THE COMPREHENSION OF SPATIO-TEMPORAL TERMS BY CHILDREN OF PRIMARY SCHOOL AGE

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SUMMARY

The research conducted in this thesis examined the development of the semantic system of *spatio-temporal* terms in children of primary school age. This investigation involved a series of experiments which looked at the child's awareness of the antonym relationship in this field as well as his conceptualisation of a limited subset of *spatio-temporal* terms. Later experiments further studied the effects of a linguistic context on the child's comprehension of these terms. In addition, data were gathered from both adult and language-delayed subjects in order to determine if children in the 7:0 to 12:0 year age group were functioning at an adult level with respect to their comprehension of *spatio-temporal* terms, and furthermore, to ascertain whether linguistic performance on a task involving these terms was affected by a developmental delay in language acquisition.

This research was conducted in the light of the *Semantic Feature Theory* as expounded by E. Clark (1973c) and H. Clark (1973). As such, two of the major hypotheses tested in the experiments were,

(1) Children will make more errors on *marked* than on *unmarked* members of *spatio-temporal* antonym pairs.

(2) The spatial sense of *spatio-temporal* terms will be learnt before their temporal sense. This will result in differential error rates to terms which are seen as being spatially dominant (e.g. *in front of, ahead of, behind*) and temporally dominant (e.g. *before, after*).

The first experiment undertaken looked at the acquisition of the antonym relationship in the *spatio-temporal* semantic field by Year 3 (7:0 to 8:0 year old) children. The results of this study demonstrated that for children of this age the notion of "opposite" was a firmly established semantic relation. Therefore, it was concluded that any comprehension errors they make with such terms can be attributed to their dual meaning and how aware the children are of this dual meaning.

Consequently, the second experiment investigated both the child's and adult's conceptualisation of a limited subset of *spatio-temporal* terms (*in front, ahead, behind, before, after, first, last*) by asking them to rate such terms for similarity of meaning. This study found that both child and adult subjects perceived these terms as existing in a 2 dimensional semantic space whose dimensions could be labelled spatial and temporal. Furthermore, this semantic space was more fully differentiated in adults than children. Therefore, some development had occurred in the semantic system of these 7 *spatio-temporal* terms.

A third experiment was therefore conducted to consider this developmental change and how it was affected by linguistic, in particular sentential, context. This experimental design was employed with three subject populations, that is 7:0 to 12:0 year old children, adults, and language-delayed children (who were functioning linguistically at an 8:0 year old level according to form (a) of the *Peabody Picture Vocabulary Test*). The results of each study indicated that all subject groups were aware of how the semantic constraints operating within the structure of a sentence affected their interpretation of the *spatio-temporal* terms *in front of, ahead of, behind, before* and *after*. Furthermore, this awareness seemed to reach an adult competence at Year 4 or around 9:0 years of age as was evidenced by the performance similarities of Year 4 and adult subjects on this task. In addition, the group of language-delayed subjects were found to be different and not merely delayed with respect to linguistic ability on this task as was indicated by a comparison of their performance with that of their linguistic age peers (Year 3 or 8:0 year olds).

The last experiment conducted, examined in more detail the effects of linguistic context on children's comprehension of the *spatio-temporal* terms *in front of, behind, before* and *after*. In addition to employing spatial and temporal contexts, as in the preceding study, this experiment utilised contexts whose meanings were ambivalent, that is, spatial/temporal contexts. (Such contexts allow either a spatial or a temporal semantic interpretation.) The findings of most interest in this study were those in spatial/temporal contexts. Subjects from Years 3 to 7 gave responses whose dominant meaning was temporal, that is, *before* and *after*, in such contexts. This was seen as indicating that children were aware of the dual sense of the temporally dominant pair *before/after* when provided with a spatial/temporal linguistic context. However, such a context failed to elicit the double meaning in children's semantic interpretations of the spatially dominant terms *in front of* and *behind*.

Overall, the results of these studies indicated few performance differences which could be attributed to variations in Verbal I.Q. or sex. This latter finding supports the research cited by Maccoby and Jacklin (1974) which indicates that few reliable sex differences exist in linguistic abilities in the middle years of childhood. Furthermore, no performance differences were found which could be attributed to the *markedness* of the *spatio-temporal* term, in line with those predicted by E. Clark (1973c). Similarly, the spatial sense of *spatio-temporal* terms was not found to be prior in acquisition as predicted by H. Clark (1973) as differential error rates to spatially and temporally dominant terms generally proved to be insignificant.

In conclusion, a theoretical model was postulated to account for the primary school age child's comprehension of *spatio-temporal* terms. This model saw a possible amalgamation of *Semantic Feature* (E. Clark, 1973c) and *Prototype Theories* (Nelson, 1974a; Rosch, 1973; Palermo, 1978) as envisaged by Bowerman (1978b). Such a model incorporates the semantic featural notion of the former and the prototype concept of the latter to explain how the word-field of *spatio-temporal* terms is conceptualised by primary school age children and how this conceptualisation is affected by sentential context.

STATEMENT

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university and, to the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except when due reference is made in the text.

Signed__

Lynette Campbell

January, 1982.

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CHAPTER 1.

INTRODUCTION

The acquisition of language is one of the major achievements of early childhood. It is this achievement which enables the child to make progress socially as well as educationally and to function effectively in his environment. However, this acquisition of the language system is not almost complete by age 5:

> "....the 5-year-old is far from having the equivalent of an adult native speaker's facility with the language."
> (Palermo & Molfese, 1972, p. 409.)

Language acquisition continues well into middle and later childhood, and some aspects, mainly semantic, are still being refined and changed in the adult years. That this is so is clearly reflected by the work of Menyuk (1977) whose book Language and Maturation covers aspects of language acquisition and use from infancy to adulthood. C. Chomsky (1969) also studied children in the 5 to 10 year age group by investigating their syntactic development. However, as yet, studies on language use and comprehension after age 5 are still few in number. Psycholinguists and other workers in the area of child language have tended to concentrate on the 2 to 5 year age group, with attention only recently being given to the periods of infancy and the school years. But the child has not achieved adult competence in his mastery of language by age 5. Such mastery is gradually approximated over the middle and later years of childhood which do see some important changes in language development. These mainly take the form of refinements in the understanding and use of the grammatical system, and a deeper grasp of the meaning or semantic component of language. It is also during this period that children acquire the ability to think about and comment on language, that is, they acquire *metalinguistic awareness*. (Read, in Sinclair, Jarvella & Levelt, 1978).

The aim of this thesis is to study this age period. To look at language understanding and use in children of primary school age, the middle and later years of childhood. Its purpose is to investigate the semantic component of language, and it asks the question:

> *What advances do school-age children make in their comprehension and production of the semantics of language?*

The term semantics as used in this thesis will be taken as referring to *conceptual meaning*. Leech (1974) states that *conceptual meaning* or sense is the "logical, cognitive or denotative content" of language (p. 26), and that "it can be shown to be integral to the essential functioning of language" (p. 10). Therefore, it is important to look at the development of conceptual meaning in school age children, for now they are exposed to language in a wider social milieu and are confronted by not only its spoken, but also its written form. Consequently these children have the chance of hearing and seeing words in a greater variety of linguistic and non-linguistic contexts which will affect not only their language use but also the meaning which they assign to language.

> "The semantic system of a language is the knowledge that a speaker must have to understand sentences and relate them to his knowledge of the world. It includes both knowledge of individual lexical items and knowledge of how the meaning of a sentence is determined by the meanings of individual lexical items and the structure of the sentence."
> (Dale, 1976, p. 166)

This statement by Dale mirrors the essence of the semantic system of language which the child must acquire. For he must not only comprehend what each word or lexical item of the language means, but he must also come to understand how sentence structure affects meaning. This is by no means a simple task. It is a long and involved process which takes many years, and indeed can be considered to continue well into adulthood, although at that stage progress and change in the language system occurs at a much slower pace.

Various theories have been put forward to explain the child's acquisition of semantics, most of which have been concerned with the comprehension of words. There has been less emphasis on how sentence structure affects meaning. Even more rare have been discussions of how the meaning of individual lexical items may be modified by the linguistic contexts in which they appear, changing meaning from one verbal context to another.

The major emphasis in studies of semantic development has been on the acquisition of the meanings of individual lexical items, in particular, on pairs characterised by the antonymic relationship. A detailed discussion of these semantic theories will follow. Evidence for and against each theory will also be considered.

