yet still use it elsewhere. Some case studies illustrating this phenomenon are given later on in section 4.4.6.

The following table summarises which prepositions were used inappropriately more than once per game and also shows how often this actually resulted in a withdrawal of a credit. (Use of IN and ON in general expressions like "in the picture" or "on the card" has been excluded.) The
number of credit withdrawals is actually quite low (a total of 6) reflecting the fact that:

- a child might not lose a credit because one had not been gained eg child number 58 who used the expression NEXT TO on two inappropriate occasions in game 3 yet failed to use it in the appropriate context;

- the number of inappropriate uses may not exceed that of appropriate ones eg child 24 who said BEHIND on two appropriate and two inappropriate occasions.

Table 16: Inappropriate use of prepositions

<table>
<thead>
<tr>
<th>Preposition</th>
<th>Number of cases used inappropriately more than once</th>
<th>Number of times resulting in withdrawal of credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEHIND</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>NEXT TO</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>BESIDE</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>BY</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>UNDER</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>BETWEEN</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>NEAR</td>
<td>5</td>
<td>n/a</td>
</tr>
<tr>
<td>WITH</td>
<td>5</td>
<td>n/a</td>
</tr>
<tr>
<td>ROUND</td>
<td>1</td>
<td>n/a</td>
</tr>
</tbody>
</table>

n/a = not applicable (as these were not items being tested)

The idea of overextensions is taken up again in section 4.5 in connection with theories on the development of word meanings.
4.4.3 Analysis of BEHIND/IN FRONT errors

The confusion between the prepositions BEHIND and IN FRONT was the most marked error of all, probably because it involved the exact opposite of the target preposition sought. There were no noticeable confusions between any other two locative expressions, although BEHIND and IN FRONT were the only prepositions being tested which had exact polar opposites.

I shall first analyse the problems encountered with BEHIND and IN FRONT in the three games individually, and then see if there is a consistent pattern. The assumptions for analysis remain as for assessing the order of acquisition (and detailed in section 4.2.1).

a) Game 1 – BEHIND/IN FRONT

Most children either produced the correct preposition in all required situations or gave no responses at all (other than a deictic one of pointing or saying "there"). The remainder of the children had responses with substitutions for BEHIND or IN FRONT. The exact breakdown between correct, substitutions (errors and alternatives for BEHIND/IN FRONT) and no responses can be seen in Table 17 which follows:
Table 17: BEHIND/IN FRONT responses (game 1)

<table>
<thead>
<tr>
<th></th>
<th>Number of children</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEHIND/IN FRONT all correct</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>Substitutions for BEHIND/IN FRONT</td>
<td>29</td>
<td>37</td>
</tr>
<tr>
<td>No preposition given</td>
<td>29</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
<td>100</td>
</tr>
</tbody>
</table>

The category of children who had responses with some substitutions suggested that BEHIND is normally acquired before IN FRONT (as seen earlier in Tables 5 and 7).

The acquisition process often seemed to comprise two stages before both locative expressions were used competently:

**Stage I:** no response for IN FRONT, either no response or often UNDER/ROUND for BEHIND.

**Stage II:** BEHIND is mastered (both featured and non-featured) but children are still unsure of IN FRONT. Responses for IN FRONT are:

- Substitutions:
  - BEHIND for IN FRONT (error) 38%
  - Alternative preps (NEAR/NEXT TO/BESIDE) 34%
  - No preposition given 28%

The early substitution errors with UNDER and ROUND in place of BEHIND in Stage I tie in with findings of Judith Johnston (1984), where early use of BEHIND was linked to a
meaning of "hidden by and/or made inaccessible by", a meaning which could also be applied to UNDER, especially considering some of the early contexts with UNDER eg "under the sofa". The UNDER and ROUND substitutions for BEHIND in my study would support this interpretation.

As seen from the figures above, BEHIND is the most common substitution for IN FRONT in game 1, accounting for the vast majority of the total substitutions given at the stage when BEHIND has been mastered. Interestingly, there were no confusions the other way round, ie IN FRONT instead of BEHIND, but BEHIND was also given to mean BETWEEN on a number of occasions (6) - in all cases when children were in Stage II. This suggests that when BEHIND is first learned and used correctly, it may be overextended to cover other situations (IN FRONT and BETWEEN) where it is not correct.

Incorrect use of a preposition does call into question how acquisition is defined for the analysis: should we accept a child as having acquired BEHIND if he or she makes even one inappropriate use? However, as discussed in the previous section on extensions, there is an interpretation where the child knows BEHIND and overextends it, not because he or she thinks it is the correct word but because he or she has no better word or is unable to remember the correct one. If this is the case, we would expect to see less confusion between BEHIND and IN FRONT.
(particularly BEHIND being used for IN FRONT) in game 2 on comprehension, which is indeed so (see Tables 18 and 19 showing higher overall accuracy rates and a much lower proportion of BEHIND for IN FRONT substitutions).

There is no evidence that BEHIND was given as a "slip of the tongue" or because concentration was lacking: the children did not self-correct or say "sorry, I mean..." as adults often do. This contrasts with semantic slips of the tongue that adults make such as muddling up "left" and "right" (the most common semantic tongue slip according to Aitchison, 1987: 76).

b) Game 2 - BEHIND/IN FRONT

As this was a game of comprehension rather than production, there was a higher proportion of children getting all the various forms of BEHIND/IN FRONT correct than for game 1, and a smaller number getting them all wrong or making no response. The precise breakdown of responses is given in the following table:

Table 18: BEHIND/IN FRONT responses (game 2)

```
                  Number of children %
                  ---------  ------
BEHIND/IN FRONT all correct          36   46
Substitutions for BEHIND/IN FRONT    27    35
No preposition given                15    19
Total                               78   100
```

182
The main error was that the configuration IN was made for BEHIND and IN FRONT (and indeed for all the other prepositions), in line with the non-linguistic strategy for younger children proposed by Eve Clark (1973a). Some children consistently put the key IN the box throughout game 2, although some changed to "tuck" the key IN with the bear when the reference object changed to the bear towards the end of the game.

The second largest single error in game 2 concerned the configuration of the key being placed IN FRONT of the reference object instead of BEHIND. This is in complete contrast to game 1 where confusion errors with BEHIND and IN FRONT only took the form of BEHIND being used for IN FRONT and not vice versa. In fact, the confusion errors with the BEHIND and IN FRONT form are not really any more predominant than other errors made in this game (see table 18). What does this suggest then - that BEHIND and IN FRONT are confused more with production than comprehension? The subject of confusion will be assessed again when we come to consider the errors and alternative prepositions given in connection with the third game.

Other assorted errors and alternatives in game 2 included a number of cases where the configuration UNDER was made instead of BEHIND/IN FRONT. This not only adds to
existing evidence for an early meaning for BEHIND along the lines of "hidden and/or made inaccessible by" raised by Johnston (1984) and mentioned earlier, but also suggests that the configuration cannot be too difficult to achieve, despite its poor performance (see Table 9).

A summary of the substitutions (nearly all of them clear errors) made with BEHIND and IN FRONT in game 2 is given in Table 19 below:

Table 19: BEHIND/IN FRONT substitutions (game 2)

<table>
<thead>
<tr>
<th>Target</th>
<th>Substitution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IN</td>
</tr>
<tr>
<td>BEHINDf</td>
<td>8</td>
</tr>
<tr>
<td>IN FRONTf</td>
<td>8</td>
</tr>
<tr>
<td>BEHIND</td>
<td>12</td>
</tr>
<tr>
<td>IN FRONT</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
</tr>
</tbody>
</table>

Figures given are % of all substitutions (87) made with BEHIND and IN FRONT.

In some respects, the results above may underemphasise the problem with confusion between BEHIND and IN FRONT, since there may well be children who were not entirely sure of the correct configurations, yet because they happened to get them right at the first attempt, would be deemed to have mastered the prepositional expressions. This would of course apply to all the locative positions being tested.
and not just BEHIND and IN FRONT, but from what we have already seen, there does seem to be a special confusion relating to the polar opposites BEHIND and IN FRONT.

Those children who exhibited problems with any of the configurations in game 2 were asked to repeat the task so that I could see if the same responses would be made again. This emphasised even more the confusion evident amongst the children with the locative expressions BEHIND and IN FRONT.

A good example of confusion is given by child number 78 in game 2, where all four instances of BEHIND and IN FRONT were wrong on the first attempt, two were corrected on a second attempt (at the end of the game), one changed to a different (incorrect) position and one remained incorrect:

Example of confusion between BEHIND/IN FRONT (child 78)

<table>
<thead>
<tr>
<th>Attempt number</th>
<th>Target preposition</th>
<th>Response given</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BEHIND</td>
<td>IN FRONT</td>
</tr>
<tr>
<td>2</td>
<td>IN FRONT</td>
<td>Y</td>
</tr>
<tr>
<td>1</td>
<td>BEHIND</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>IN FRONT</td>
<td>BEHIND</td>
</tr>
<tr>
<td>1</td>
<td>BEHINDf</td>
<td>IN FRONT</td>
</tr>
<tr>
<td>2</td>
<td>IN FRONTf</td>
<td>NEXT TO</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>BEHIND</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>BEHIND</td>
</tr>
</tbody>
</table>
c) **Game 3 - BEHIND/IN FRONT**

There was a larger number of children not getting all cases of BEHIND/IN FRONT either correct or incorrect in game 3 than in the previous two games. To a large extent this must be due to the increased number of BEHIND/IN FRONT elements involved in the card game because of the more complicated pictures with the side facing featured reference objects. There is also the possibility that the game itself was more complex as it involved three dimensional items being represented in two dimensional form. The precise breakdown of responses is as follows:

<table>
<thead>
<tr>
<th>Number of children</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEHIND/IN FRONT all correct</td>
<td>7</td>
</tr>
<tr>
<td>Substitutions for BEHIND/IN FRONT</td>
<td>57</td>
</tr>
<tr>
<td>No preposition given</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>76</strong></td>
</tr>
</tbody>
</table>

As with game 1, there seemed to be observable stages of acquisition with many of the children (over 20% of those giving substitutions):

**Stage I:** no response for IN FRONT, either no response or attempts on BEHIND, particularly the side facing featured BEHIND (BEHINDfs). In many cases, the children have a different perspective of the
lion/crocodile picture, seeing the lion as standing on the crocodile rather than BEHIND. This phenomenon is associated with the younger children and can be connected to the work done by Piaget (1926) on children’s cognitive development; the children perceive the lion as standing on the crocodile and their language reflects their thoughts (see chapter 1). The way that children view the picture of the lion/crocodile could be due to a large extent to the fact that the lion is much taller and larger than the crocodile behind which it is standing. If the animals’ positions had been reversed, would many of the children have thought that the crocodile was on top of the lion, or might they have interpreted the picture as the crocodile in the lion’s legs?

Examples of responses from children in Stage I:

<table>
<thead>
<tr>
<th>Child number</th>
<th>Age</th>
<th>Target preposition</th>
<th>Response</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>2;10</td>
<td>BEHINDf</td>
<td>UNDER</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONTf</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEHIND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONT</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEHINDfs</td>
<td>ON TOP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONTfs</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>2;11</td>
<td>BEHINDf</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONTf</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEHIND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONT</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEHINDfs</td>
<td>ON TOP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONTfs</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
Stage II: a correct response is usually given for BEHIND and the child may now attempt IN FRONT. This is often a stage of confusion, with BEHIND being given in place of IN FRONT (highlighted below with a *).

Overall, the children exhibiting Stage II behaviour seemed to be somewhat older than the Stage I children.

Examples of responses from children in Stage II:

<table>
<thead>
<tr>
<th>Child number</th>
<th>Age</th>
<th>Target preposition</th>
<th>Response (Y = correct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3;8</td>
<td>BEHINDf</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONTf</td>
<td>* BEHIND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEHIND</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONT</td>
<td>* BEHIND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEHINDfs</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONTfs</td>
<td>* BEHIND</td>
</tr>
<tr>
<td>23</td>
<td>4;9</td>
<td>BEHINDf</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONTf</td>
<td>OUTSIDE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEHIND</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONT</td>
<td>* BEHIND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEHINDfs</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONTfs</td>
<td>AT THE SIDE</td>
</tr>
<tr>
<td>44</td>
<td>3;1</td>
<td>BEHINDf</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONTf</td>
<td>* BEHIND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEHIND</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONT</td>
<td>* BEHIND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEHINDfs</td>
<td>ON TOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN FRONTfs</td>
<td>* BEHIND</td>
</tr>
</tbody>
</table>
The confusion with BEHIND and IN FRONT occurs primarily, although not exclusively, with BEHIND substituted for IN FRONT. This appears to be the most significant error made in game 3, since it is the opposite preposition from that required (rather than a more vague term used to cover any uncertainty with the precise preposition required).

Whilst significant, the BEHIND/IN FRONT confusions were by no means the only substitutions made in game 3. Table 21 which follows later shows all the substitutions made. I have divided the substitutions into broad categories, on the basis of similarity of features and comparison with the adult (target) form. The categories form a continuum, going from "obvious errors" to "acceptable adult alternatives" and are intended simply as a guide to assessing the substitutions made by the children.