1.1 SEMANTIC DEVELOPMENT THEORIES

The major theories to be discussed will be the *Feature Theory* as expounded by E. Clark (1973c) and *Prototype Theory* (Rosch, 1973; Nelson, 1974a; Palermo, 1978). Currently these are the major theories which are put forward as alternative explanations of the child's acquisition of word meaning. As such, they have inspired much of the experimental work which has been done in this area, the findings of which can generally be found to fit the predictions of one or the other model. Their specific relevance to the child's comprehension of antonym pairs, along with the research work done on these terms will receive major emphasis.

1.1.1 Semantic Feature Theory

The *Semantic Feature Theory* is an early model of the language acquisition process put forth by E. Clark (1973c). In its initial form, the *Full Semantics Hypothesis,* this theory is only concerned with the child's acquisition of features of word meaning. No consideration is given to how the child's non-linguistic knowledge, which is perceptually based, may affect his comprehension of language. However, the later *Partial Semantics Hypothesis* does take such non-linguistic knowledge into account in the model it proffers for semantic development. This later model developed from the former in an effort to explain experimental findings which could not be attributed solely to the presence or absence of word features in the child's semantic system. Therefore, it discusses the importance of the interaction between the child's perceptually determined knowledge and his partial semantic knowledge for the acquisition of word meaning.

Both versions of the *Feature Theory* are concerned with the development of the child's understanding of the meanings of individual words or lexical items which are seen as being composed of semantic features or components (Katz & Fodor, 1963; Bierwisch, 1967, 1970). Indeed Clark and Clark (1977) state that one of the three fundamental characteristics of the sense of a word is that it is composed of a collection of simple semantic components which have been variously labelled semantic markers, or features, or components, meaning postulates, or minimal units of meaning. These semantic features are conceptualised in terms of a plus or minus notation which indicates whether or not the semantic feature can be attributed to a particular lexical item. Richards (1979) encapsulates the general form of *Semantic Feature Theory* as follows:

> "(it) assumes that the meaning of individual lexical items can be characterised as a set of values on a concatenation of underlying meaning components which are taken to describe all the entries in a common lexical field."
> (Richards, 1979, p. 1)

These semantic features, which are also called semantic primitives (Bierwisch, 1967, 1970), are furthermore held to be universal in that they underlie all languages. Linguists (Bolinger, 1965; Bierwisch, 1967, 1970), state that these semantic markers or features are based on the world knowledge of the human organism. Such markers represent "certain deep seated, innate properties of the human organism and the perceptual apparatus, [and] determine the way in which the universe is conceived, adapted, and worked on." (Bierwisch, 1967, p. 3). Consequently, what differs between languages is not the set of universal semantic components with their basis in world knowledge, but the rules by which they are combined in different languages. This description of semantic features is heavily Chomskian in tenure. However, such a description is necessary to adequately describe the nature of the semantic features which comprise word meaning. The idea that semantic markers are universal properties of language has not yet received definitive empirical validation. However, whether they are universal or not does not critically influence the argument put forward by the Clarks.

The *Full Semantics Hypothesis* (E. Clark, 1973c) is concerned with how the child acquires the meanings of words during the course of language development. This hypothesis states that the child does not know the full adult meanings of words when he first begins to use them. Instead he has only partial entries for words which consist of one or two features or components of meaning, rather than the complete set of components with which the adult characterises the meanings of words. Only gradually during the course of development does the child acquire all of the features which represent the full or adult meaning of the word. Therefore, at first the child's meanings are only partial meanings. He has only used criterially one or two of the features of a word in his decision of when and when not to apply the word. An important point to make with respect to these semantic features which comprise the child's early word meanings is that they are related to the perceptual information the child has about the world he lives in. This can be seen most clearly in looking at the overextensions which are characteristic of the child's productive speech between 1:0 and 2:6 years. In her extensive examination of diary data E. Clark concluded that:

> "....the features that are used criterially in the overextensions of words appear to be derived predominantly from the perceptual input to the child.... ."
>
> (E. Clark, 1973c, p. 79)

Indeed, the perceptual basis for these productive overextensions falls into the six major categories of shape, movement, size, sound, taste, and texture (E. Clark, 1974, 1977a). Such a large perceptual component in the earliest features utilised by the child in assigning word meanings lends further credence to the universal and innate nature of semantic markers postulated by Bierwisch (1967, 1970).

This theory makes three basic assumptions which must be considered in order to gain an understanding of its basis. The first supposition is that word meaning can be reduced to some combination of meaning units which is smaller than that described by the word. These are the semantic features. A second postulate states that the child's semantic markers or features result from the coding of his percepts. It is an identifiable (perceptually salient) characteristic of the object that the child's word refers to. The third premise asserts that the child learns, as he develops linguistically, which perceptual features are relevant to his understanding of the meanings of the words in his language and which are not. Each of these assumptions further underlines the importance of perception in this theory, that is, the perceptual basis of semantic features. This factor is supported by Olson (1970) who states that both language and perception involve the search for features to enable the distinction between the actual event itself and the perceived or inferred alternatives.

The *Semantic Feature Hypothesis* has concentrated on two major areas in child language development. The first of these is the source of the child's earliest semantic features. As stated above these are held to be the encoding of perceptual attributes by the child. Such features are held to be part of the universal set of semantic primitives as they are derived from the interpretation placed on his own cognitions and perceptions by the human organism (E. Clark, 1973c). These perceptual features are in the form of non-linguistic knowledge which the child has been acquiring in the first year of life through interaction with and observation of both objects and events in his environment. Such non-linguistic knowledge provides the child with his first hypotheses about word meaning (E. Clark, 1975, 1977b).

The second major area investigated and discussed by the *Semantic Feature Hypothesis* is the acquisition of the semantic features which comprise words. These features or components are learnt gradually or "component - by - component". Such an acquisition is characteristic of adult as well as child language learning. Adult lexical concepts are acquired in a "component - by - component" manner similar to that which depicts "baby-talk" (Baron, 1973). It is in this second area of semantic feature acquisition that E. Clark makes the following predictions:

(1) More general features are acquired before more specific ones.

(2) "....if the features which, combined, make up the meaning of a word are related to each other hierarchically, then the order of acquisition is top - down, ..." (E. Clark, 1973c, p. 75). The top feature, which is the most general, is acquired first, and the other features are acquired in line with their order in the hierarchy.

(3) The child learns separately the features of each word in the acquisition of the word itself.

It is the order of acquisition of the semantic features, particularly of words which comprise fields of semantically related terms, which is of especial interest to *Feature Theory*. For E. Clark's theory holds that certain features are acquired before others, and it is this factor which has provided the major impetus for research into English antonym pairs.

Two other researchers in this area offer their own interpretations of E. Clark's theory. These workers are Bartlett (1976) and Richards (1979). Bartlett (1976) succintly states what she sees as being the four basic propositions of the theory. First, word meanings reflect the child's knowledge of percpeutal attributes as well as the strategies he uses to organise events perceptually, both of which can be seen to evolve from the initial dependence of word meanings on the child's perceptual knowledge. Secondly the relationship between adult word meaning and the child's perceptual strategies determines the order in which word meanings are acquired. Thirdly, the semantic features which characterise word meaning indicate the several types of relationships which exist amongst terms that belong to the same conceptual field. The final proposition states that semantic development, within a particular field, proceeds in an hierarchical manner with the more general features being acquired prior to the more specific ones.

Richards (1979) observes that semantic feature acquisition for any particular domain can be characterised in terms of three developmental principles each of which exists in a dependent relationship. The first of these three principles she calls the *top-to-bottom hypothesis*. It states that features exist in an hierarchy and within this hierarchy they are acquired in the order from general or broad (top) to specific (bottom). Her second proposition has to do with the *nonsimultaneous (asymmetric) acquisition* of semantically contrasting pairs. This principle holds that one member of an antonym pair is acquired earlier than the other. *Semantic Overextension* is the third principle Richards sees as being characteristic of *Semantic Feature Theory*. Not only do children overextend the names of objects in their early vocabulary, but they also overextend the meaning of the earlier acquired member of an antonym pair to include its later acquired opposite.