Categories of substitutions
---------------------

a) Definite errors
----------

These are errors which are immediately obvious as "wrong" to an adult observer. For example, child 44 describing the picture of the balloon as being "BEHIND the bricks" instead of the target "IN FRONT". Other examples are child 13 describing the teddy as being "IN the piano" instead of "BEHIND the piano" and child 43 describing the
car as being "IN the house" instead of "IN FRONT of the house".

b) "Child-like" errors

These errors reflect a child’s way of viewing things but are not what an adult would say, even if an adult might be able to appreciate why the child makes these errors. For example, as discussed earlier in this section, a number of children (12 to be precise) described the lion on the card as being "ON TOP of the crocodile" instead of "BEHIND the crocodile" (this was the side facing featured item, i.e. BEHINDs).

It is not always easy to distinguish between definite errors and child-like ones, since there may well be reasons for some of the definite errors which are not immediately apparent. Maybe, for example, child 43 described in a) above had simply forgotten the lexical item "FRONT" when saying the car was "IN the house" instead of "IN FRONT". Or maybe it was an overextension of the preposition IN which had already been acquired. We do not know on the evidence available.

In the "child-like" group of errors there were also several occasions when children described the card with the teddy hiding behind the piano (BEHINDf) as the teddy
being "UNDER the piano". Technically speaking the teddy was stuck down on the card under the picture of the piano, but the error was more likely to be made because of the "hidden by/inaccessible" logic which has been seen in the two previous games (and which relates to the everyday situations whereby shoes or toys are hidden and inaccessible when they are UNDER the bed, for example).

c) Avoidance strategies
--------------

What I have termed "avoidance strategies" were particularly evident with the locative expressions IN FRONT of and IN FRONT.

For example, when shown the picture of the car in front of the house and asked where the car was, some children made replies such as

"where the house is"
"on the paper"
"in the picture"

Whilst these answers are not strictly incorrect either factually or grammatically (which makes it impossible to categorise them as errors as they are a true description of a depicted situation), I was left with the distinct impression that the target expression was being avoided, probably because the child was unsure or did not know what
it was. Further prompting in these instances did not usually bring the required prepositions (and these would not be included as correct in the analysis even if they were provided). This type of response does give us some insight into how the child’s developing mind is operating: the child seems to realise that a verbal response is needed, yet is unable or unwilling to give the required response.

Many of the words/phrases which appeared to be used to avoid the target preposition fall into the "others" category in Table 21 below.

d) Circumlocution

Circumlocution was deemed to have occurred when a more vague preposition such as NEAR was used, probably because the preposition concerned had not yet been acquired. For example, in response to the question "where’s the guitar?" child 1 replied "NEAR the drum" instead of "BEHIND the drum".

One feature of these vague circumlocutions (often NEAR or NEXT TO) is that they were often repeated with subsequent cards. It was almost as if certain children answered the cards as correctly as they could (and remember, they were presented in predicted increasing order of difficulty), then once they came to their "acquisition limit" they
switched into a general mode which they felt would adequately answer all difficult forthcoming questions, or at least give as good a reply as possible.

For example, child 77 who had competently answered all the card questions relating to IN, ON, UNDER, NEXT TO and BEHINDf then "switched" to using NEXT TO to describe all the rest of the cards testing locative expressions (IN FRONTf, BETWEEN, IN FRONT and IN FRONT) with the exception of BEHIND and BEHINDfs which proved in my analysis to be less difficult than in the predicted hierarchy. Interestingly, BEHIND was given correctly (the guitar was described as "BEHIND the drum") but for BEHINDfs, the lion was described with the "child-like" error as being "ON the crocodile" which seems to confirm that the mental representation children have of this particular situation is a definite (albeit "wrong") one: if the child had had any doubts about the suitability of his response to the lion/crocodile question, would he not have replied "NEXT TO" as he had on three previous occasions? This brings to mind the quote from Carol Chomsky (1969) that we encountered earlier when talking about children understanding our sentences: "they understand them, but they understand them wrongly" (section 4.2.4). Perhaps here we could say that this child was not, as he saw it, unsure as to how to answer the question of where the lion was: he was sure (but got it wrong).
e) Acceptable alternatives

This group of substitutions were very much alternatives to the prepositions required rather than errors. They were in fact responses which could have been made by an adult without anyone thinking them particularly wrong.

One example of an acceptable alternative was, in response to the question asking where the car was, the colloquial reply "parked outside the house" (instead of the target "IN FRONT of the house").

Other examples of acceptable alternatives included giving the response "NEXT TO the crocodile" when asked where the lion was (where the side facing featured BEHINDfs was being tested and the response "BEHIND the crocodile" was expected) and describing the goat as "NEXT TO the horse" or "WITH the horse" for the target "IN FRONT of the horse" (testing the side facing, featured IN FRONTfs).

Again, there are no clear limits between categories: when does circumlocution become an acceptable alternative (eg would "NEAR the bricks" be a circumlocution or an acceptable alternative?). Much may depend on context and the decision on classification will be a subjective one.
Explanations for substitutions, both errors and alternatives, can therefore help us build up a picture of the mental representations of locative expressions in young children. It is, however, a complex area and the evidence from the results here cannot provide us with the full picture.

The substitutions given in the table below are detailed objectively as what was given in place of what, although many of the substitutions have been used as examples in my more subjective classification of categories.

Table 21: BEHIND/IN FRONT substitutions (game 3)

<table>
<thead>
<tr>
<th>Target</th>
<th>Substitutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BEH</td>
</tr>
<tr>
<td>BEHf</td>
<td>5</td>
</tr>
<tr>
<td>FROf</td>
<td>8</td>
</tr>
<tr>
<td>BEH</td>
<td>1</td>
</tr>
<tr>
<td>FRO</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>15</td>
</tr>
</tbody>
</table>

* The NEXT TO column includes the responses BY and BESIDE.

Figures given are % of all substitutions (131) made for BEHIND and IN FRONT.

There was a considerably higher number of substitutions for all forms of IN FRONT compared with BEHIND (around 60%
compared with 40%), even taking into account the high incidence of children giving ON TOP for BEHINDfs (the highest individual substitution). Again, this supports the earlier data which showed that BEHIND normally appears accurately in speech before IN FRONT.
4.4.4 Children’s consistency

As mentioned earlier (in section 4.4.3 above), if the children in the study exhibited problems with either the production or comprehension of locative expressions, (ie made totally inappropriate responses), I would normally retest to see if the error was repeated or amended (although if a correct response was subsequently given, this could not be included in the main analysis).

In cases where I did retest certain items (for instance, showing cards that had resulted in interesting substitutions again at the end of the game), some children showed complete "confidence in their errors" eg child 44 (shown in the example of stage II in section 4.4.3 above) who repeated BEHIND for IN FRONT on all retests.

Other children, however, changed their minds on retesting and might answer correctly, give no response, or give another incorrect response.

One example of inconsistency was given earlier in section 4.4.3 by child 78, when the subject of confusion between BEHIND and IN FRONT was discussed. This child produced incorrect configurations for all instances of BEHIND and IN FRONT in game 2. At a second attempt (at the end of the game) two configurations were corrected, one changed to a different (incorrect) position and one remained
incorrect.

A further example of inconsistency is seen with child 15, described below, who corrected two out of three confusions with BEHIND and IN FRONT on repeat testing.

Example of inconsistency on repeat testing (child 15)

<table>
<thead>
<tr>
<th>Attempt number</th>
<th>Target preposition</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BEHINDf</td>
<td>Y</td>
</tr>
<tr>
<td>1</td>
<td>IN FRONTf</td>
<td>Y</td>
</tr>
<tr>
<td>1</td>
<td>BEHIND</td>
<td>* IN FRONT</td>
</tr>
<tr>
<td>2</td>
<td>IN FRONT</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>BEHINDfs</td>
<td>* IN FRONT</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>IN FRONTfs</td>
<td>* IN BACK OF</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* denotes confusion between BEHIND and IN FRONT

Inconsistency was only prevalent in some of the cases where a child was unsure and perhaps working out how to use a certain preposition. Another option when the child was unsure was to use an avoidance strategy - an alternative way of expressing him or herself which avoided the necessity of using the target preposition. Where the preposition had been mastered, there seemed to be a very high level of both confidence and consistency.
The notion of the child changing his or her mind raises the question of what can be legitimately concluded from the child’s failure to produce the target preposition. It would be nice to be able to get at cases where this failure to produce the target is due to the child not having the appropriate linguistic knowledge; but this is made difficult in the sort of tasks used in the tests by the possibility of the child being uncooperative, inattentive and so on.

Retesting certain items also brings with it the possibility of the child realising that the task is being repeated and trying to remember what was said the last time so that this can either be repeated (if the child is confident in its earlier response) or change it (if the child thinks it is being re-tested because it made an incorrect response). I do not intend to delve into this particular psychological area and indeed have no evidence that children did try to "remember responses" when tasks were repeated (perhaps I am assuming that more adult-like behaviour applies to this young age group). There was evidence, however, that sometimes the children remembered the cards, as a couple of times children said "I done this one already" (or words to this effect) when re-shown a particular card.

What we appear to have is a typical learning pattern: on the one hand, young children whose prepositional concepts
and linguistic forms are developing, who have only acquired one or maybe two of the easiest locative expressions (eg IN and ON). On the other hand, we have older children who have acquired many, perhaps even all of the locative expressions being tested. In the middle, we have this complex area of confusion errors, overextensions, circumlocution, avoidance strategies, perception differences and more. The uncertainties which these children have, and the "certainties which are wrong" (eg the perceptual differences) all need to be resolved before adult-like acquisition of the prepositions can be achieved. This sensitive area is then seen reacting to the emotional, physical and intellectual demands of the test environment.

Whilst this does make it difficult to interpret the data, it does not mean that some of the insights are not helpful in our understanding of how the prepositional expressions are acquired: for example, it shows us that acquisition is not a simple process of moving from "no preposition" to "full acquisition" with nothing in-between.
Some of the different ways a child has of viewing and/or expressing things have already been mentioned:

Firstly, with the picture of the lion standing BEHIND the crocodile (see below), young children often described the lion as standing "ON TOP of the crocodile" (one child even asked where its feet were!) 

See discussions relating to this topic in section 1.2 on a child’s way of viewing things; section 4.2.3 when looking at featured items facing the side and section 4.4.3 on the errors made with BEHIND and IN FRONT in game 3.

Secondly, children substituted UNDER for BEHIND. For example, in game 1 some children described the ball as "UNDER the teddy (or tin)" rather than BEHIND, and similarly in game 3, the teddy was described as "UNDER the
piano" rather than BEHIND.

See discussions relating to this particular perspective error in section 4.4.3.

Another common answer that didn’t provide the target preposition or even what an adult would have said, yet wasn’t entirely wrong, was the use of IN to describe the position of the ball in game 1 when the ball was really hidden UNDER the blanket. In these cases, I would hide the ball again in another UNDER position (usually under my dress or under the little chair) and very often the target locative would be achieved, despite the fact that the subsequent positions also had an element of enclosure (which one might have assumed had caused the initial substitution of IN for UNDER). This illustrates, I believe, the considerable effect that the choice of test items has on the results, a recurring issue which will be
The idea of IN suggesting enclosure in the blanket may be related to some of Fillmore’s work on spatial terms (e.g., 1967, 1971) when looking at the prepositions AT/ON/IN in one-, two-, and three-dimensional space. Fillmore points out that "John is on the grass" treats the grass as a two-dimensional surface whereas "John is in the grass" treats the grass as a three-dimensional space where John is inside the space with grass all around him.

In my study, one thing that some of the younger children were keen to do was to tuck the picture of the ball into the top of the stairs in game 3 (even though I was supposed to be doing the actions for UP and DOWN!) In many ways this was similar to their desire to tuck the key in with the little bear and put the key into the box in game 2, which supports Eve Clark’s work on non-linguistic strategies (1973a). Clark’s work does not consist of a theory of lexical development precisely because lexical development is not studied. Non-linguistic strategies have no inherent interest in my study, but the evidence from my research which supports Clark’s results (the key being put in the box or being tucked in with the little bear in game 2, and the ball being tucked in at the top of the steps in game 3) does illustrate a methodological problem. The results where the configuration IN is made in game 2, for example, should be treated with caution.
If the configuration IN is made consistently when testing prepositions other than IN, then how can we know that the preposition IN itself is known? As we saw from the Guttman results from game 2, there was a "no difficulty" score of 1.00 with IN. This may reflect everyone having acquired IN, but could potentially reflect some not having the complete knowledge of the form and meaning of the preposition but gaining a credit by simply acting out a non-linguistic strategy. This potential problem was one thing that I sought to eliminate by taking out IN with the Mokken analysis (see section 4.2.6), although in the event, excluding IN did not improve the scale at all.

There was also evidence of vivid imaginations and attention to detail with some of the cards in game 3, particularly the one with the tractor NEXT TO the tree.

With this picture there were responses which were
"possible" but not really the required answer:

eg Q: "Where's the tractor?"
A: "On the farm"
"Picking up mud"
"Going past the tree...there's no man (driver)"

To some extent this type of answer may well have been the child adopting an avoidance strategy, if unsure of how to express him or herself. In other cases, the child would avoid a certain preposition, like BESIDE/NEXT TO on one occasion, yet use it elsewhere, suggesting that the word might be known but not always used in the right context (see also the case studies which follow).
4.4.6 Case studies

The examples given and discussed below as case studies help to illustrate some of the errors and other substitutions made with perspective. They also show a few of the problems and complexities involved with prepositions, demonstrating in particular how a word may be produced on an inappropriate occasion before it is used correctly (see also section 4.4.2 on overextensions and the inappropriate uses of prepositions). Most examples are taken from game 3, and those given in footnotes are "exceptional" ones, that is, they are not the more typical types of error that have already been discussed.

Case study 1

----------------------------------

Child number: 23
Age: 4;9

This child saw the tractor as BEHIND the tree rather than NEXT TO, yet later on in game 3 used BESIDE for IN FRONTs with the picture of the horse and the goat (so he did know the word BESIDE). This is further evidence for the discovery that young children have a non-adult perspective in some cases, ie he did not say the tractor was "BEHIND the tree" because he did not know the word for BESIDE and thought that BEHIND would be a reasonable alternative: he said BEHIND because that was how he saw it. As well as saying BESIDE instead of IN FRONTs, child 23 avoided
other instances of IN FRONT by substituting "outside the house" for IN FRONT (the picture of the car IN FRONT of the house) and BEHIND for IN FRONT for the picture of the balloon IN FRONT of the bricks (a confusion error). This child (a boy) therefore consistently avoided giving the response IN FRONT, by giving substitutions (one error and two alternatives). At 4;9 he seemed rather old to have perspective and confusion errors.

Case study 2  
-------------

Child number: 49  
Age: 2;4

This child made no responses for NEXT TO or BEHIND on the appropriate occasions, but said BEHIND for IN FRONT (a confusion error or mismatch) and NEXT TO for IN FRONT (an acceptable alternative but not the target), ie she used the prepositions in inappropriate situations before being able to use them in appropriate ones.

Case study 3  
-------------

Child number 58  
Age: 2;9

This child avoided saying NEXT TO when appropriate, by describing the tractor as "on the lawn", but he did use NEXT TO for IN FRONT (both featured and non-featured)
suggesting that he knows the words but is not yet able to apply them in the appropriate situation.

Case study 4

Child number: 59
Age: 3;11

This child gave no response for the card with the tree and the tractor (target BESIDE/NEXT TO) yet said BESIDE for IN FRONTfs (describing the car IN FRONT of the house) and for IN FRONTf (describing the goat IN FRONT of the horse).

Again this suggests that children do not readily describe the tractor as being NEXT TO the tree, maybe because:

a) they do not perceive the tractor as being NEXT TO the tree (but as BEHIND/IN FRONT or they are not sure)

b) the card was not an ideal one for eliciting the target response of BESIDE (as mentioned earlier in section 4.2.3)

c) a combination of the two reasons.

It is when one is looking in detail at the substitutions made that patterns like the perspective errors appear to emerge. Another error that became apparent, as we have seen, was the application of a preposition in an inappropriate situation when not used in the appropriate
one. This is not overextension since there is no evidence that the original target form has been acquired, but does suggest that the child is examining and trying to work out the correct application of this particular form.

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Footnote of less common substitutions

<table>
<thead>
<tr>
<th>Child number</th>
<th>Age</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>4;0</td>
<td>MIDDLE given for BETWEEN (not an acceptable alternative) but BETWEEN given for both BEHINDfs and IN FRONTfs.</td>
</tr>
<tr>
<td>68</td>
<td>3;3</td>
<td>child seems to avoid IN FRONT by saying BY for IN FRONTF, &quot;hiding in&quot; for IN FRONT, no response for IN FRONTFs, yet IN FRONT is given for BETWEEN (!)</td>
</tr>
<tr>
<td>78</td>
<td>2;10</td>
<td>DOWN given for UNDER, but UNDER given for NEXT TO and BEHINDf.</td>
</tr>
</tbody>
</table>
4.4.7 Consistency of errors between games

Some errors/substitutions were particular to individual games (e.g., the error of putting the key IN in game 2, or the perspective error of seeing the lion standing ON the crocodile in game 3). Other substitutions were common to more than one game: the substitution of UNDER for BEHIND (seen in all three games to a greater or lesser degree); circumlocution, where a more general locative (often NEAR or BY) was used when the child was unsure of the precise preposition to use (games 1 and 3).

In particular, the confusion between BEHIND and IN FRONT was a common and salient element throughout all three games, where, as we have seen, BEHIND was often substituted for IN FRONT and sometimes for other locatives as well. This fascinating error, pervading areas of both production and comprehension, will be considered in the next section to see if the results from my study are consistent with other studies.
4.5 Consistency of results with other studies

It is pertinent to consider whether the interesting results with BEHIND and IN FRONT from my research are consistent with other work done specifically on locatives and whether there is a link with other areas of language development. Before assessing this, I shall first examine an influential theory of the development of word meanings (the semantic feature hypothesis) and look critically at some of the problems and subsequent developments in this area. I shall then examine the acquisition of relational terms (other than locative ones) to see what similarities there are. Discussion of studies in this area will also introduce the topic of markedness.

4.5.1 The development of word meaning

The componential analysis of word meanings was a key part of the semantic feature hypothesis - a developmental theory set out in the 1970s by Eve Clark (1973b, 1974). It should be noted that Clark has now distanced herself from this hypothesis, preferring the subsequently developed theory of lexical contrast (discussed later). However, since much of the empirical work on relational terms in the 1970s was influenced by the semantic feature hypothesis, it is worth outlining its main characteristics. The basic idea is that the human mind
(linguistic capacity) has a vocabulary of primitives that are used to "decompose" the meanings of words. So, for example, the meanings of "dog" and "puppy" might be partially represented along the lines:

```
dog
---
+ ANIMAL
+ CANINE
- JUVENILE
```

```
puppy
-----
+ ANIMAL
+ CANINE
+ JUVENILE
```

The words in capitals represent components of meaning and may be assigned a plus (+) or minus (-) value. In the foregoing example, we see that "dog" and "puppy" are identical in their representations, with the exception of the feature specification for juvenile, since a puppy is a young dog.

Clark’s analysis also focused on the fact that some semantic features can be organised in a hierarchy. For example, the temporal prepositions "before", "after" and "while" can be represented as governed by a hierarchical organisation of features as follows:

```
- SIMULTANEOUS
  - ANTERIOR
    before
  + ANTERIOR
    after
  + SIMULTANEOUS
    while
```
Clark's hypothesis was that superordinate features in feature hierarchies would be filled in first in the child's representation of word meanings and that positive feature specifications would be acquired first. In the case of the temporal terms above, a specification for simultaneity would be part of a word's meaning before a specification for anteriority was added, predicting that the difference between "before" and "after" would be mastered later than the general distinction between "before"/"after" and "while". In addition, the priority of positive feature specifications in Clark's theory predicted that "while" (and "when") would be mastered by children earlier than "before"/"after" and that "before" would be mastered by children earlier than "after" (see also section 4.5.2.d below).

Some early experimental work on children's production and comprehension of temporal terms appeared to support these predictions with respect to children's understanding of "when", "before" and "after" (Clark, 1971). Also, the phenomenon of overextension of word use (which was discussed earlier in section 4.4.2) was shown to be of particular importance to the semantic feature hypothesis. Clark (1973b) examined many cases in which children (normally aged one to two-and-a-half years old) overextended the use of words in a way which could be
described in terms of a focus on perceptual/semantic features common to sets of lexical items. An example was the word "moon" being used to refer not only to the moon, but to all kinds of round objects. Such overextension is compatible with a theory of the development of word meanings in which words are initially underspecified or underextended (see Griffiths, 1986).

Despite the early supporting evidence, there has been considerable criticism directed towards the semantic feature hypothesis and, as we have already noted, Clark herself has moved away from the original hypothesis. Nelson (1974) claimed that the similarity which underlies generalisation need not be restricted to perceptual dimensions.

"Similarity may be based on many different dimensions of which the static perceptual dimension of shape is only one; others include function, action or affect" (Nelson, 1974: 269)

Nelson illustrates this with an example of the hypothetical development of the concept "ball", which starts off as the representation of the situations the child has met with the ball (e.g. in living room, mother throws, picks up, holds etc) rather than being based on the physical attributes of the ball itself. Nelson puts forward the case for a functional core hypothesis, but
this, too, has been subject to criticism (see Atkinson, 1982, and Goodluck, 1991 for discussion of and challenges to the functional core hypothesis and semantic feature hypothesis).

One problem was that overextensions are not as common as semantic feature theory predicted; another that it was extremely difficult to identify the relevant sets of semantic features which make up the meanings of most words. For a number of reasons, including these, Clark has abandoned semantic feature theory and instead proposed a theory of lexical contrast (Clark, 1983, 1987, 1990). According to this theory, the process of lexical development is driven by two dominant operating principles which are followed by the child: the principles of contrast and conventionality. The principle of contrast means that the child assumes that any new word encountered must contrast in its meaning with other words already known to the child: this principle therefore leads the child to search for possible lexical contrasts for that word. The principle of conventionality, on the other hand, means that the child assumes that there are always conventional linguistic forms which can be used for referring to particular entities; this principle leads the child to search for conventional means for referring to entities.
So, according to this theory, overextensions in early lexical development are due to the child stretching the use of a conventional word in order to refer to something for which the more appropriate word has yet to be acquired. When that more appropriate word is eventually acquired, the child searches for the appropriate lexical contrasts and rescinds the original overextension.

However, lexical contrast theory has not really been fully developed as an explanation of some of the other major phenomena which characterise early lexical development (such as context-bound word use and decontextualisation - see Barrett, forthcoming for details).

Another theoretical explanation for early lexical development, first mentioned in chapter 1 of this thesis, is prototype theory. According to this, the meaning of a referential word is initially acquired, not in the form of either semantic features or lexical contrasts, but in the form of a prototypical referent or "best example" for that word. The child then generalises the word to other referents on the basis that they share common features with this prototype. This theory can explain why overextended words are not always linked by an invariant set of common features (the "clock" for bracelet and dripping tap example) because they must share features with the prototypical referent but do not have to share the same common features as each other.
Prototype theory can also explain the finding that, when young children underextend words, it is usually the more peripheral referents which are excluded from the extension of the word and not the more typical referents (Kay and Anglin, 1982).

Prototype theory is popular at the moment, but there is a general lack of consensus about what a prototype actually consists of, and also a number of other areas in child language acquisition that prototype theory does not explain (or even address) such as context-bound words (see Barrett, forthcoming).
4.5.2 Acquisition of relational terms

Children's understanding of relational terms is of special interest for developmental psychologists, because they are frequently used in tests of cognitive development. In these tests, the major concern is often not whether the children understand the language used, but whether they understand the properties of the objects and situations which are the topic of conversation. The possibility that there is a linguistic barrier to understanding as well as a conceptual one operating in these tests was one which Donaldson and Wales (1970) set out to explore by carrying out a series of experiments on nursery children's understanding of terms such as MORE/LESS, SAME/DIFFERENT and dimensional adjectives.

a) Dimensional adjectives

The study conducted by Donaldson and Wales (1970) comprised a comprehension test and a production test designed to compare the comparative and superlative forms of the opposite pairs BIG/SMALL, LONG/SHORT, HIGH/LOW, and FAT/THIN. In the comprehension test, children were shown four objects and asked to show the experimenter the biggest one, for example, or one which was bigger than the one the experimenter identified. In general, the children were more accurate with the positive adjective from each pair than with the negative one (see the discussion on
markedness below) and this effect was more obvious with the superlative items than with the comparative ones. In the light of later studies, one of the most interesting results from the production test was the fact that although there was a general improvement in the appropriate use of the terms, there was an indication that in the six months between the initial and later testing of the same children, some of them had specialised their use of BIG in the sense that they no longer used it as a general, multi-dimensional adjective, but restricted its use to comparison along a single dimension.

With reference to the first main finding, why should positive dimensional adjectives appear to be acquired before their negative counterparts? Eve Clark (1973b), following work by Herbert Clark (1970) on marked and unmarked terms, offered an account along the following lines.

Marked/Unmarked
-------------

For each pair of adjectives, the positive member is unmarked according to a number of criteria (for an extensive discussion of markedness see Lyons, 1977: 305ff). As well as being used in explicit or implicit comparison

eg "John is taller than Glyn"
"John is tall"
the positive adjective also has a non-comparative use, when it can be seen as simply identifying the relevant dimension. Thus we find phrases such as

"6 feet tall"
"5 miles wide"

but not normally phrases such as

"6 feet short" (or even "5 feet 8 short"); or
"5 miles narrow"

The non-comparative or neutral interpretation can be viewed as including one less feature than the comparative or contrastive one, and so H Clark (1970), subscribing to the psycholinguistic theory that psychological complexity directly reflects linguistic complexity, proposed that in language development, children would acquire unmarked (positive) terms before the corresponding marked (negative) ones (see also the discussion by Bartlett, 1976 on this topic).

Also, when the marked terms did appear, Clark proposed that their meaning would often be absorbed into that of the unmarked term (see examples of this under MORE/LESS).

Later studies have confirmed the polarity effect, whereby the positive term is associated with a higher level of
accuracy than its negative counterpart (e.g., Eilers, Oller and Ellington, 1974; Brewer and Stone, 1975).

Another study by Klatsky, Clark and Macken (1973) investigated the basis for the polarity effect. They argued that the superiority of the positive term could be either the result of the children's encountering it more frequently in adult speech, or the result of a difference in conceptual complexity between the positive and negative ends of dimensions. To decide between these explanations they took a group of four year olds and taught them nonsense words for the positive and negative ends of the dimensions of size, height, length and thickness. They found that the children had greater difficulty in learning the nonsense words for the negative pole than those for the positive pole, and concluded that there was a conceptual basis to the children's difficulty with negative dimensional adjectives and not just a problem of less frequent exposure to them in adult speech.