Each of these writers has captured the essentials of the theory postulated by E. Clark (1973c). However, the emphasis they give to different aspects of this theory does differ. Bartlett (1976) tends to stress the perceptual basis of early word meanings and how this affects the acquisition process. In doing so she acknowledges the important place of perceptual knowledge in E. Clark's *Semantic Feature Theory*, demonstrating that the child's percepts are the foundation from which the semantic features associated with early word meanings develop. However, Bartlett does not extend these principles as they are applied to a particular lexical domain. Explication of this is more evident in Richards' (1979) discussion. This latter worker, like Bartlett, stresses that hierarchical acquisition characterises semantic development within a specific field. However, Richards further explicates the application of E. Clark's (1973c) theory to the semantic domain of antonym pairs. It is in just this field that E. Clark's theory posits strong predictions which lend themselves readily to experimentation. Such research has generated a wealth of data and discussion, much of it in conflict with E. Clark (1973c), thus demonstrating the importance of this theory to current work in the area of semantic development.

Having discussed interpretations of *Semantic Feature Theory*, the theory itself will be considered in more detail. The emphasis will be on its application to, and predictions with respect to antonym pairs, in particular *dimensional* adjectives. H. Clark's (1970b, 1973) explanation of children's comprehension of antonym pairs will also be examined. Although there are differences in emphasis in the explanations put forth by E. Clark and H. Clark, both rely heavily on the relevance of perceptual features in the child's environment as aids to his comprehension of antonym or relational pairs.

A second area in which they agree is that relational pairs can be conceptualised in terms of the *unmarked-marked* distinction posited by linguists. Greenberg (1966) has provided several criteria to characterise the principle of *marking* of word pairs in language. The first of these is the neutralisation of the *unmarked* member of the pair. *Unmarked* terms can be used in question form without implying any expectation about the object being discussed, e.g. *"How wide is that bench?"*. However, when the *marked* term is used, e.g. *"How narrow is that bench?"*, something is suggested about a characteristic of the object. This principle of contextual neutralisation is the major one theorists have used in discussing the acquisition of antonym pairs by young children. However, other criteria are also used in differentiating *unmarked* from *marked* terms. Zero expression of the *unmarked* member, e.g. *author-authoress* is one such criteria. This is allied to another yardstick of *markedness* where the *unmarked* member of a pair is seen as having an ambiguous nature. It indicates both the name of the category to which the pair belongs as well as being a specific opposite to the *marked* term with respect to meaning. The *marked* member has only this latter opposite function. Two other criteria of *markedness* refer to usage frequency and antiquity of meaning. The *unmarked* member is not only found to occur more frequently than the *marked* term but is also held to have a current meaning which is prior in terms of the developmental history of the language itself.

Experimental support for the application of the *unmarked-marked* distinction to antonym pairs comes from two studies. Salus and Salus (1977) had 55 children between the ages of 4:7 and 9:6 supply "opposites" for 28 common words. From their results they concluded that the notion of *markedness* is a valid one. This was evidenced by the asymmetries in response rates. The *unmarked* members of pairs yielded their opposites with greater frequency than was the case for the *marked* members. Hamilton and Deese (1971) also found evidence for the relevance of the *unmarked-marked* specification in their study of adjectival opposites. They had their 28 adult subjects sort the 86 words from 43 antonym pairs into groups. Their major findings were that the adjectives which were covertly distinguished by linguistic criteria of *marking* could be sorted by subjects, and an evaluative feature formed the basis for such separation into groups. From this they concluded that *marking* and a feature of evaluation were functionally correlated. The presence of this evaluative feature in the *marking* distinction is further emphasised by French (1979). He found that adults could more easily solve reasoning problems when the affect of the noun and adjective were congruent, both positive (e.g. *more friends*), than when they were incongruent (e.g. *more enemies*).

The asymmetry in the comprehension of *unmarked-marked* pairs is the principle finding in the acquisition literature which the notion of linguistic *marking* has been used to explain. Many studies have found that the *unmarked* member of antonym pairs is acquired before its *marked* counterpart. Such a finding has been replicated across a wide variety of semantic fields. It has been found to be the case for not only comparative terms, e.g. *more/less*, but also for *dimensional* adjectives, e.g. *long/short*, spatial/relational terms, e.g. *in front/behind*, and temporal terms, e.g. *before/after*. This consistent finding of the earlier comprehension of the *unmarked* member can be attributed to the properties which characterise it. The fact that the *unmarked* term has zero expression in language, greater antiquity of current meaning as well as contextual neutralisation as characteristics points to the hypothesised ease of comprehension of this term. The *marked* term, by contrast, must be specified by the addition of something, either phonetically or semantically. Consequently, it should be a later acquisition in the development of language.

Not only do children have difficulty with *unmarked* and *marked* terms, but so also do adults. One argument which is frequently put forward to explain the ease with which people use and comprehend the *unmarked* member of relational pairs is based on the greater frequency of such terms. However, this argument is refuted to a certain exted by Huttenlocher and Higgins (1971). These authors state that there are a few *unmarked-marked* pairs in which the *marked* term occurs more frequently as reflected in the Thorndike-Lorge frequency count. A second reason they give to discount this argument is that *marked* terms are less frequent as a result of being negative and, therefore, more cognitively complex than *unmarked* terms. Consequently, Huttenlocher and Higgins favour a theory of cognitive complexity, based on the *markedness* of antonym pairs, to explain the comprehension difficulties which occur with such pairs.

H. Clark (1969, 1970a, 1976) and Flores D'Arcais (1970) also put forward theories on the comprehension of comparative sentences by adults which seem to be related to theorising in the area of children's comprehension of antonym pairs. H. Clark's theory is formulated in terms of three principles. *The Principle of the Primacy of Functional Relations* states that the simple functional relations, such as "subject of" and "object of" which underlie sentences are more readily available from memory than other, less basic kinds of sentential *marking*. His second principle, *The Principle of Lexical Marking,* asserts that certain positive adjectives are stored in memory in a less complex form than their negative counterparts. Finally, *The Principle of Congruence* holds that listeners can only retrieve from memory, information which is congruent at a deep level to the information they are seeking. It is with respect to the second principle that this theory has most application to the acquisition of relational pairs by children. It is stated that the positive or *unmarked* member of such pairs has two senses, a *nominal* and a *contrastive*. By comparison the negative or *marked* member has only a *contrastive* sense. According to

H. Clark, the *nominal* sense is stored and retrieved from memory more easily than the *contrastive* sense. He posits this as being the reason for the *unmarked* terms being understood more easily and earlier than the *marked* ones. This is also the reason why the meanings of the two terms are often confused.

On the other hand Flores D'Arcais (1970) deals exclusively with the comprehension of comparative sentences containing the forms *"more....than"* (C M sentences) and *"less....than"* (C L sentences). The former type of sentences are easier to understand than the latter. This is not due to the linguistic structure of such sentences, which is the same for both. Rather, it is the result of differences in what he calls the "focus of comparison" in these sentences. Flores D'Arcais states that C M sentences, those containing *more,* have the same grammatical subject and "focus of comparison". However, in C L sentences containing the term *less,* the "focus of comparison" and grammatical subject are different, and so such sentences are more complex. This argument leans heavily on the notion that linguistic ability is closely related to cognitive ability, and is firmly supported by experimental data from adult subjects. Such data were collected from Italian adults in two experiments on comparative sentences. For the first experiment subjects were required to recall comparative sentences of the form "N1 is (are) *more/less* A than N2", where N1 and N2 were nouns and A was an adjective. It was found that the subject and attribute were more easily recalled in C M sentences, whereas in C L sentences adjective or attribute and object were easier for subjects to remember. The second experiment involved subjects' judgments of the relatedness of content pairs in comparative sentences similar to those used in the first experiment. Such judgments were found to be closer for the subject and the attribute in C M sentences, whilst in C L sentences the object or complement was seen as being more closely related to the adjective. The results of both experiments underline and emphasize the validity of the impressionistic notion "focus of comparison" as an explanation of differences in the comprehension of C M and C L comparative sentences.

After this discussion of alternative theories to account for the asymmetry in adults' comprehension of antonym pairs or relational terms, children's asymmetrical acquisition will now be discussed. There are two theories currently put forward to explain the results obtained from the studies of such terms in children. These are those of E. Clark (1973c) and H. Clark (1970b, 1973).

The *Semantic Feature Theory* of E. Clark has been applied extensively in studying the child's acquisition of antonym pairs or *dimensional* adjectives. These terms are held to be confused in their meanings even when the child has many words in his lexicon which have full (adult) meaning for him. It is said that this confusion results from the many semantic features that such words have in common. They differ only with respect to one feature, that of *polarity*. Bierwisch (1970) has characterised such pairs in the following manner:

> "E1 and E2 are antonyms, if their meanings are identical except that the meaning of E1 has a component C where that of E2 had C^1, and C and C^1 belong to a particular subset of mutually exclusive components."
> (Bierwisch, 1970, p. 170)

It is not until children realise that the two antonymous terms differ as regards the pole (C and C^1) they designate, that they will be able to distinguish and so comprehend them correctly.

The *Semantic Feature Theory* holds that *dimensional* adjective pairs are composed of two types of semantic features: those which specify the dimension and those which denote *polarity* (positive or negative). On the basis of the notion of feature generality, E. Clark predicts that the *size* dimension will be acquired first. It is the most general and can be applied without restriction. The theory further postulates that the *dimensional* component of meaning is acquired before the *polarity* component. Only later is the *polarity* feature added. Here the hypothesis states that *polarity* will be acquired in the order *+Polar* then *-Polar*. Underlying this prediction is the child's perceptual preference or non-linguistic strategy to choose the object which has the greatest extent. Consequently, when applied to the area or conceptual domain of *dimensional* adjectives the *Semantic Feature Theory* makes three predictions:

(1) There will be an order of acquisition among *dimensional* terms. *Big/small* will be the first pair acquired.

(2) The positive *(+Polar)* or *unmarked* members of such pairs will be acquired before their negative *(-Polar)* or *marked* opposites.

(3) Initially children will confuse the meanings of members of these antonym pairs. Both members will be treated as possessing the positive polar meaning and the *dimensional* meaning or name.

It is important here to discuss how E. Clark has modified her initial theory to incorporate non-linguistic strategies. Such is the name appended to the response biases which children have been found to exhibit in comprehension studies. The existence of non-linguistic strategies has been found most clearly in the area of locative prepositions (E. Clark, 1973b, 1974, 1975, 1977b, 1979). These findings will be reviewed in detail later, but the main result is that non-linguistic factors, residing in the context, strongly affect children's comprehension of the locative terms *in, on* and *under*. As a consquence of such evidence E. Clark has reformulated her original theory to account for the effect of non-linguistic information on children's comprehension processes. This newer *Partial Semantics Hypothesis* states that children's word meanings are based on a combination of partial semantic knowledge and a non-linguistic strategy which is perceptually determined and contextually based. Such an hypothesis contrasts with E. Clark's earlier *Full Semantics Hypothesis* which predicts that the child has full knowledge of the earlier acquired members of antonym pairs or relational sets.

The *Partial Semantics Hypothesis* is favoured by E. Clark, who cites much research in the area of locative terms and spatial/relational terms to support it (E. Clark, 1980). Indeed this hypothesis ties in closely with her three stage model of the acquisition of *dimensional* terms:

Stage 1 : Only the name of the dimension is understood by the child (*partial semantic knowledge*).

Stage 2 : The child has acquired both the *dimensional* feature and the *+Polar* feature. This latter feature is acquired as a result of the child's perceptual preference (a non-linguistic strategy) for choosing the greater of two extents.

Stage 3 : Full meaning for both members of the *dimensional* pair has now been acquired. The child comprehends the *dimensional* as well as the $\pm$ *Polar* features.

H. Clark (1970b) studies The Primitive Nature of Children's Relational Concepts. To do this he looks at the nature of the *dimensional* adjectives which are the members of such relational or antonym pairs. H. Clark labels these antonym pairs as comparatives in his discussion. He states that the members of such pairs are polar opposites, one being positive or *unmarked* and the other negative or *marked*. This distinction is based on the fact that one member of the pair represents the presence of an attribute and the other its absence. The positive member of such pairs is said to have two meanings *nominal* and *contrastive*, whereas the negative member has only a *contrastive* sense. By *nominal*, H. Clark means that this term can be used in a "neutral" sense. It refers to or names the dimension, e.g. *length*, and can also be used neutrally in questions, e.g. *"How long is the board?"*, where it implies no expectation at all on the questioner's part. The positive member of a *dimensional* pair possesses this *nominal* sense together with a *contrastive* or comparative sense. In contrast, the negative member has only a comparative sense. Based on this discussion of the different senses of *dimensional* pairs, seen in terms of the possession or not of certain semantic features, H. Clark suggests three stages for the acquisition of relational pairs:

<u>Stage 1</u> : Both members of the pair are used in a *nominal*, non-comparative sense only.

<u>Stage 2</u> : At this stage it is assumed that the best exemplar of a dimension is an object with the most extent. Therefore, as the *nominal* term refers to extension, both members of a relational pair are used to refer to the extended end of the scale or dimension.

<u>Stage 3</u> : The child has learnt to distinguish the positive and negative members of the pair. Therefore, he has acquired the full meaning of both terms.

The above three stages closely parallel those put forth by E. Clark (1973c).

In a later article H. Clark (1973) examines in greater detail the role that perceptual characteristics play in determining when and how the child acquires the meaning of spatial terms. It is postulated that the child's acquisition of spatial concepts is based on his early knowledge of the world around him. This knowledge has been acquired through the processes of perception. Therefore, H. Clark agrees with E. Clark in citing the existence of a strong relationship between perceptual characteristics and the acquisition of word meaning in its earliest stages. This is seen clearly in his reference to "P-space" and "L-space". "P-space" refers to the child's own perceptual space in which the spatial terms are initially learned and laid down as concepts. "L-space" is the semantic organisation underlying the spatial terms of English which are based on a concept of perceptual space.

There is a close relationship between these two types of space. Indeed, for the child to apply a word he must have the appropriate concept in his "P-space". The close relationship between "P-space" and "L-space" is put forward strongly in the *correlation hypothesis*, which is the first of two hypotheses H. Clark posits to account for language and language acquisition. This hypothesis states that:

> "The perceptual features in the child's early cognitive development (his P-space) are reflected directly in the semantics of his language (his L-space)."
> (H. Clark, 1973, p. 30).

After discussing the properties of "P-space" and "L-space", purely in the geometrical terms of reference points, planes, directions and dimensions, Clark goes on to state the psychological implications of his theorising. With respect to the *correlation hypothesis* it can be said that the child must use his "P-space" if he is to learn the semantics associated with spatial words in the English language. This means that spatial terms whose rules of application refer to natural dimensions of "P-space" will be learnt more easily than those whose application rules do not. It also implies that the child will have difficulty with spatial terms if he does not possess their underlying concept in "P-space".

It is mainly H. Clark's second hypothesis, the *complexity hypothesis,* which makes it clear just how this theory can be applied to children's comprehension of relational terms. This hypothesis states that the rules of application of spatial terms constrain their acquisition order. A rule of application is defined as a provision which needs to be fulfilled if a word is to be used to refer to a perceptual event. On the basis of this hypothesis H. Clark predicts that the positive *(unmarked)* members of antonym pairs will be acquired before the negative *(marked)* members. This is because:

> "....the positive member specifies the assumed normal direction or relation, and the negative member specifies its direction or relation by negating the assumed one."
> (H. Clark, 1973, p. 55)

Consequently, the former term is seen as being cognitively simpler than the latter and so is easier to process and comprehend.

H. Clark further states that there is support for this idea being applicable to adjectives, directional prepositions, and relational prepositions, all of which possess the shared characteristic of being antonymous terms. A further extension of the *complexity hypothesis* enables H. Clark to predict the order of acquisition of locational and relational prepositions, as well as of spatial or *dimensional* adjectives. This last prediction is based on the notion of perceptual dimensions and their salience. Those terms that refer to fewer dimensions will be acquired before those that relate to many. One-dimensional terms are learnt earlier than two-dimensional terms which precede three-dimensional terms in acquisition. As regards the salience of dimensions, it is hypothesised that those terms referring to secondary dimensions will be learnt after those that refer to a primary dimension. Again, both of these predictions derive from the notion of semantic complexity as it is reflected in the features which characterise these terms.