BIG and SMALL appeared to be handled more accurately than the other terms by three year old children (Eilers, Oller and Ellington, 1974) which was consistent with Clark's (1972) finding that if four year olds are asked for the opposite of a dimensional adjective, they are likely to substitute either BIG or SMALL for a more specific adjective of the appropriate polarity. However, it could be argued that the children may have been confusing BIG
with the more specific term rather than using the more
general term to mask their lack of knowledge of the more
specific one.

Even the general terms are not always easy to use
correctly eg my son Glyn aged 2;7 who, when asked "Would
you like a little more?" replied "I'd like a BIG more!"

The semantic feature hypothesis applied to dimensional
adjectives did not really make any predictions about the
appearance of forms in the lexicon, but only about the
order of development of understanding these forms.

Some of the findings from studies on relational terms have
been difficult to accommodate within the semantic feature
hypothesis, but Carey (1978) made proposals which differed
from the semantic feature hypothesis in two main respects.

Firstly, the child acquires semantic information about
polarity before he or she acquires information about
dimensionality. One source of evidence for this is
provided by Brewer and Stone (1975) which shows that,
given the array in Figure 18 which follows and asked to
choose the shortest one, children's errors respect
polarity but not dimensionality, ie the erring child will
make the error of choosing D rather than the error of
choosing A.
Other tests involved an array where the spatial properties were questioned using inappropriate dimensional adjectives (e.g., FAT and its related forms FATTER and FATTEST when items in the array differed only in terms of height). Responses appeared to indicate that children use polarity information in the inappropriate adjectives.

Carey’s position is consistent with Clark in that the learner first acquires the dimensionally undifferentiated adjectives BIG and LITTLE, providing what Carey terms a "core comparative structure". Because the differentiated adjectives are syntactically similar to BIG and LITTLE it is suggested that this core comparative structure is overgeneralised to these adjectives before the appropriate dimensionality features are acquired, leading to a situation where BIG is synonymous with TALL, WIDE, FAT etc and SMALL is synonymous with SHORT, NARROW, THIN etc, resulting in the sort of error described.
b) MORE and LESS

One of the most common words children use in very early language development is MORE, frequently requesting extra food or drink (eg "more milk") or the repetition of a pleasurable activity (eg "more swing"). Such examples are often related to the adult lexical form "another" (eg "another drink"/"another push on the swing"). The child’s use of "more" may even be used in contexts where it is equivalent to "the other" eg my son Gareth searching for the missing bits of a puzzle ("where more gone?" ie "where are the other pieces?"). From these examples, it is clear that the meaning of the word MORE still has a long development ahead of it, even if it has appeared early on in speech.

In contrast, LESS appears late in children’s speech and may even have a restricted use in the speech addressed to children. It has been suggested that children’s early encounters with this term may be in utterances such as "give him less" where some quantity is being offered and the comparison is unspecified (Elliot, 1981: 131).

Donaldson and Balfour (1968) devised eight types of settings in which their children (aged 3;5 to 4;1) could be asked for judgments involving MORE and LESS or asked to
carry out instructions involving the same terms. All made reference to two cardboard apple trees, each of which had six hooks on which a number of cardboard apples could be hung. The children were asked to make static comparisons of the two trees, to imagine and carry out transformations of the number of apples on the trees and, in a follow-up study six months later, to change the number on a single tree in accordance with a specific instruction. The overall result was that the children did not discriminate between items which involved MORE and those which involved LESS, and in general their responses were those appropriate for the MORE items. Only one child was consistently correct on the LESS items.

These results lend support to Eve Clark’s theory if they are interpreted as indicating that nursery children understand MORE and interpret LESS to mean MORE. Clark’s claims can be represented by the following three stages:

1. more [+ AMOUNT]
   less [+ AMOUNT]

2. more [+ AMOUNT]
   [+ POLARITY]
   less [+ AMOUNT]
   [+ POLARITY]

3. more [+ AMOUNT]
   [+ POLARITY]
   less [+ AMOUNT]
   [- POLARITY]
There is, however, a problem concerning the non-comparative use of MORE in the first stage (Clark describes MORE and LESS as being used only in the nominal non-comparative sense to begin with). Whilst it is possible to argue a (weak) case for MORE being unmarked relative to LESS on the basis of its relatedness to MUCH (versus LITTLE), it is not the case that MORE, unlike the unmarked dimensional adjectives, has the specialised task of naming a dimension. This calls into question whether there is indeed a coherent notion of markedness.

It is also difficult to relate the non-comparative usage in the comprehension of nursery school children in Donaldson and Balfour's study (where MORE and LESS seemed to be interpreted as SOME under some conditions) to Clark's theory where this usage is presented as taking place near the beginning of lexical development which would normally be taken as pre-nursery.

It is possible to conclude that the semantic feature hypothesis suffers from important defects when applied to the acquisition of MORE and LESS (as it does for the dimensional adjectives).

Other research has also investigated the topics of MORE and LESS and found that children certainly do have difficulty with the comprehension of LESS, but they do not
necessarily give it a consistently wrong interpretation. Palermo (1973) replicated the Donaldson and Balfour study and found that even some seven year olds were still performing well below chance on LESS items. Palermo (1974) compared the ability of three and four year olds to judge "Which has less?" when applied to apple trees, beakers of water and linear arrays, and found that on all these tasks there were some four year olds and even more three year olds who made systematic errors on the question. These children stuck to their erroneous interpretation of LESS even in the face of a strong inducement (sweets) to bias their choice in the correct direction.

Townsend (1974) extended the investigation to questions in which an explicit standard was mentioned (eg "Who has more apples than Carl?"). He found that three to five year olds did well on MORE instructions but performed only at chance on LESS items.

Carey (1978) included a condition in which the comparative adjective was replaced by a nonsense word and found that the response patterns for LESS items and nonsense items were similar. Since it is not likely that one would wish to argue that the children had a semantic reading available for the nonsense word, this experiment points out the danger of concluding from these results anything
about the meaning of LESS for the children other than the fact that it appears to cause them considerable difficulty.

One source of difficulty was explored by Pike and Olson (1977) who deduced from their results that some children quite simply seem to see an arrangement in terms of which has the greater quantity (and then have to reinterpret the arrangement to judge a statement which uses the word LESS).

Trehub and Abramovitch (1978) also showed that when nursery children were asked to point to one of two piles of objects they had a strong tendency to point to the pile with the greater number of objects, even when the instruction contained no reference to MORE or LESS.

Children do sometimes have surprising difficulty in judging which arrangement has more items in it. Four year old children, in particular, frequently use length as a criterion of quantity (Siegel, 1977) to the exclusion of considerations of density, so that they will judge that a row of three counters spread out is bigger than a row where five counters are placed close together (see following figure).
There is some indication (Bever, Mehler and Epstein, 1968) that younger children are less susceptible to this illusion and Weiner (1974) has reported that three year old children can perform above chance both on MORE and on LESS judgments of quantity, applied to rows of objects.

We can conclude then that nursery children’s judgments of relative numerosity are unreliable and that proper application of MORE and LESS* is still developing.

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Footnote

* Throughout this section we have seen studies looking at MORE and LESS, yet no reference to FEWER. I have always understood that plurals do not take LESS (eg LESS manpower but FEWER men - see Fowler’s Modern English Usage) and can only conclude that one should ask "which tree has FEWER apples" rather than "which tree has LESS apples" (although no doubt this would complicate matters even further!)
Various studies have asked children to select an object which is the same as or different from one indicated by the experimenter. These studies are not tracing the development of descriptions of quantity, but are frequently discussed along with such studies largely because the initial results were similar to the systematic confusion found for MORE and LESS. Donaldson and Wales (1970) found that their children were as likely to choose a maximally similar object to the standard whether the instruction asked for one that was "the same in some way" or one that was "different in some way".

As in the case of MORE and LESS, much of the subsequent discussion has centred on whether the two terms are indistinguishable for the young child and also on what the positive term (SAME) means for the children. I do not intend to review all the literature in this area, but would like to make a number of observations and draw on other related studies.

With SAME and DIFFERENT, it becomes particularly clear how difficult it is to separate information about semantic development from considerations of the development of cognitive skills, such as estimations of quantity; from
social skills, such as assessing the reasons behind the experimenter's questions; and from other features of language use, such as the use of determiners and anaphoric reference (referring back to something previously expressed).

As a test of the relation between cognitive and linguistic development, Sinclair (1967) took a group of "conservers" as defined by Piaget's standard tests showing the ability to conserve (see section 1.2.1) and asked them to describe pairs of objects such as two pencils of different lengths. She found that most of the non-conservers used absolute adjectives in their descriptions ("This pencil's long and this one's short") while over 70% of the conservers compared the lengths. Similarly, if the objects varied on two dimensions, such as length and width, the conservers tended to coordinate the dimensions in their descriptions ("This pencil's longer but thinner than that one"), while the non-conservers treated each dimension separately. This difference in language use between the groups shows that an important factor in conservation may be the ability to attend to features of the visual array in a particular way. Sinclair then demonstrated that training the non-conserving children to describe the objects comparatively, and by co-ordinating the dimensions, did not help them to conserve when they were tested later.

It is evident that cognitive, linguistic and interactional
factors are too closely entwined in these tests to make it useful to try and see language as dependent on cognition or the reverse.

Experiments by Donaldson (1978) tested children's understanding of the meaning of ALL and EVERY. It should be noted that even the youngest children in the experiments (aged three) had some understanding of the meaning of the quantifiers ALL and EVERY. For example, faced with an array of toy garages with doors that open, three year olds were generally accurate in verifying whether a statement such as "all the garage doors are open" is correct or not. However, children were frequently wrong in verifying the accuracy of statements in sentences that involved a quantifier and more than a single set of entities - for example, a set of garages and a set of cars.

Donaldson found that children appear to focus on one of the sets of entities and evaluate the truth of a statement with a quantifier with respect to whether a particular quantifier relationship holds for that set. Children were asked to evaluate the correctness of the following sentences:

1. All the cars are in the garages
2. All the garages have cars in them
when faced with one of either of two situations: a row of four garages, three of which contained cars; or a row of four garages, each of which contained a car plus an additional car (not in a garage) at the end of the row. For adults, (1) is true in the first of the two situations and false in the second, and (2) is false in the first situation and true in the second. Many children said, however, that both sentences were false in the situation where there is a row of four garages, three of which contained cars, and that both sentences were true in the situation where there are four garages and five cars. Thus the children respond consistently as if they were responding to the question "Does every garage have a car in it?"

The basic pattern of results just described has been found in a number of studies and appears to be grounded partly in perceptual and partly in linguistic factors. In the example just described, perceptual properties (the greater salience of the garages than of the cars) may account for the fact that children consistently responded as if they were answering the question "Does every garage have a car in it?" rather than "Is every car in a garage?" which would produce the opposite of the responses observed. Further studies by Philip and Takahashi (1990) looked at the quantifier EVERY (rather than ALL) and also found a pattern of responses suggesting that children have their own interpretation of the test questions.
This provides another example of the problems encountered with empirical work and suggests that caution must be used when assessing the results of any test with children.

d) BEFORE and AFTER

We saw in the previous section describing the semantic feature hypothesis that the temporal preposition BEFORE (positive feature) would be mastered earlier than AFTER. Eve Clark’s work on the comprehension of BEFORE and AFTER provides a good example of the interplay of the acquisition of semantic features and non-linguistic strategies. She describes four stages in this development:

I Whilst understanding that BEFORE and AFTER involve the ordering of events in time, the child formulates his/her actions on the basis of an order-of-mention strategy: whatever is mentioned first happens first (note that we could also get stage I behaviour if the temporal conjunctions were missed out/replaced - see Carey, 1978 for discussion).

IIa The child understands utterances containing BEFORE, but AFTER continues to be at stage I.

IIb AFTER is more fully specified but incorrectly, so that the child interprets it as if it had the meaning
of BEFORE. Thus the child is now consistently correct on BEFORE utterances and consistently incorrect on AFTER utterances.

III The child is able to distinguish BEFORE from AFTER and consistently responds correctly in the tests.

In trying to provide an explanation as to how the feature value [+/- PRIOR] is involved in the acquisition of BEFORE and AFTER, leading to the transition from Stage IIb to III above, H Clark (1973) proposed that the system of prepositions, conjunctions etc encoding temporal concepts in English is based on the following spatial metaphors:

BEFORE (temporal) = BEFORE (spatial) = IN FRONT (spatial)
AFTER (temporal) = AFTER (spatial) = BEHIND (spatial)

Clark argued that the child’s concept of the space in front of him/her develops more quickly and is more elaborate than the child’s concept of the space behind him/her. In addition, the space in front of the child can be viewed as positive, when compared to the space behind him, thus establishing links between the pair BEFORE/AFTER (positive and negative) and pairs of words discussed earlier in this section.

According to H Clark, FRONT is therefore seen as positive and unmarked (referring to the visually perceptible end of
a dimension) whereas BACK is negative and marked, as it reflects the negative end (the obscured, far side). This means that IN FRONT should be learned first, since it is the unmarked term, and BEHIND later - something which is in direct contrast with the findings in my study. However, other studies also have findings that contradict the idea that IN FRONT is the unmarked term which is learned first and these will be discussed in the following section (4.6). Note that unmarked and learned first are taken as definitionally linked here. This is one way to view markedness, but it is not the only one (it is not appropriate here, however, to survey the whole complex area of other ways of looking at markedness).
Determining the exact nature of the concepts of BEHIND and IN FRONT is no easy task, as contemporary linguists and psycholinguists have discovered (Bierwisch, 1967; H Clark, 1973; Cohen Levine and Carey, 1982). At least part of the problem is the complex nature of the concepts themselves. What is the principle which allows us to know what the fronts of various objects are? H Clark (1973) pointed out that the front of an object is usually the side that is prominent in some way, but this is only true for one type of front, namely featured (or intrinsic) fronts such as those found with a house, horse or television. The front of an object with an intrinsic front does not change from day to day, nor does it change from situation to situation. BACK (or BEHIND) is generally defined most easily as the part of the object opposite to the front; and though both FRONT and BACK are each sides, the term THE SIDE refers to those sides which are neither front nor back.