Several criticisms have been levelled against *Semantic Feature Theory* by workers in the area of child language development. Nelson (1974a) criticises this theory on the grounds that it does not suggest processes which enable the child to organise individual semantic features into meaningful word units. Nelson states that the child does operate on semantic features at a cognitive level which lies between perception and language. However, E. Clark's theory is unable to account for this conceptual meaning which is independent of lexical items. Barrett (1978) further criticises the *Semantic Feature Hypothesis* by noting that two of its major predictions are not upheld when the child language acquisition data are examined closely. First Barrett states that not all semantic features are based on perceptual attributes. Some of the earliest features used by children have a functional basis as proposed by Nelson (1974a). Barrett further notes that some of the child's earliest words are underextended in use, e.g. the young child who only understood *shoes* to refer to these objects when in a particular location. Such underextension of words suggests that the first features associated with a word may be specific rather than general in nature as postulated by E. Clark. Keil (1979) further questions E. Clark's principle of the primacy of general over specific semantic features in the acquisition of word meanings. In the light of research on spatial adjectives Keil states the meaning of many features varies from object to object causing their initial acquisition to be idiosyncratic in nature. Such is the case for the term *tall* whose *polarity* feature is acquired before its *dimensional* feature, and which is used by children in a manner which is peculiar to particular objects.

Sinha (1979) also concludes that the *Semantic Feature Hypothesis* is inadequate as an explanation of child language development. She rejects this theory in favour of the *Functional Core Hypothesis* as elaborated by Nelson (1974a) and further characterised in Rosch's (1973) notion of "prototype" or "best exemplar". Sinha observes that words are encoded as sets of features that cohere together at the level of functional similarity. She states this most clearly in her rejection of the *Semantic Feature Hypothesis*:

> "....human beings encode objects not as abstract feature lists but as stable complexes of features clustered around a level of abstraction at which there exists a maximal functional similarity between the instances of the object class."
> (Sinha, 1979, p. 15)

Both Palermo (1978) and Richards (1979) cite experimental evidence which has failed to support one or more of the predictions of the *Semantic Feature Hypothesis*. The first principle called into doubt is that of the overextensions of early object names. Whilst such overextension has been found in productive speech it is rare in studies of the child's comprehension during this same period. Indeed, it seems probable that the overextensions observed in children's early speech data reflect their use of the limited number of words they have for expressing concepts. To communicate, they use the word in their productive vocabulary which best fits the situation. Therefore, such overextension is not due to lack of comprehension but rather to the small number of words in their productive lexicon. Palermo and Richards have also noted the lack of support for two of E. Clark's other major predictions. The first of these is that *unmarked* or positive terms are learnt before their negative or *marked* counterparts. The second states that at some time during the course of their acquisition, the members of an *unmarked-marked* pair are treated as synonyms, both being assigned the *unmarked* meaning. Each of these predictions has failed to receive support from subsequent developmental studies, and so the validity and generality of E. Clark's theory is again questioned. The *top-to-bottom* hypothesis is the only principle to receive consistent verification according to Richards (1979). In hierarchically organised lexical domains acquisition order occurs from the top of the hierarchy downward. However, even the corroboration of this principle is qualified by being limited to the field of *dimensional* adjectives which characterise spatial reference.

In conclusion, it can be stated that *Semantic Feature Theory* offers an explanation of child language development which can be tested in a formal situation. The nature of the predictions formulated by this theory enables systematic research to be conducted which will either confirm or disconfirm them. There is evidence both for and against the earlier acquisition of the *unmarked* members of antonym pairs. However, the applicability of the *markedness* concept to the relational pairs in language has not been questioned, and so remains a viable distinction to test. For, it is important to discover if there is an asymmetry in the acquisition of antonym pairs, and if so what is the form or direction of this asymmetry. A further relevant attribute of this theory is the differentiation of words into units of meaning labelled as semantic features or components. Such features are held to characterise word meaning for adults and are what children must acquire. The postulation of these semantic components enables developmental predictions to be made regarding the acquisition of relational or antonym pairs. However, again the research on these pairs has yielded contradictory findings as to whether the *dimensional* or *nominal* feature is learnt before the *polarity* feature. Nevertheless, the characterisation of words as being composed of semantic features is a viable proposition to test and can produce interesting results when studied in the area of child language development.

It is mainly in the area of the predicted basis of these semantic features that *Semantic Feature Theory* is most difficult to test. Both E. Clark (1973c) and H. Clark (1970b, 1973) state that semantic features are derived from the child's early percepts. However, this notion has been heavily criticised by two researchers who see word meanings as having a functional basis (Nelson, 1974a, and Sinha, 1979). For these latter workers, word meanings are composed of tightly organised functional concepts and not lists of features as postulated by E. Clark. Nelson and Sinha see the function of objects in the environment as being important in the determination of word meaning by the child. For them, perceptual attributes or features have little or no place in the child's early comprehension of language. Thus, they directly contradict E. Clark's hypothesis that the basis of early word meaning lies in the perceptual attributes of objects. Furthermore, this contradiction has led to a wealth of research and theorising which has culminated in the postulation of *Prototype Theory* as an alternative explanation of the comprehension of lexical terms.

1.1.2 Prototype Theory

Prototype Theory is one of the two theories currently offered as an explanation of the language acquisition process. However, this theory concentrates mainly on the early concepts of the child which are said to underlie language, or words. The general focus of most workers in this area has tended to be on the concepts which are the basis of the child's first terms of reference, that is, the very earliest stages of semantic development. *Prorotype Theory* does not concentrate on words per se, as do *Semantic Feature Theories*, and consequently a direct comparison with these latter theories as regards antonym pairs is not possible. However, a discussion of this theory enables a conceptualisation of how it may be applied to opposites as an explanation of their acquisition and of the development of the antonymous relationship in childhood.

At present, the main proponents of *Prototype Theory* are Palermo (1978), Nelson (1974a) and Rosch (1973). Each of these theories will be considered in turn, and the major emphasis of their approaches will be discussed. Research work on both child and adult subject populations which is relevant to *Prorotype Theory* will also be reviewed. Lastly, Bowerman's (1978b) proposal of a possible amalgamation of *Prototype* and

Semantic Feature Theories as explanations of language acquisition will be examined.

Palermo (1978) encapsulates the conceptual basis of *Prototype Theory* by stating that "meanings or ideas consist of prototypic concepts" (p. 244) as well as the relation between such concepts and their existence in space and time. For Palermo there are two different types of prototypes, conceptual and relational. The former are the concepts which underlie nouns whilst the latter are those which underlie verbs. Relational prototypes also perform the function of relating conceptual prototypes to each other. These prototypic concepts are held to consist of a central core which extends to vague boundaries. The examples included within a particular concept vary in their degree of similarity to the core meaning and to one another. Each prototype consists of three components, perceptual, functional, and emotive, which although isolated at a conceptual level nevertheless exist as a unitary whole in the prototype.

Having delineated the essence of prototypical concepts Palermo then discusses natural and acquired prototypes. The former are held to exist in the environment and to be based on natural dimensions, e.g. colours, geometric forms. As such they are relatively stable over time and change little with experience. On the other hand acquired prototypes derive from objects and events which are partly classified on the basis of natural dimensions and partly on the basis of acquired distinctions which exist in the environment and with which the child must deal. Consequently, these latter prototypes are subject to change over the developmental period as the child's experiences vary and widen.

For Palermo, language acquisition requires that the child acquire the syntactic rules and words for representing the prototypic concepts he already has. The child must discover from his language community how to express the concepts he already has in his possession. As the basis for these concepts is prototypic, then it follows that word meanings will also have a prototypic base. Word meanings will consist of a central core with a vague periphery. It is this peripheral region which differs between children and adults especially for acquired concepts and results in different prototypes for the two age groups. However, Palermo holds that it is not the concepts of children and adults which differ greatly, indeed they may be the same, but rather how the complexity of relationships into which they can enter is conceptualised. Therefore, language acquisition consists of the development of an understanding of the complexity of relationships into which concepts may enter, and not a change in the concepts themselves.

Rosch (1973) states that most natural categories are highly structured internally with boundaries which are less well-defined. This internal structure means that:

> "....categories are composed of a 'core meaning' which consists of the 'clearest cases' (best examples) of the category, 'surrounded by other

> category members of decreasing similarity to that core meaning."
> (Rosch, 1973, p. 112)

The core meaning of the category can be likened to a prototype around which examples of the category group along dimensions of similarity. Those examples which are best instances of a category will be very close or central to its core meaning (prototype), whilst the examples which are on the periphery of the category will be the worst instances of that particular category. For Rosch, the structure of categories can be assimilated to that of natural language concepts. Such concepts are seen as being composed of a central prototypic core of best exemplars surrounded by instances of decreasing similarity to that core.