With non-featured items, another locational system is defined not by the intrinsic characteristics of the object but by the speaker’s own spatial relation to the object.

The complexity of this situation did not escape Alice in Lewis Carroll’s "Alice in Wonderland" (first published in
1865), when told that one side of a large mushroom will make her grow taller and the other side will make her grow shorter:

"Alice remained looking thoughtfully at the mushroom for a minute, trying to make out which were the two sides of it; and as it was perfectly round, she found this a very difficult question." (Carroll, 1994: 60)

Kuczaj and Maratsos (1975) devised a variety of tasks to explore the concepts of BACK and FRONT: children placing objects in relation to themselves; touching the front or back of certain featured objects (eg hippo, spoon); placements with featured and non-featured objects (eg beads, cube) and a "generalization task" where boxes represented a gumdrop machine (gadgets on sides/top) and a spaceship (gadgets inside) and the child was asked to touch the front/back of the machine involved after a short directed play.

Kuczaj and Maratsos found that children appear to acquire the notion that FRONT and BACK are opposites before they have a general understanding of either term (although if FRONT/BACK is a linguistic opposition, it is not at all clear what it would mean for one term to be acquired without the other; from a Saussurean/Jakobsonian structuralist perspective, the position would be
impossible). Children in the study were then seen to simultaneously acquire both terms correctly (there was a slight but non-significant tendency for children to understand IN BACK OF more accurately than IN FRONT OF), with the term SIDE being acquired well after FRONT and BACK. Correct use of FRONT and BACK began with reference to the self and spread to objects with fronts (in line with results obtained by Hall, 1975). H Clark (1973) maintained that it is from knowing what is the front that one can work out the back. Thus Kuczaj and Maratsos’ findings are not in line with H Clark’s predictions (1973) that FRONT is acquired earlier. Locative comprehension data reported by E Clark (1977) also revealed no significant difference in difficulty between the two forms.

Other writers, including Johnston and Slobin (1979) have argued that acquisition of BEHIND should precede IN FRONT because of the greater communicative and cognitive salience of IN BACK OF (the Italian, Serbo-Croatian and Turkish data confirmed this, although the English data did not for featured objects). Adults and children use BEHIND (or BACK OF) more frequently than IN FRONT (Wells, 1975) and this may well be because there is more need to tell someone that an object is behind and perhaps hidden by another than there is to say that an object is in front of another and in full view (see also Appendix 1 suggesting that the real life situations are reflected in children’s
books). If an object is in front of something else and one person asks where it is, the other person may reasonably look and point and say "There". It is not necessary to relate the object to another in the environment. On the other hand, if the object is behind another and cannot efficiently be indicated by gesture, it will be more informative if it is related to another landmark by linguistic means - "It's behind x". Thus, the child learns that BEHIND generally relates one object to another, but he or she may not realise that IN FRONT OF can also serve a similar function. It is not until the age of about six years, according to data from Cox (1979, 1981a and c) that the locative meanings of both IN FRONT OF or BEHIND are mastered.

In the study done in Britain by Cox (1979) with children aged 2;2 to 8;10, children's comprehension of IN FRONT and BEHIND was examined. Children were asked to place a ball either BEHIND or IN FRONT OF another ball. The finding that the BEHIND instruction is understood earlier than the IN FRONT OF one also contradicts H Clark's hypothesis. Cox suggests that H Clark's assignment of the labels "positive" and "negative" to the prepositions is incorrect. Whereas FRONT (positive) and BACK (negative) refer to opposite sides of the mid-point (the person) of the horizontal-frontal dimension, Cox points out that the action of putting one object IN FRONT OF or BEHIND another
takes place at the positive end of the dimension, i.e., IN FRONT OF the subject. Perhaps the object which is placed BEHIND the other and therefore further towards the positive end of the dimension is conceptually easier (Cox, 1979: 374).

Cox also had some interesting data on the confusion between BEHIND and IN FRONT. Responses were classified as correct, opposite or other. Whereas the youngest children made a variety of placements, older children mostly made a correct or opposite placement. There was a distinct difference between placements though: most four-year-olds who were asked to put their ball BEHIND placed it correctly; of those asked to put it IN FRONT, however, nearly as many placed the ball on the far side as placed it correctly. Again these results tie in very well with those from my own study: not only is there agreement about understanding BEHIND before IN FRONT (it appears to be acquired earlier), but this manifests itself in a similar way (BEHIND is substituted for IN FRONT). To some extent this may be natural, since it suggests that children are at least restricted to the same dimension, even if the opposite term is understood. On the other hand, there is little evidence of other opposite locational terms being confused.

In a study by Cox and Ryder Richardson (1985) with children aged three to ten years, descriptions of the
spatial relationship between two objects were examined. The youngest children often just gave deictic responses, the five year olds began to use spatial terms such as AT THE FRONT/BACK or environmental landmarks (eg "the red ball is towards the window"). By age six, spatial terms predominated, and adult groups were found to use spatial terms exclusively. BEHIND, as opposed to AT THE BACK, was also found to be particularly an adult term.

Susan Cohen Levine and Susan Carey (1982) set out to test the prediction that the words for BACK and FRONT would precede the concept (a sort of Sapir/Whorf position in development). Their study consisted of two non-linguistic tasks (orienting toys) and one comprehension task. The results of their study actually confirmed the opposite of that predicted in that a complex disjunctive concept of "front-back" orientation was found to precede any knowledge of the words FRONT and BACK. The non-linguistic tasks were 1) to line up various featured toys (doll, horse, car, house etc) in a parade and 2) to place each of the toys where it could talk to a doll held by the experimenter (the canonical encounter task). In the linguistic (comprehension) task the child's knowledge of the words FRONT and BACK was assessed by asking the child to point to fronts and backs of featured toy objects from various categories (human, animal, vehicle, inanimate).
Like the results from my study, Cohen Levine and Carey found that BEHIND was acquired before IN FRONT and that there were errors where BEHIND was interpreted for IN FRONT on the comprehension task. One other interesting feature from this study was when children were asked to point to either the FRONT or BACK of objects and many pointed just to the back. (This was also the case with my twins when, aged 1;8 and asked to point to their back/front, they were only able to point to their back and either made no response for the "front" request or pointed instead to their back.) In case this phenomenon might be a behavioural preference (and children would point to the back of something regardless of what was said), Cohen Levine and Carey asked the children in their study to point to the object’s "wug". In response to this, the children either indicated its TOP or looked puzzled and did nothing.

Another relevant study looking at the locatives BEHIND and IN FRONT is that done by Judith Johnston (1984). Like my investigation, hers was based on the earlier work done by herself and Dan Slobin (1979). This time she used more natural elicitation procedures by using puppets (rather than employing isolated where-questions as used in the Johnston and Slobin tests). The puppet story procedures appeared to be more effective in eliciting target locatives and an early use of BEHIND and IN FRONT with large reference objects was explored. Thirty-three
children aged 2;7 to 4;7 told puppets where to look for missing objects and the results indicated an order of acquisition for (American) English "consistent with prior reports" (Johnston, 1984: 407). However, there were some interesting findings through manipulating features of the reference objects. For example, the relative size of the reference objects was varied and included:

- non-featured and taller (T) than the located object (e.g., a can, tree)
- non-featured and virtually flat (N) (e.g., bracelet, plate)
- ordinary featured (F) (e.g., doll, truck)

The order of difficulty produced by the data was:
ON < IN < UNDER < NEXT TO < BACK(T) < BACK(F) < FRONT(F)
< BACK(N) < FRONT(T) < FRONT(N).

The children's responses to these items suggested a new parameter of meaning in the early uses of BEHIND and IN FRONT. Prior research (E Clark 1977, Johnston & Slobin 1979, Kuczaj & Maratsos 1975) had established that children use or understand BEHIND and IN FRONT for featured reference objects before non-featured ones. The new data suggested that the developmental picture is more complex by identifying an early use of BEHIND which is not bound to any feature of the reference object, but to the invisibility and inaccessibility of the located object.
To my mind it is logical that there may be factors other than the nature of the reference object which could affect the responses made by children and this is another reason why experimental results should be viewed with caution (see section 5.1). The following stages for the acquisition of BEHIND and IN FRONT are speculated by Johnston:

a) A child begins by speaking of things BEHIND or IN FRONT of his/her own body. The meaning focus seems to be on "inaccessible" and/or "hidden" compared with "visible".

b) The child recognises the relationship of spatial proximity implicit in the self-reference contexts in a) above and adds this notion to previous meanings. This enables him/her to use BEHIND for relationships to reference objects other than self ie the BACK(T) configurations which are larger/taller than the located object. The meaning of BEHIND here may be glossed as "next-to-and-made-inaccessible/invisible-by". Temporary uses of IN FRONT to mean "next-to-and-visible" also occur.

c) The child recognises the relationship of object-part previously implicit in self-reference contexts in a). This enriched understanding plus the proximity notion from b) leads to new uses of BEHIND and IN FRONT with
featured objects in the BACK(F) and FRONT(F) configurations. Meanings here may be glossed as "next-to-the back/front of".

d) The child recognises the relationship of order previously implicit with the larger objects in b). Re-analysis leads to new uses of BEHIND in the non-featured/flat configurations and then to analogous extensions for non-featured IN FRONT glossed as "first/second-in-the-line-of-sight".

Although this picture is consistent with the locative data to date, it is not yet complete, since it does not cover, for example, when and how the child differentiates between the meanings of UNDER and BEHIND (an error common to both Johnston's and my own research). It does appear, however, to make a useful contribution to the explanation of why BEHIND is so often acquired before IN FRONT and also emphasises the importance of the type of reference object, a subject which will be considered in the next chapter.
There are a number of issues arising from the results of my research which will be covered in this chapter. I shall first consider the change in position of BEHIND and IN FRONT (both featured and non-featured forms) compared with the predicted order. The most likely explanation for this earlier acquisition of BEHIND and IN FRONT seems to be that my results reflect a simpler testing method (as child, tester and featured objects were all aligned — see discussion in chapter 4). This raises even more important issues, namely the influence of testing methods and materials on the results of experiments and, as a consequence of this, how reliable and comparable experimental data are. I shall examine these concerns in section 5.1, before looking at possibilities for further research in section 5.2.

Another issue which has been discussed during the course of this thesis has been the definition of acquisition and how to measure it (see, for example, sections 3.2, 4.2.1 and 4.2.5). Whilst implicational scaling (the Guttman analysis) may be the best statistical procedure to apply to studies on the acquisition of locative expressions, it should not be forgotten that this produces an order of difficulty which is then equated to one of acquisition. If acquisition and difficulty are definitively linked then
there may be no problem, but one should still be careful to ensure that the testing method does not include anything which might make producing or understanding a target preposition harder and thus affect the results (see 5.1.c below).

5.1 Importance of testing materials

My research study was designed to be as simple as possible and to minimise any extraneous task demands. This was particularly the case for the prepositional expressions BEHIND and IN FRONT where I ensured that the featured items were facing both myself (the experimenter) and the child at all times, except for the additional test items in game 3 to look at side facing featured items. The increase in difficulty experienced by the children with these additional, more complicated, items provided a strong indication that the nature of the test can affect the results. Insofar as my tests were successful in minimising task demands, their results may be more indicative of the nature of the locative expressions than those of other studies. What has become increasingly clear, however, is that all experimental data should be treated with caution.

We have seen many examples of the influence of testing materials/method throughout this thesis, and it may be
useful here to recall some of them:

a) Nature of reference object

When looking at the acquisition of BEHIND and IN FRONT we saw that a key role is played by the reference object and whether it is featured or not. Johnston and Slobin (1979) predicted that BEHIND/IN FRONT with featured objects (such as houses and dolls) would be mastered before non-featured ones (such as drinking glasses and tins) and this seems to be confirmed by the results from my study. Johnston’s (1984) study also introduces additional categories of "non-featured and taller" and "non-featured and virtually flat" reference objects. All this information undoubtedly helps us assess how children relate to reference objects when acquiring locative prepositions, but it does stress the importance of testing materials and orientation and also raises the question of classification - when, for example, does a tall reference object become one of normal height?

b) Nature of object to be located

There is an interaction between the nature of the object to be located and that of the reference object, i.e. if the object to be located is small, the reference object is relatively larger, and vice versa. This is important in connection with Johnston’s (1984) proposals on the
development of BEHIND and IN FRONT along the lines of "inaccessible/made invisible by" and "visible". We also saw in Bavin's (1991) study that the orientation of the items to be located could influence the child's selection, e.g. with an array of four small dogs facing the child and a featured reference object (cow) facing away, there was some confusion as to which dog was "at the back of the cow". This brings us to the topic of deictic and non-deictic uses of locative expressions (see Figure 10 in chapter 1) and the whole question of children being able to take account of different points of view.

Another example of the importance of the object to be located was seen in Cox's work (1981b) where she found that placing a man behind a wall was enough to elicit partial occlusions whereas placing a ball behind a ball was not (see section 1.2.2). Even calling something a wall rather than a block made a difference, and these contextualised tasks seemed to be particularly important for the younger children (four-year-olds) in drawing tasks.

Further work by Cox (1985a) looking specifically at task materials has shown that the more similar the two objects in a scene, the less likely the children are to use partial occlusions; instead they tend to separate the two
objects when drawing them. Cox suggests that it is asymmetry between the objects in the scene which leads the older children particularly to use partial occlusion whereas similarity leads them to separate the objects. There is still no clear explanation for why this is.

c) An extra dimension

When considering the significance of a low Guttman coefficient of reproducibility, the possibility of an extra dimension was raised (section 4.2.3). The point was made that if any part of the test involved something different (e.g., an extra skill like reading in a mathematical test) then this could have an effect on the test results. With many tests, such a big difference may not be apparent, but there might still be subtle differences in the tasks involved.

I have wondered whether the poor performance of UNDER in the comprehension test of my study (game 2) was linked in any way to an extra task demand - perhaps the test materials did not allow the key to be "hidden" enough for the younger participants (although the picture of a ball clearly visible "UNDER the table" in game 3 did not prove to be a problem). Another, more likely, explanation may be the physical co-ordination needed to place the toy key UNDER the plastic box in game 2 compared with the other tasks of placing the key straight down on something:
either ON the box itself or on the chair surface (BEHIND/IN FRONT/NEXT TO to the box). The configuration IN the box, whilst also requiring physical co-ordination, may be more familiar to children because of experience with "posting" games and, as we saw in chapter 2, this is the first choice non-linguistic strategy adopted by young children (E Clark, 1973a).

It is also possible that, as a whole, the task demands for testing production in game 3 (the card game) were slightly harder than those for game 1 (the hide-and-seek game with real objects) because the children were looking at pictures (two-dimensional) representing three-dimensional things (see section 3.4.3 commenting on the more abstract and sophisticated nature of the card game). This might contribute to the fact that all but two of the Guttman scores were slightly lower in game 3 than for game 1 (see section 4.2.8).

Another example of an extra dimension was seen in section 1.2.3 on conversational role taking and deixis, where the terms HERE and THERE were considered. Charney (1979) claimed that the results from her tests differed from previous ones because her instructions were simpler, eg "which one is over here/there" rather than asking the child to "make the dog over here/there turn round" or "make the horse over here/there jump up and down", which required the child to work out not only which object
should be selected but also what action should be performed. If the child has a limited processing capacity, he or she may use most of it on deciding which action to perform and may then fall back on a near-self location for the other part of the task. This could explain why most of the youngest children in Clark and Sengul’s (1978) study (average age 3;3) did not contrast the terms HERE and THERE but picked up the animal on their own side of the table regardless of the instruction and speaker position.

d) Child’s interpretation

We considered the problem of experimenters simply failing to get the message across to children when asking them to draw what they see (section 1.2.2). I also mentioned what could be termed a "trying to please" factor where children may want to draw what they think is wanted. In the examples considered earlier relating to the child’s point of view as an artist (section 1.2.2), what the experimenters really wanted was for the child to draw exactly how each object appeared, e.g., one ball partially occluding another or a picture of a cup with the handle facing away. The child may interpret this as being asked to draw two balls or a picture of a cup.

In section 4.5.2, when considering Donaldson’s work (1978)
on children’s understanding of the meaning of ALL with more than one set of entities (e.g., cars and garages), we saw that children consistently responded as if they had been asked the question "Does every garage have a car in it" i.e., they made their own interpretation of the question.

This preference for an alternative interpretation of the question was also apparent in studies by Philip and Takahashi (1990) who were looking at the quantifier EVERY. They used picture cued question response tasks and found, for example, that a question such as "Is every pig eating an apple?" elicited a relatively high number of incorrect ("no") responses, as did the question "Is a pig eating every apple?" when applied to a picture of three pigs and two alligators, each of which was eating an apple. The children appeared to be interpreting both questions along the lines of "Is it always the case that a pig is eating an apple?"

The child’s understanding of the task demands is therefore important if the results are to be assessed correctly.

Another example of the danger of misinterpreting results by drawing the wrong conclusions was shown earlier (section 4.5.2) when Carey (1978) replaced the word LESS with a nonsense word and found that the response patterns were similar.
e) Children's perspective

A child's way of viewing things is a subject which has cropped up regularly throughout this thesis, and in many ways it ties in with the foregoing paragraphs on the child's interpretation of the test demands. The evidence from my study showed that the youngest children (aged two to three) often had a very different interpretation of the picture in game 3 and saw the lion standing ON TOP of the crocodile rather than BEHIND, as had been expected.

This difference in perspective may also be evident in other areas (see section 4.4.5). For example, in game 1 the ball was hidden UNDER the blanket, yet was sometimes described as being IN (perhaps because the ball was in contact with the blanket which suggested a sense of enclosure?)

The card of the tractor and tree in game 3 to test the locative expression BESIDE/NEXT TO may also be another example of how the choice of test materials may affect the results (see section 4.2.3), and indeed it would be very interesting to conduct further research to look more closely at the whole area of the influence of design method and materials on experimental results.

What can we conclude then from looking at the importance
of test materials? Certainly that test design is not something to be taken lightly, and that if we are interested in linguistic capacities, maybe we should attempt to minimise extralinguistic task demands as much as is possible. We should also remember that any data must be treated with caution.

Given all these problems with empirical testing, particularly the vulnerability of experimental data, should we continue to carry out experimental research at all, and what alternatives are there? Diary studies, mainly carried out by the linguist or psychologist parent, were the first studies on language acquisition and they began to appear over a hundred years ago (see Ingram, 1989 for a full discussion of both methods and theoretical orientation in the field of child language acquisition). After the first world war, the emerging form of psychology which became known as "behaviourism" led to establishing norms through the observation of large numbers of children and, from the late 1950s, a third method used in collecting data on language acquisition became popular (longitudinal language sampling), whereby a child is visited at predetermined intervals for a reasonable length of time with the purpose of collecting a representative sample (eg Brown’s 1973 study of Adam, Eve and Sarah). I doubt if diary studies or longitudinal studies of children could prove any less prone to the criticism we have
examined in relation to the influence of materials in testing, as there is still the influencing factor of context affecting the child's perceptions and responses (if anything, this would be harder to observe and control outside experimental conditions).

So, what do experimental studies tell us about the nature of the mental representation of linguistic objects and are they worth carrying out? Empirical studies can provide insights into how children go about learning linguistic forms, as we have seen in this thesis, and they can also be useful in helping to cut down the number of variables under consideration. They can be used to test out certain models and the tests can be repeated to see if the results can be repeated (or to see if there is any change over time with the same subjects). Perhaps we should conclude that experimental data are important because they can give us information about a specific area, but that we should be aware that they can be easily influenced and consequently should be treated with caution. From this, we should deduce that it is also difficult to compare results from different experiments without looking carefully at the methodology involved.
5.2 Scope for further research

As mentioned earlier in section 4.1, there is a mass of data available from my study, and many opportunities for further analysis, some of which are listed below:

a) a comparison of performance in the three games by children individually (for example, did a child make the same mistakes in each game?)

b) an examination of the child’s position in his or her family - do single children perform better because they have more individual attention? It was interesting to note that the two children who did not co-operate very well were both boys aged 3;2 with a young baby sibling (from different play sessions).

c) a more detailed analysis of how children coped with the incongruous items in the third game.

d) a full analysis of all substitutions.

There are also opportunities for new research to look at some of the interesting areas in more detail, for example:

e) further investigation into the area of perspective, raised by the children’s interpretation of the lion standing on the crocodile.

f) a more detailed examination of the comprehension of
locative expressions, perhaps with younger children to obtain a greater range of results.

g) a more thorough investigation of children's understanding of OUT OF and OFF, perhaps in combination with a more extensive selection task.

h) a detailed, structured examination of BEHIND and IN FRONT using a variety of test situations (both simple and complex).

Another issue which has been discussed in this thesis is the question of when exactly a locative should be considered acquired. For example, BEHIND may appear correctly early on, yet it is also used in substitutions and overextensions in other situations. If a child frequently extends a locative to inappropriate contexts, it can be argued that he or she does not really know the meaning of that locative at all. But what if the overextension is only occasional and does not overshadow correct usage? Is it because the child knows that he or she is using it incorrectly but has not yet mastered the appropriate expressive means? The whole area of overextensions, uncertainty and the definition of acquisition would also be an interesting one to explore in more detail.

There are also semantic issues which would be looked at in more detail: if something is "at the back of the
wardrobe" it would probably be in a different position from "behind the wardrobe". An interesting supplementary study would be to test British children (and adults) on placements AT THE BACK OF as well as BEHIND with laterally-placed featured objects for instance.

Another area for further research which suggests itself is the whole area of concepts versus linguistic manifestation. What evidence could be found for the child having the appropriate concept in circumstances where he or she does not use the appropriate locative expression? This might lend support to the idea of Johnston and Slobin's (1979) "waiting room", which in itself presents an appealingly neat way of looking at the whole question of the acquisition of locative notions.

Last, but by no means least, I think one of the main issues arising from my research which could usefully be studied in more detail has been the importance of testing materials, as we saw in the foregoing section. This is something, however, which applies not just to locative expressions, but is also relevant to other empirical studies from varying disciplines.
I took the finding from Johnston and Slobin’s (1979) study that children would acquire locative prepositions in a certain order based on a combination of cognitive and linguistic factors and decided to test this order with British children. My study involved eighty children aged between 2;0 and 5;0 and used three games to cover both the production and comprehension of prepositions. I achieved results which suggested that there is a general order, and that this appears to be broadly consistent with the order which was being tested. The order arrived at using the data from my study is:

IN < ON < UNDER < BEHINDf/BEHIND < FRONTf/FRONT/BESIDE/BETWEEN

This is the same as the predicted order in many respects: the initial order of the prepositions IN, ON, UNDER and the fact that BEHIND and IN FRONT with featured objects occur before their non featured counterparts. However, my order differs from the predicted one in that BEHIND and IN FRONT (both featured and non-featured) occur at an earlier stage, thus shifting BESIDE and BETWEEN to later positions. Also, non-featured BEHIND occurs before featured IN FRONT suggesting that BEHIND is acquired in both forms before IN FRONT.

The prepositions BEHIND and IN FRONT were in fact
considered in some detail, since this proved to be an important and interesting area for errors, as BEHIND was frequently given instead of IN FRONT. This endorses and adds to evidence from other findings in this particular area.

The reason why BEHIND and IN FRONT appear earlier in the results from my study compared with the predicted order is, I have proposed, primarily because of simpler testing methods to elicit different "types" of BEHIND and IN FRONT. Evidence to support this can be seen from the results in game 3 where more complicated cards showing featured animals facing the side were involved. Here, the results for BEHIND and IN FRONT dropped considerably, and if combined with the other results for featured BEHIND and IN FRONT, would significantly lower the overall scores.

In conclusion, therefore, a general order for locative prepositions can be confirmed. There may, however, be deviations within this order, particularly with the prepositions BEHIND and IN FRONT, depending on context and circumstances, especially the type of reference object and type of object to be located, as well as the position/orientation of the speaker and hearer. As a consequence of the extreme importance of testing methods, all experimental data should be treated with caution.
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APPENDIX 1

Examples of locative expressions in children’s books

The following excerpts from popular books for young children are intended to demonstrate how, along with everyday situations, some locative expressions (e.g. IN FRONT OF) occur less frequently than others.

1. *Where’s Spot?* by Eric Hill (a lift the flap book)

Is he BEHIND the door?
Is he INSIDE the clock?
Is he IN the piano?
Is he UNDER the stairs?
Is he IN the wardrobe?
Is he UNDER the bed?
Is he IN the box?
There’s Spot! He’s UNDER the rug.

2. *Spot’s Birthday Party* by Eric Hill (lift the flap)

Spot has found someone BEHIND the curtain
... and someone IN the cupboard.
... look UNDER the coat!
... Spot knows who’s BEHIND the door.
Who’s that UNDER the table?

4. *Postman Pat’s Treasure Hunt* by John Cunliffe

(no specific illustrations to go with the prepositions)

They lifted cushions; they looked UNDER chairs and BEHIND chairs; they peered BEHIND the television-set and AMONGST the coats that hung on the back of the door.
5. **Postman Pat’s Rainy Day** by John Cunliffe

(no specific illustrations to go with the prepositions)

The rain banged on the roof of the van and rattled on the windows. IN the fields, the sheep huddled BEHIND the walls.

6. **Here and There** by Sara Lynn (illustrated)

DOWN the stairs
ON with the boots
OUT of the house
THROUGH the gate
OVER the log
ACROSS the stream
UNDER the hedge
UP the hill
ALONG the wall
and INTO the pond!