With respect to the development of word meaning, Rosch holds that children initially use the tangible "clear cases" of a category to define it rather than any abstract criterial features. For children, their concepts are initially composed of only the central instances of the corresponding adult concept, that is, the prototypic core. Only with development do the children's concepts expand to include the more peripheral instances. Since such concepts are said to form the basis of word meanings, it can be concluded that the latter are originally restricted in form to a central exemplar. Only as development progresses do children become capable of categorising peripheral members as instances of a concept, or word.

The research conducted by Rosch (1973) defines the characteristics of such categories. For the perceptual categories of colour and form, she found that the concept of internal structure had validity. The adolescent Dani subjects used in this research found it easier to learn colour and form categories in which a core exemplar was present. These subjects also learnt the core exemplar of such categories with greater ease and for the form category identified the assumed natural prototype as being the most representative member of the category. Her research into semantic categories, an offshoot of that on perceptual categories, demonstrated that adult subjects do find it a meaningful task to answer questions about the degree of similarity of category members to a central core. Rosch also found that both children and adults responded more rapidly to sentences of the form, *"An x is a y"*, when *x* was a central rather than a peripheral member of *y*. For example in the fruit category responses were quicker to the sentences *"An apple is a fruit"* than to that which stated *"An olive is a fruit"*. Based on frequency norms *apple* is a central member of the fruit category whereas *olive* is an example which falls at the periphery of this category. In addition to a quicker response time on the latter tasks, child subjects were found to make more errors when *x* was a peripheral and not a central member of the semantic category.

Rosch (1975) conducted a series of experiments to look at the nature and structure of semantic categories as well as to discover the form the mental representations of semantic categories might take. In the first of these experiments, Rosch found that for her adult subjects semantic categories do have internal structure. Such subjects found it meaningful to rate the members of superordinate categories with respect to their typicality. The remaining experiments used the priming technique to discover the nature of the cognitive representation of these superordinate categories. In these experiments subjects had to classify pairs of stimuli from 9 superordinate categories, as either "same" or "different". The stimuli for each task were either words or pictures of high-, medium-, and low-rated members of these 9 categories, which were preceded in presentation by a prime, a category name, or nothing. It was found that this prime only facilitated performance for good category members. Even this effect was reduced for word stimuli when the time interval between the prime and presentation of the stimulus pair was shortened. On the basis of these experiments Rosch made the following major conclusions with respect to the cognitive representations of semantic categories:

> (1) These representations are more similar to good than poor examples of the categories.
> (2) The perception of the meaning of pictures and words is, "....in the form of an abstract ordered set of inclusion probabilities of the meanings of the members of the category with the probabilities ordered according to the internal structure of the category."
> (Rosch, 1975, p. 226)

(3) There is more to the representation of superordinate semantic categories which cannot be simply coded in terms of the meaning of words and pictures. This underlying representation may take the form of an abstract set of items whose associated probabilities can reflect the category meaning. However, Rosch does not clearly define this representation and so a more rigorous explanation of its form is not possible.

Rosch and Mervis (1975) conducted a series of 6 experiments to examine one of the structural principles thought to govern the formation of prototypes in semantic categories. Their basic hypothesis was that category members are seen as prototypical of a category in relation to the number of attributes they have in common with other members of the category. This notion of attribute overlap amongst category members is referred to as "family resemblance" by Rosch and Mervis. Such an hypothesis was related to the model of cue validity where frequency of a cue within a particular category as well as contrasting categories defines its validity. In these experiments, adult subjects had to list attributes of members of categories, superordinates, and attributes of contrasting categories, as well as learn artificial categories. The results confirmed the hypothesis that cue validity is related to prototypicality. Therefore, it was concluded that "family resemblance" is an important factor in prototype formation. The exemplars of a concept have a "family resemblance", with peripheral members having little in common with one another, and commonality increasing towards the central core or prototype.

Nelson (1973, 1974a) in her discussion of language acquisition concentrates upon the earliest stages of referential meaning, when the child is aged between 12 and 24 months. She is concerned with this very early stage of conceptual and semantic development, and how the child learns to relate language to the conceptual knowledge he already possesses. For Nelson, conceptual knowledge precedes semantic knowledge in the development of the child, and is the base to which he must learn to attach the language of his community. Therefore Nelson (1974a) focuses upon the development of the concepts which underlie the child's early speech forms. These natural language concepts do not have well-defined boundaries. Instead they are seen as being "fluid, open and prototypical" (Nelson, 1974a, p. 274). Consequently they can be related to Rosch's (1973) discussion of internal structure. Indeed, as noted by Sinha (1979), Rosch's notion of a prototype or best exemplar characterises the essence of the *Functional Core Hypothesis*.

Nelson (1974a) states that concepts are formed by two processes, categorisation followed by identification of common attributes. This categorisation involves a synthesis of the functional relationships into which an object can enter, and forms the basis of the child's early concepts. For the young child variation is salient. Therefore, his first ideas about an object which become incorporated into his concept of that object will be based on actions and changes in state. The function of objects is held to be the primary basis for their categorisation. This is amply demonstrated in an experiment by Nelson (1973). Here, child subjects, between 12 and 24 months, were required to choose a "ball" from among 10 objects. These objects were rated along the dimensions of *Form* and *Function* for their similarity to a "ball" by 16 adult judges. The objects used in this study were similar in form only (e.g. a heavy black ball of hard plastic) or function only (e.g. a small soft rubber football) or unlike in both form and function (e.g. a small frisbee) to a rubber ball which was used as a standard. Initially, the child made 5 choices from the set, and then, after a period of free play with the objects, made another 5 choices. The results conclusively proved that when children were able to manipulate the objects, function became a more potent force in the identification of the "ball" than form.

Nelson sees the development of a concept as being composed of four processes. First, the object is identified as such. Next, the child identifies the important relationships into which objects may enter and assigns entities to an organised cognitive concept on the basis of their functional relations. Thirdly, new instances of the concept are classified by noting their relationship to the hierarchy of identificational attributes derived from the functionally salient characteristics of the objects already included in the concept. Lastly, the child attaches a name to the already formed concept. Therefore, functional information is the first component of the concept which children acquire and forms the core of the concept. This functional core derives from the various relationships and acts into which the objects forming the concept can enter. For Nelson (1978):

> "....function [is] at the core of the child's object concepts, with identificational or property knowledge a subsidiary, more peripheral component, necessary for the identification of objects, but not essentially definitional."
> (Nelson, 1978, p. 63)

As a result of this functional core the difference found between child and adult concepts has been found to be smaller than previously thought. Both children and adults begin the process of concept formation with a functional core. Identificational features are added to this core when it is necessary to classify new instances. Indeed, Nelson stresses the importance of the functional core by hypothesising that it is what children and adults look for when learning a new word.

Language is said to develop from this functional core. Verbal labels are held to be well formed from the outset. All that is required of the child is the appending of a word to a concept with a well-formed functional core. Therefore, the word is ultimately defined by the core meaning of the concept. However, concepts can change over time and may vary from context to context. As a result, to learn the meaning of a word the child must learn to "match his own core concept meaning to the narrow linguistic concept" (Nelson, 1977, p. 132).

The child must rearrange the information in the functional core so that it is now composed of object specific functions, with abstract markers for the other general relationships into which it may enter. This differentiation of general and specific information in the functional core enables the child to use words only with their socially agreed upon definition. As such, it is a development which comes after the initial word learning phase.

Nelson (1974b) conducted an experiment to investigate the characteristics of young children's conceptual categories in long-term memory. Rosch's (1973) theory suggests that such concepts have a strong central core. The experimental subjects, 63, 5:0 year olds and 68, 8:0 year olds, had to state all of the things which belonged to 9 categories, e.g. furniture, clothes, tools. One of the major findings was that all subjects tended to agree amongst themselves on typical category members. This was reflected most clearly in the furniture category which was found to have a central, well-defined core in both age groups. Nelson also reported that subjects relied on functional, and not perceptual or abstract definitions for these categories. A reflection of the importance of functional information in the formation of categories. With development, it was found that the category boundaries became more defined due to the structuring and expansion of the already existent structures. For older children the categories were more strongly articulated and organised into hierarchical form. These results are seen as a reflection of the category growth process postulated by Rosch (1973).