7. **Ned and the Joybaloo** by Hiawyn Oram

...not that meeting a Joybaloo had been easy for Ned. He’d looked IN everything, UNDER everything, THROUGH everything, BEHIND everything.
APPENDIX 2

Age and sex distribution of children

<table>
<thead>
<tr>
<th>Age (years;months)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5:0</td>
<td>x</td>
</tr>
<tr>
<td>4:11</td>
<td></td>
</tr>
<tr>
<td>4:10</td>
<td></td>
</tr>
<tr>
<td>4:9</td>
<td>o</td>
</tr>
<tr>
<td>4:8</td>
<td>o  o  o</td>
</tr>
<tr>
<td>4:7</td>
<td>x</td>
</tr>
<tr>
<td>4:6</td>
<td>x  x  o</td>
</tr>
<tr>
<td>4:5</td>
<td></td>
</tr>
<tr>
<td>4:4</td>
<td>x</td>
</tr>
<tr>
<td>4:3</td>
<td>o</td>
</tr>
<tr>
<td>4:2</td>
<td></td>
</tr>
<tr>
<td>4:1</td>
<td>o  o</td>
</tr>
<tr>
<td>4:0</td>
<td></td>
</tr>
<tr>
<td>3:11</td>
<td>x</td>
</tr>
<tr>
<td>3:10</td>
<td>x  o  x</td>
</tr>
<tr>
<td>3:9</td>
<td>x  x  o</td>
</tr>
<tr>
<td>3:8</td>
<td>o</td>
</tr>
<tr>
<td>3:7</td>
<td>o</td>
</tr>
<tr>
<td>3:6</td>
<td>x  o</td>
</tr>
<tr>
<td>3:5</td>
<td></td>
</tr>
<tr>
<td>3:4</td>
<td>x</td>
</tr>
<tr>
<td>3:3</td>
<td>o  x</td>
</tr>
<tr>
<td>3:2</td>
<td>x  o  o  (o)  (o)</td>
</tr>
<tr>
<td>3:1</td>
<td>o  x  x  x  o  o</td>
</tr>
<tr>
<td>3:0</td>
<td></td>
</tr>
<tr>
<td>2:11</td>
<td>o  o  o  x  o</td>
</tr>
<tr>
<td>2:10</td>
<td>x  o  o  o  x</td>
</tr>
<tr>
<td>2:9</td>
<td>o  o  x  x</td>
</tr>
<tr>
<td>2:8</td>
<td>x  o  o</td>
</tr>
<tr>
<td>2:7</td>
<td>o  x  o  x  x  x</td>
</tr>
<tr>
<td>2:6</td>
<td>x  x  x  o</td>
</tr>
<tr>
<td>2:5</td>
<td>o</td>
</tr>
<tr>
<td>2:4</td>
<td>o  x  x</td>
</tr>
<tr>
<td>2:3</td>
<td>o</td>
</tr>
<tr>
<td>2:2</td>
<td>o  x  x</td>
</tr>
<tr>
<td>2:1</td>
<td>o  o</td>
</tr>
<tr>
<td>2:0</td>
<td>x  x</td>
</tr>
</tbody>
</table>

Key

- o  boy
- x  girl
- ( ) no co-operation
APPENDIX 3

Examples of forms used

------------------------

a) Information on child ................................... 291
b) Response chart for the hide-and-seek game .......... 292
c) Response chart for the putting game ............... 293
d) Response chart for the cards ...................... 294
a) Information on child

Name of child ..................................................

Date of birth ..................................................

Age ....................................................................

Brothers/sisters + ages .......................................

.................................................................

Nursery/playgroup/childminder ............................

.................................................................

Other details ..................................................

.................................................................

.................................................................

.................................................................

Contact details:

Name of mother ..................................................

Address ...........................................................

Phone No .......................................................
b) Response chart for the hide-and-seek game

<table>
<thead>
<tr>
<th>correct preposition</th>
<th>pointing/&quot;there&quot;</th>
<th>&quot;over there&quot;</th>
<th>no response</th>
<th>other/comments</th>
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</thead>
<tbody>
<tr>
<td>in away</td>
<td>after hesitation/prompting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in(side)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>on</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>under(neth)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>beside/next to</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>behind (f)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in front (f)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>between</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>behind</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in front</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>any repeats:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHILD LANGUAGE RESEARCH</td>
<td>RESPONSE CHART</td>
<td>PUTTING GAME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------------</td>
<td>--------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name of child: ..........</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age: ..................</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date of testing: ..........</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>correct position</th>
<th>incorrect (state where)</th>
<th>change in position of reference point</th>
<th>other/comments</th>
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<tbody>
<tr>
<td>straight away</td>
<td>after hesitation/prompting</td>
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<td></td>
</tr>
<tr>
<td>in</td>
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<tr>
<td>on</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>under</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>behind</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in front</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>beside</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>between</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>behind (f)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in front (f)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>any repeats:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>out of (for in)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>off (for on)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Name of child ..................
Age ..................
Date of testing ...............  

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<th>preposition</th>
<th>where's the ...</th>
<th>correct</th>
<th>pointing/ &quot;there&quot;</th>
<th>no response</th>
<th>other</th>
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<td>1. in</td>
<td>cat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. on</td>
<td>teddy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. under</td>
<td>ball</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. next to</td>
<td>tractor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. behind (f)</td>
<td>teddy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. in front (f)</td>
<td>car</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. between</td>
<td>hat</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>8. behind</td>
<td>guitar</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>9. in front</td>
<td>balloon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. behind (s)</td>
<td>lion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. in front (s)</td>
<td>goat</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>12. under *</td>
<td>television</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>13. over *</td>
<td>umbrella</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. around *</td>
<td>basket</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. top</td>
<td>ball</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>up</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

* incongruous
APPENDIX 4

Picture of items used in hide-and-seek-game
APPENDIX 5

Picture of items used in putting game
APPENDIX 6

Picture of cards used in third game
APPENDIX 7

Statistical details

| Sample of data used for the statistical analysis | 305 |
| Guttman Scalogram Analysis: results for game 1 | 306 |
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| SPSS: Scheffe test, age data, game 2 | 318 |
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| SPSS: Scheffe test, age data, game 3 | 320 |
| SPSS: Sex data, game 1 | 321 |
| SPSS: Sex data, game 2 | 322 |
| SPSS: Sex data, game 3 | 323 |
### SAMPLE OF GAME DATA FOR STATISTICAL ANALYSIS

<table>
<thead>
<tr>
<th>columns</th>
<th>game 1</th>
<th>game 2</th>
<th>game 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>a b c</td>
<td>======</td>
<td>======</td>
<td>======</td>
</tr>
<tr>
<td>1 1 3</td>
<td>1 1 1 0</td>
<td>0 0 0 0</td>
<td>0 0 0 0</td>
</tr>
<tr>
<td>2 1 3</td>
<td>0 0 0 0</td>
<td>0 0 0 0</td>
<td>0 0 0 0</td>
</tr>
<tr>
<td>3 2 4</td>
<td>1 1 1 0</td>
<td>1 0 0 1</td>
<td>0 1 0 1</td>
</tr>
<tr>
<td>4 2 3</td>
<td>1 1 0 1</td>
<td>0 0 1 0</td>
<td>1 0 1 0</td>
</tr>
<tr>
<td>5 2 3</td>
<td>1 1 1 0</td>
<td>1 1 1 1</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>6 2 4</td>
<td>1 1 0 0</td>
<td>0 0 1 0</td>
<td>0 0 1 0</td>
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<tr>
<td>7 1 2</td>
<td>1 0 0 0</td>
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</tr>
<tr>
<td>8 2 4</td>
<td>1 1 1 1</td>
<td>1 1 1 1</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>9 1 4</td>
<td>1 1 0 1</td>
<td>0 1 0 1</td>
<td>0 1 0 1</td>
</tr>
<tr>
<td>10 1</td>
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<td>11 2</td>
<td>3 1 1 0</td>
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<td>12 2</td>
<td>3 1 1 0</td>
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</tr>
<tr>
<td>16 2</td>
<td>2 1 1 0</td>
<td>0 0 1 0</td>
<td>0 0 1 0</td>
</tr>
</tbody>
</table>

**Key**

- **a** = child number
- **b** = sex:
  - 1 = boy
  - 2 = girl
- **c** = age group:
  - 1 = 2;0 - 2;11
  - 2 = 3;0 - 3;11
  - 3 = 4;0 - 5;0

- 1 = credit for preposition
- 0 = absence of correct preposition
- 9 = missing data

Prepositions listed in order of testing

---

**Examples**

- Child number 8 is a girl in the oldest age group with credits for all prepositions tested.

- Child number 7 is a boy in the youngest age group only with credits for IN (game 1), IN (game 2) and IN and ON (game 3).
GUTTMAN: RESULTS FOR GAME 1
----------------------------------

Guttman Scalogram Analysis
----------------------------------

An analysis of data in the file named \working\lizl.dat
Number of cases read was 71 on 9 items.

Number of profiles fitting the model = 10
Number of Profiles not fitting the model = 11

Number of possible profiles = 512
Number of observed profiles = 21
Ratio of observed to possible profiles = 0.041

<table>
<thead>
<tr>
<th>Item Order</th>
<th>Item Name</th>
<th>% on 0</th>
<th>% on 1</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A1 IN</td>
<td>1.408</td>
<td>98.592</td>
<td>0.986</td>
</tr>
<tr>
<td>2</td>
<td>A2 ON</td>
<td>18.310</td>
<td>81.690</td>
<td>0.817</td>
</tr>
<tr>
<td>3</td>
<td>A3 UNDER</td>
<td>22.535</td>
<td>77.465</td>
<td>0.775</td>
</tr>
<tr>
<td>5</td>
<td>A5 BEHINDf</td>
<td>43.662</td>
<td>56.338</td>
<td>0.563</td>
</tr>
<tr>
<td>8</td>
<td>A8 BEHIND</td>
<td>47.887</td>
<td>52.113</td>
<td>0.521</td>
</tr>
<tr>
<td>6</td>
<td>A6 IN FRONTf</td>
<td>67.606</td>
<td>32.394</td>
<td>0.324</td>
</tr>
<tr>
<td>9</td>
<td>A9 IN FRONT</td>
<td>70.423</td>
<td>29.577</td>
<td>0.296</td>
</tr>
<tr>
<td>4</td>
<td>A4 BESIDE</td>
<td>76.056</td>
<td>23.944</td>
<td>0.239</td>
</tr>
<tr>
<td>7</td>
<td>A7 BETWEEN</td>
<td>85.915</td>
<td>14.085</td>
<td>0.141</td>
</tr>
</tbody>
</table>

Coefficient of Reproducibility = 0.937
Minimal Marginal Reproducibility = 0.740
Scalability Coefficient = 0.759

306
GUTTMAN: RESULTS FOR GAME 2

*********************************************************
* The Psychometric Analysis Package (PAP). *
* A programme for the multivariate analyses of *
* psychometric data. *
* Written by Sean Hammond *
* Department of Psychology *
* University of Surrey *
* 1986, 1988, 1990 *
*********************************************************

Guttman Scalogram Analysis

An analysis of data in the file named \working\lizl.dat
Number of cases read was 74 on 9 items.

Number of profiles fitting the model = 6
Number of Profiles not fitting the model = 28

Number of possible profiles = 512
Number of observed profiles = 34
Ratio of observed to possible profiles = 0.066

<table>
<thead>
<tr>
<th>Item Order</th>
<th>Item Name</th>
<th>% on 0</th>
<th>% on 1</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B1 IN</td>
<td>0.000</td>
<td>100.000</td>
<td>1.000</td>
</tr>
<tr>
<td>2</td>
<td>B2 ON</td>
<td>12.162</td>
<td>87.838</td>
<td>0.878</td>
</tr>
<tr>
<td>4</td>
<td>B4 BEHIND</td>
<td>25.676</td>
<td>74.324</td>
<td>0.743</td>
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<tr>
<td>9</td>
<td>B9 IN FRONTf</td>
<td>28.378</td>
<td>71.622</td>
<td>0.716</td>
</tr>
<tr>
<td>7</td>
<td>B7 BETWEEN</td>
<td>31.081</td>
<td>68.919</td>
<td>0.689</td>
</tr>
<tr>
<td>6</td>
<td>B6 BESIDE</td>
<td>32.432</td>
<td>67.568</td>
<td>0.676</td>
</tr>
<tr>
<td>3</td>
<td>B3 UNDER</td>
<td>32.432</td>
<td>67.568</td>
<td>0.676</td>
</tr>
<tr>
<td>5</td>
<td>B5 IN FRONT</td>
<td>32.432</td>
<td>67.568</td>
<td>0.676</td>
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<tr>
<td>8</td>
<td>B8 BEHINDf</td>
<td>33.784</td>
<td>66.216</td>
<td>0.662</td>
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</table>

Coefficient of Reproducibility = 0.799
Minimal Marginal Reproducibility = 0.746
Scalability Coefficient = 0.207
GUTTMAN: RESULTS FOR GAME 3

Guttman Scalogram Analysis

An analysis of data in the file named \working\lizl.dat
Number of cases read was 77 on 11 items.
Number of profiles fitting the model = 11
Number of Profiles not fitting the model = 27
Number of possible profiles = 2048
Number of observed profiles = 38
Ratio of observed to possible profiles = 0.019

<table>
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<tr>
<th>Item Order</th>
<th>Item Name</th>
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<th>% on 1</th>
<th>Difficulty</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>C1 IN</td>
<td>6.494</td>
<td>93.506</td>
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<td>C2 ON</td>
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Coefficient of Reproducibility = 0.835
Minimal Marginal Reproducibility = 0.759
Scalability Coefficient = 0.314
GUTTMAN: RESULTS FOR GAME 3 - excluding BEHIND/FRONT side facing featured objects

Guttman Scalogram Analysis

An analysis of data in the file named \working\lizl.dat
Number of cases read was 77 on 9 items.