In contrast to the results of the above experiment, Saltz, Soller and Sigel (1972) found that the concepts of young children are narrow and fragmented. By contrast Nelson (1974b) reported that such concepts were wide and unbounded. In their experiment, Saltz et al. (1972) tested children's ability to classify 72 pictures under 6 concept labels. The three age levels studied were 5:0 to 6:0, 8:0 to 9:0, and 11:0 to 12:0 year olds. For the purpose of analysis, core items were defined as those chosen by 75% or more of children and non-core items were those chosen by less than 75%. One major finding was that younger children used concepts as referring to one small aspect of the meaning used by older children. The younger children's concepts were also composed of all the characteristics, whether relevant or irrelevant of their initial contact with the concept. From these results, Saltz et al. concluded that conceptual development consists of the integration of fragments and that young children's concepts rely heavily upon perceptual attributes. Both of these conclusions are at variance with Nelson (1974b). However, despite these differences, both experiments did discover the existence of a strong central core in children's concepts, thus lending credence to the prototype view of concept formation.

Anglin (1977) tends to disagree with Nelson's (1974a) view as regards the well-formed nature of verbal labels. For Anglin word meaning is not well-formed for the child in the beginning. This results from the lack of coordination between *intension*, the properties which define a word or concept, and *extension*, the exemplar objects of a concept or word, in the child's concepts. The child has not yet organised these properties or exemplars into a coherent whole for a word or concept. However, Anglin does agree with Nelson in stating that prototype-like mechanisms are important in the child's categorisation of the world through language. Nevertheless, unlike Nelson, Anglin sees these prototypes as being equivalent to perceptual schemata. Children categorise objects on the basis of how they conform to the typical form and not function of the stored prototype.

Barrett (1978) criticises the *Functional Core Hypothesis* on the grounds that word meaning must contain both perceptual and functional information which serves to determine its extension, and not merely functional information as postulated by Nelson (1974b). Nelson (1979) counters this argument by asserting that the functional core contains many varied dynamic relations. As such, it was posited to integrate the perceptual and semantic aspects of early concepts and not to separate them.

Sinha (1979) offers a model for conceptual development which extends Nelson's (1974b) notion of functional core concept. In this model functional core concepts are held to be pre-prototypical. Once they are formed, they must be supplemented by rules which allow prototypes to be adequately specified. These prototypes are also subject to analysis as soon as they are formed and as a result are decomposed into their constituent features. It is the isolation of perceptual knowledge from the procedural functional core which enables "propositional knowledge" (a later acquisition) to develop. Again, the emphasis in this model is on a conceptual core which organises meaning and is the basis of the semantic system.

In conclusion, *Prototype Theory* offers an explanation for the semantics of language which relies heavily on the notion of cognitive concepts. Such concepts are said to be composed of a strong central core with vague boundaries. The examples which exist in this core are held to be the best instances of the concepts, whilst those occupying the vague boundaries of the periphery are the worst exemplars. Objects are organised into these concepts on the basis of similarity of attributes. Those objects which have many characteristics in common form the tightly organised and structured central core. For the poor exemplars of a concept, the structure is less well organised. Indeed, these objects form the ill-defined boundaries where attributes are common to members of not one but several concepts. The basis on which these concepts are initially formed is held to be functional (Nelson, 1974b). Objects are classified into concepts on the basis of the functions they perform rather than the perceptual characteristics they possess. Therefore, according to Nelson, concepts are composed of a strong functional core. However, regardless of the basis for the formation of this conceptual core the important point to make with respect to *Prototype Theory* is the existence of this core. It is this central core with its vague boundaries which defines a prototype. This internal structure is said to characterise the concepts which underlie word meaning and affect child language development. Consequently, *Prototype Theory* offers an alternative explanation to *Semantic Feature Theory* for language acquisition. It sees language development as the learning of conceptual wholes rather than feature lists. It is the central cores which compose these concepts which the child first learns in acquiring word meaning. Only later does he come to grasp the structure of the ill-defined periphery of such concepts. In contrast, *Semantic Feature Theory* sees language acquisition as consisting of the learning of semantic features. These are added to word meaning by the child as they are learnt so that eventually his feature list coincides with that of the adult.

Bowerman (1978b) envisages a synthesis of *Prototype* and *Semantic Feature Theories* as necessary to explain the language acquisition process. In this article Bowerman discusses the acquisition of word meaning by an analysis of the spontaneous speech data of two young children. From the <u>complexive</u> word usage of these children she concludes that early word meanings do have a prototype structure. This usage is characterised by a set of variations around a prototype composed of central instances. For example, one child learnt the word *moon* in reference to the real moon, the prototype, but later extended its application to such objects as a lemon slice, the dial on a dishwasher, a shiny leaf, a D-shape, and hangnails. For the complexive categories in the data, the prototypical referent was present initially and was the core around which the category developed. This development occurs as a result of the child subjecting the prototypical referent to a featural analysis. Consequently, the child is capable of recognising the prototype's attributes in isolation. New referents come to be included in the category on the basis of their possession of one or more of these attributes. The features which compose a prototype must be further considered because in early word usage they vary in their centrality or importance in a child's concepts. Both of these findings, feature analysis and variability, suggest the importance of analysing prototypes into their featural components if an adequate account of early word meaning is to be found. Rosch and Merviś (1975) also state the importance of considering the features or attributes which comprise a prototype. For items vary in the degree to which they are prototypical members of a category, and such variation is reflected in their featural commonality.

The possible amalgamation of *Prototype* and *Semantic Feature Theories* suggested by Bowerman (1978b) offers a viable alternative explanation of language acquisition. Such a model seems to capture the essence of word meaning for adult speakers. For such meaning is conceptualised in terms of whole units rather than individual features. However, adults are aware of the featural composition of such units. These features are relevant if the acquisition of word meaning is to be discussed and also if the extension of words outside their usual boundaries is to be dealt with. It is these features which compose the central prototype which the child must acquire if he is to both adequately produce and comprehend the language of his community. Furthermore, the child must come to grasp those features which exist at the periphery of the central core so that he can understand the application of the word to new instances or objects. Consequently, a prototypical model composed of features which the language user can recognise and use seems to be a model which may be appropriate as an explanation of language development.

CHAPTER 2.

RESEARCH ON THE SEMANTICS OF ANTONYM PAIRS

The theoretical models described by *Semantic Feature Theory* and *Prototype Theory* generate many testable hypotheses. Much of the empirical work thus generated has concentrated on terms incorporating antonymic relationships. The following chapters will review such studies in the light of predictions made by the *Semantic Feature Theory*. The evidence for and against each of the predictions will be considered for words in particular lexical domains. This will lead to a discussion of the issue of contextual constraints, specifically linguistic, and their effect on meaning. The importance of the school age child's increasing understanding of the effect of verbal context will also be examined.

2.1 ACQUISITION OF THE ANTONYM RELATIONSHIP

Three studies have been undertaken concerned with the child's acquisition of the antonym relationship. These studies were conducted by E. Clark (1972) and Heidenheimer (1975, 1978). The results of the latter studies were contrary to those found by E. Clark.

One of the major questions asked by E. Clark (1972) concerned the child's ability to recognise the relationship among words in semantic fields. Her experimental subjects were required to supply the "opposite" of words from the two semantic fields of *dimensional* and *spatio-temporal* terms. On the basis of her results, E. Clark concluded that semantic fields are set up early by the child. Indeed, semantically related words are grouped even before children have full knowledge of the meaning of such words, indicating that terms from these two semantic fields are learnt as pairs and not as single items.

However, Heidenheimer (1975, 1978) has challenged this conclusion on the basis of the results of two research studies. Heidenheimer (1975) gave her 80 experimental subjects a word association task with 15 common adjective pairs as experimental stimuli. She found that children responded with a negation of the stimulus word, for example *not big*, prior to producing the antonym response. Therefore, Heidenheimer concluded that each member of an antonym pair is learnt as a single lexical item before the contrasting relationship, which associates the terms as a pair, is acquired. In her later study, Heidenheimer (1978) found that 6:0 and 10:0 year old children learnt the antonym response before the synonym response in semantic fields. This evidence is in conflict with E. Clark's (1972) proposal that semantic fields, characterised by commonality of features, are well organised even in young children.

The results of these studies clearly support the notion that the antonym relation is well-established in children by 6:0 years of age. However, they differ with respect to how semantic fields are established and organised by the child.