Number of profiles fitting the model = 10
Number of Profiles not fitting the model = 22

Number of possible profiles = 512
Number of observed profiles = 32
Ratio of observed to possible profiles = 0.063

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Coefficient of Reproducibility = 0.882
Minimal Marginal Reproducibility = 0.763
Scalability Coefficient = 0.500
MOKKEN: RESULTS FOR GAME 1

The Psychometric Analysis Package (PAP),
A programme for the multivariate analyses of psychometric data.
Written by Sean Hammond
Department of Psychology
University of Surrey
1986, 1988, 1990

Cumulative Stochastic Scaling Using Mokken's Homogeneity Model

Inter-Item Homogeneity Coefficients

<table>
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<tr>
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<th>A9</th>
<th>A6</th>
<th>A8</th>
<th>A5</th>
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<th>A1</th>
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Scale Statistics

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Scale Reliability | Scale Homogeneity | Scale Delta | Probability
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MOKKEN: RESULTS FOR GAME 2

******************************************
* The Psychometric Analysis Package (PAP). *
* A programme for the multivariate analyses of *
* psychometric data. *
* Written by Sean Hammond *
* Department of Psychology *
* University of Surrey *
* 1986, 1988, 1990 *
******************************************

Cumulative Stochastic Scaling Using Mokken’s Homogeneity Model

Inter-Item Homogeneity Coefficients

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Scale Statistics

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Scale Reliability Scale Homogeneity Scale Delta Probability

| .9999 | .268 | 21.3163 | 0.0000 |

311
MOKKEN: RESULTS FOR GAME 3

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
* The Psychometric Analysis Package (PAP). *
* A programme for the multivariate analyses of *
  psychometric data. *
* *
* Written by Sean Hammond *
* Department of Psychology *
* University of Surrey *
* 1986, 1988, 1990 *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

Cummulative Stochastic Scaling Using Mokken's Homogeneity Model

Inter-Item Homogeneity Coefficients

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<th>C8</th>
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Scale Statistics

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<th>Delta</th>
<th>Probability</th>
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Scale Reliability | Scale Homogeneity | Scale Delta | Probability |
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312
MOKKEN: GAME 1 WITHOUT "IN"

********************************************************************************
* The Psychometric Analysis Package (PAP).
* A programme for the multivariate analyses of psychometric data.
* Written by Sean Hammond
* Department of Psychology
* University of Surrey
* 1986, 1988, 1990
********************************************************************************

Cumulative Stochastic Scaling Using Mokken's Homogeneity Model

Inter-Item Homogeneity Coefficients

<table>
<thead>
<tr>
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<th>A6</th>
<th>A8</th>
<th>A5</th>
<th>A3</th>
<th>A2</th>
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<tr>
<td>A6</td>
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<td>0.371</td>
<td>0.815</td>
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<tr>
<td>A8</td>
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<td>0.218</td>
<td>0.348</td>
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<td>0.178</td>
<td>0.290</td>
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<td>0.791</td>
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<tr>
<td>A3</td>
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<td>0.096</td>
<td>0.139</td>
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<td>0.094</td>
<td>0.107</td>
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Scale Statistics

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<th>Item Name</th>
<th>Difficulty</th>
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<th>Delta</th>
<th>Probability</th>
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<tr>
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<tr>
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Scale Reliability | Scale Homogeneity | Scale Delta | Probability |
<table>
<thead>
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<th></th>
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</thead>
<tbody>
<tr>
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**MOKKEN: GAME 2 WITHOUT "IN"**

<table>
<thead>
<tr>
<th>Item</th>
<th>Difficulty</th>
<th>Homogeneity</th>
<th>Delta</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>B8</td>
<td>0.662</td>
<td>0.518</td>
<td>10.283</td>
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<td>B3</td>
<td>0.676</td>
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<tr>
<td>B6</td>
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<td>10.713</td>
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<td>B7</td>
<td>0.689</td>
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<td>B9</td>
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<td>B4</td>
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**Scale Reliability**

<table>
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<th>Scale Delta</th>
<th>Probability</th>
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<td>.9913</td>
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SPSS: AGE DATA, GAME 1

--- ONE WAY ---

Variable GAME1
By Variable AGE

Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>D.F.</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F Ratio</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2</td>
<td>9.0618</td>
<td>4.5309</td>
<td>.6748</td>
<td>.5127</td>
</tr>
<tr>
<td>Within Groups</td>
<td>66</td>
<td>443.1411</td>
<td>6.7143</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>452.2029</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>Count</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Standard Error</th>
<th>95 Pct Conf Int for Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grp 2</td>
<td>33</td>
<td>4.3636</td>
<td>2.7818</td>
<td>.4843</td>
<td>3.3772 TO 5.3500</td>
</tr>
<tr>
<td>Grp 3</td>
<td>21</td>
<td>4.8571</td>
<td>2.3725</td>
<td>.5177</td>
<td>3.7772 TO 5.9371</td>
</tr>
<tr>
<td>Grp 4</td>
<td>15</td>
<td>5.2667</td>
<td>2.4339</td>
<td>.6284</td>
<td>3.9188 TO 6.6145</td>
</tr>
<tr>
<td>Total</td>
<td>69</td>
<td>4.7101</td>
<td>2.5788</td>
<td>.3104</td>
<td>4.0907 TO 5.3296</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>GROUP</th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grp 2</td>
<td>1.0000</td>
<td>9.0000</td>
</tr>
<tr>
<td>Grp 3</td>
<td>.0000</td>
<td>9.0000</td>
</tr>
<tr>
<td>Grp 4</td>
<td>2.0000</td>
<td>9.0000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>.0000</td>
<td>9.0000</td>
</tr>
</tbody>
</table>
SPSS: SCHEFFE TEST, AGE DATA, GAME 1

---------------------------------------------------

- - - - ONE WAY - - - -

Variable GAME1
By Variable AGE

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if
\[
\text{MEAN(J)} - \text{MEAN(I)} \geq 1.8322 \times \text{RANGE} \times \sqrt{\frac{1}{N(I)} + \frac{1}{N(J)}}
\]
with the following value(s) for RANGE: 3.54

- No two groups are significantly different at the .050 level
SPSS: AGE DATA, GAME 2

--------------

--- ONE WAY ---

Variable: GAME2
By Variable: AGE

Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
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<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F Ratio</th>
<th>F Prob.</th>
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<tbody>
<tr>
<td>Between Groups</td>
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<td>61.7111</td>
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<td>4.9537</td>
<td>.0098</td>
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<tr>
<td>Within Groups</td>
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<td>429.7889</td>
<td>6.2288</td>
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<tr>
<td>Total</td>
<td>71</td>
<td>491.5000</td>
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</table>

Group Count Mean Standard Deviation Standard Error 95 Pct Conf Int for Mean

<table>
<thead>
<tr>
<th>Group</th>
<th>Count</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Standard Error</th>
<th>95 Pct Conf Int for Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grp 2</td>
<td>34</td>
<td>6.0882</td>
<td>3.0188</td>
<td>.5177</td>
<td>5.0349 TO 7.1415</td>
</tr>
<tr>
<td>Grp 3</td>
<td>24</td>
<td>6.6250</td>
<td>2.2614</td>
<td>.4616</td>
<td>5.6701 TO 7.5799</td>
</tr>
<tr>
<td>Grp 4</td>
<td>14</td>
<td>8.5714</td>
<td>.9376</td>
<td>.2506</td>
<td>8.0301 TO 9.1128</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>6.7500</td>
<td>2.6311</td>
<td>.3101</td>
<td>6.1317 TO 7.3683</td>
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GROUP MINIMUM MAXIMUM

<table>
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<tr>
<td>Grp 2</td>
<td>1.0000</td>
<td>9.0000</td>
</tr>
<tr>
<td>Grp 3</td>
<td>1.0000</td>
<td>9.0000</td>
</tr>
<tr>
<td>Grp 4</td>
<td>6.0000</td>
<td>9.0000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1.0000</td>
<td>9.0000</td>
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</table>
SPSS: SCHEFFE TEST, AGE DATA, GAME 2
------------------------------------------

--- ONE WAY ---

Variable  GAME2
By Variable  AGE

Multiple Range Tests:  Scheffe test with significance level .05

The difference between two means is significant if

\[ \text{MEAN}(J) - \text{MEAN}(I) \geq 1.7648 \times \text{RANGE} \times \sqrt{\frac{1}{N(I)} + \frac{1}{N(J)}} \]

with the following value(s) for RANGE: 3.54

(*) Indicates significant differences which are shown in the lower triangle

\[
\begin{array}{ccc}
G & G & G \\
r & r & r \\
p & p & p \\
2 & 3 & 4
\end{array}
\]

Mean  AGE

6.0882  Grp 2
6.6250  Grp 3
8.5714  Grp 4  *

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- - - - ONEWAY - - - -

Variable GAME3
By Variable AGE

Analysis of Variance

<table>
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<th>Source</th>
<th>D.F.</th>
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<th>Mean Squares</th>
<th>F Ratio</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>54.5195</td>
<td>27.2598</td>
<td>3.5576</td>
<td>.0337</td>
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<tr>
<td>Within Groups</td>
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<td>544.0345</td>
<td>7.6625</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>73</td>
<td>598.5541</td>
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</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>Count</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Standard Error</th>
<th>95 Pct Conf Int for Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grp 2</td>
<td>35</td>
<td>4.0857</td>
<td>2.9741</td>
<td>.5027</td>
<td>3.0641 TO 5.1074</td>
</tr>
<tr>
<td>Grp 3</td>
<td>24</td>
<td>4.4583</td>
<td>2.0847</td>
<td>.4255</td>
<td>3.5780 TO 5.3386</td>
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<tr>
<td>Total</td>
<td>74</td>
<td>4.6622</td>
<td>2.8635</td>
<td>.3329</td>
<td>3.9988 TO 5.3256</td>
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GROUP  | MINIMUM | MAXIMUM |
-------|---------|---------|
Grp 2  | .0000   | 11.0000 |
Grp 3  | 1.0000  | 9.0000  |
Grp 4  | 2.0000  | 11.0000 |
TOTAL  | .0000   | 11.0000 |
SPSS: SCHEFFE TEST, AGE DATA, GAME 3
------------------------

- - - - ONE WAY - - - -

Variable GAME3
By Variable AGE

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if
\[ \text{MEAN}(J) - \text{MEAN}(I) \geq 1.9574 \times \text{RANGE} \times \sqrt{\frac{1}{N(I)} + \frac{1}{N(J)}} \]
with the following value(s) for RANGE: 3.54

(*) Indicates significant differences which are shown in the lower triangle

\[
\begin{array}{cccc}
G & G & G & \\
R & r & r & \\
P & p & p & \\
\end{array}
\]

<table>
<thead>
<tr>
<th>Mean</th>
<th>AGE</th>
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</thead>
<tbody>
<tr>
<td>4.0857</td>
<td>Grp 2</td>
</tr>
<tr>
<td>4.4583</td>
<td>Grp 3</td>
</tr>
<tr>
<td>6.3333</td>
<td>Grp 4 *</td>
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</table>
t-tests for independent samples of SEX

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
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</thead>
<tbody>
<tr>
<td>GAME1</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>SEX 1</td>
<td>36</td>
<td>4.5000</td>
<td>2.624</td>
<td>.437</td>
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<tr>
<td>SEX 2</td>
<td>33</td>
<td>4.9394</td>
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<td>.444</td>
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</table>

Mean Difference = -.4394

Levene’s Test for Equality of Variances: F= .341  P= .561

t-test for Equality of Means

<table>
<thead>
<tr>
<th>Variances</th>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
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</thead>
<tbody>
<tr>
<td>Equal</td>
<td>-.70</td>
<td>67</td>
<td>.484</td>
<td>.624</td>
<td>(-1.685, .806)</td>
</tr>
<tr>
<td>Unequal</td>
<td>-.71</td>
<td>66.77</td>
<td>.483</td>
<td>.623</td>
<td>(-1.683, .804)</td>
</tr>
</tbody>
</table>
### t-tests for independent samples of SEX

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEX 1</td>
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<td>6.6842</td>
<td>2.682</td>
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<td>SEX 2</td>
<td>34</td>
<td>6.8235</td>
<td>2.611</td>
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Mean Difference = -.1393

Levene’s Test for Equality of Variances: F = .093  P = .761

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<th>Variances</th>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
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</thead>
<tbody>
<tr>
<td>Equal</td>
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<td>70</td>
<td>.824</td>
<td>.625</td>
<td>(-1.387, 1.108)</td>
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<tr>
<td>Unequal</td>
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<td>.824</td>
<td>.624</td>
<td>(-1.385, 1.107)</td>
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</tbody>
</table>
t-tests for independent samples of SEX

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>GAME3:</td>
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<td></td>
</tr>
<tr>
<td>SEX 1</td>
<td>39</td>
<td>4.5641</td>
<td>2.972</td>
<td>.476</td>
</tr>
<tr>
<td>SEX 2</td>
<td>35</td>
<td>4.7714</td>
<td>2.777</td>
<td>.469</td>
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</table>

Mean Difference = -.2073

Levene’s Test for Equality of Variances: F = .106  P = .746

t-test for Equality of Means 95%

<table>
<thead>
<tr>
<th>Variances</th>
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<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>-.31</td>
<td>72</td>
<td>.758</td>
<td>.671</td>
<td>(-1.545, 1.130)</td>
</tr>
<tr>
<td>Unequal</td>
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<td>71.87</td>
<td>.757</td>
<td>.668</td>
<td>(-1.540, 1.125)</td>
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