2.2 ORDER OF ACQUISITION OF ANTONYM PAIRS

The *Semantic Feature Theory* predicts that in an hierarchically organised lexical field the semantic features will be acquired in the order from general to specific or *top-to-*

bottom (Richards, 1979). The more general terms comprising such semantically related fields will be acquired before the more specific where degree of generality is defined in terms of semantic features.

For *dimensional* adjective pairs this featural analysis has been widely researched on the basis of extensive theorising (Bierwisch, 1967; H. Clark, 1973). In the hierarchy of *dimensional* adjectives, the term *big* includes the meaning of the other terms in the hierarchy. *Big* is semantically less complex as it requires fewer conditions for its application, that is, it is specified by more general semantic features. The meanings of the other *dimensional* adjectives are more complex semantically because they require additional features to specify their conditions of application. Table 2.1 illustrates the featural analysis of these pairs based on Bierwisch (1967) and elaborated by E. Clark (1973c) and H. Clark (1973).

TABLE 2.1. Featural Analysis of Dimensional Adjective Pairs.

DIMENSIONAL PAIR	FEATURE LIST
Big/Small	*n-Space*
Tall/Short *High/Low*	*1-Space* *+ Vertical*
Long/Short	*1-Space, - Vertical*
Wide/Narrow *Thick/Thin* *Deep/Shallow*	*1-Space* *- Vertical* *+ Secondary*

In this table the *Space* feature specifies the number of dimensions a pair can refer to, whilst the other features, ± *Vertical* and ±*Secondary*, further particularise the direction and salience of the dimension indicated by a specific pair. This analysis demonstrates that *big* is the more general term and that specificity increases for the terms below it in the table. *Wide, thick* and *deep* possess the greatest semantic complexity because they require the specification of a secondary dimension which is less perceptually salient than the primary vertical dimension. Consequently, the predicted order of acquisition is *big* before *tall, high,* and *long*, and lastly *wide, thick,* and *deep.*

In the area of *spatio-temporal* terms there are fewer systematic relations existing among the pairs. Therefore the prediction of order of acquisition, based on the notion of semantic complexity, is more difficult. However, H. Clark (1973), using his conceptualisation of prepositions as positional and relational, postulates that *in* and *on* should be acquired before *above, over, ahead*, and *in front of* because they are semantically less complex. E. Clark (1972) agrees with this prediction and also states that *up* is simpler than *over* and *above* as it can only specify direction on the vertical axis. Furthermore, *in front of* is held to be simpler than *before, first,* and *early* because the latter are the temporal terms whose spatial basis is *in front of*.

Having discussed at some length the order of acquisition of antonym pairs, the studies which have been done in this area will now be examined.

E. Clark (1972) looked at the question of order of acquisition within both *dimensional* and *spatio-temporal* semantic fields. Her results confirmed the predicted order of acquisition for each of these fields, as illustrated above, based on the notion of semantic complexity. Indeed, the generality of the pair *big/small* was indicated by its frequency of substitution for other pairs in the *dimensional* field.

Several other studies have been conducted to look at the order of acquisition of pairs within the field of *dimensional* adjectives. All of these have been unanimous in their consistent finding of an order of acquisition based on the semantic complexity of these terms.

Donaldson and Wales (1970) studied young Scottish children's comprehension of the pairs *big/wee, long/short, thick/thin* and *high/low*. These pairs were studied in both their superlative and comparative forms. Their results indicated that responses to the pair *big/wee* were generally superior to those given to other pairs when three dimensional objects were used as stimuli. Wales and Campbell (1970) further analysed this data to look at longitudinal effects. Their analysis yielded the predicted order of acquisition with the pair *big/wee* being first, and led them to conclude:

> "that semantic development proceeds initially from 'indifferentation' of the members of a set of related terms or constructions to *complete* differentiation."
> (Wales & Campbell, 1970, p. 394)

This again underlines the postulation of a general to specific acquisition order (E. Clark, 1973c).

Four other studies (Eilers, Oller & Ellington, 1974; Brewer & Stone, 1975; Bartlett, 1976; Smith, Johnston & Coop, 1979) have investigated the order of acquisition of *dimensional* adjectives by conducting experiments on children's comprehension of such pairs. The pairs commonly used in such experiments are *big/small* or *little, long* or *tall/short*, and *wide/narrow*. Experimental subjects are generally of preschool age, and their task is to choose an "*x one*", where *x* is one of the *dimensional* terms, from an array of objects which vary on predetermined dimensions. All studies have been consistent in finding superior performance on the pair *big/small* or *little*, and a decreasing performance on pairs as they become less general. The order of acquisition was also continually found to be *big* before *tall* before *wide* as was predicted. Such results support E. Clark's (1973c) theory as they indicate that children initially acquire broader, more general meanings. Only as they mature do they come to understand the more specific meanings as is demonstrated by better performance with increasing age.

E. Clark .(1980) studied the non-linguistic strategies pre-school children use in the acquisition of *top, bottom, front,* and *back*. The results of her two experiments showed that there was an acquisition order of *top* before *bottom* and lastly *front* and *back*. Furthermore, this acquisition order was determined by the existence of two non-linguistic strategies. These were the preference to choose the topmost or upper surface of an object, and the perceptual salience of the vertical over other dimensions.

2.3 COMPREHENSION OF SINGLE TERMS

Research work which has looked at the acquisition of single terms has shown the earlier acquisition of the more general features before the more specific as predicted by E. Clark (1973c). Much of this work has been concentrated on the antonym pair *big/little*.

Cook (1976) investigated the acquisition of semantic features based on the perceptual characteristics of *Area* and *Extension* for the words *big, long,* and *little*. The results obtained demonstrated the existence of a six stage model of development where more general features (*Area*) are used before more specific ones (*Extension*). This same developmental sequence was also found for subject populations of Down's Syndrome and gifted children.

Maratsos (1973, 1974) also conducted studies to examine the preschool child's acquisition of the word *big*. In his first study, Maratsos (1973) found that 3:0 year olds defined *big* by reference to overall size whereas children over 4:5 years used the vertical dimension in their definition of *big* and, as a result treated this word as meaning *tall*. Maratsos (1974) further emphasised the increasing use made of the vertical dimension by preschool children when defining *big*. Children were tested for their comprehension of *big, tall*, and *high* in a series of experiments. The results indicated that with age the notion of "top-point" had an increasing influence on children's definitions of these terms. Consequently Maratsos concluded that as children grow older "top-point" acquires greater salience as a perceptual categorisation. This conclusion corroborates both his earlier results, and the postulation of the salience of the vertical dimension in children's comprehension of spatial terms by H. Clark (1973) and E. Clark (1973c; 1980).

Several studies, however, have reported data which seem to contradict the child's initial reliance on an overall size cue for the meaning of *big*. These studies have noted the child's early dependence on one dimension only when defining *big*. Despite these differences though, all have still found the salience of the vertical dimension in young children's comprehension of this *dimensional* term.

Bausano and Jeffrey (1975) found that their 2:0 and 3:0 year old subjects used the most salient cue (width or height) in their judgments of the *bigness* of stimulus objects. Lumsden and Poteat (1968) and Bartlett (1974) have also noted the importance of the vertical dimension in young children's concept of *big*. Both research studies found that children relied on the vertical dimension when choosing the "*bigger one*" or "*big one*" from an array of stimuli. Lumsden and Poteat further found that their adult subjects took longer to respond because they relied on a notion of "areal expanse" in making their choices. Such a finding was seen as evidence of a developmental progression from a specific, one dimensional to a more general, multidimensional definition (contrary to E. Clark, 1973c).

Finally, Layton and Stick (1979) provide experimental evidence which indicates the productive priority of *big* in the relational terminology of children. Their data, when examined for substitutions, indicated that the first primary lexical item used for any comparison was *big*. This result mirrors the earlier acquisition of *big* reported in comprehension studies and as predicted by E. Clark (1973c).

The results of the above studies support the priority of *big* in both comprehension and production. However, they fail to agree on the basis of the word meaning of *big* and its development. Some reported a general to specific progression, whilst others found that the broader, general meaning develops out of an initial specific one based on one dimension only.

2.4 COMPREHENSION OF COMPARATIVE TERMS

2.4.1 *More/Less*

The theoretical explanations put forward to account for children's understanding of the comparative pair *more/less* will be discussed first. Then a review of the research done in this area will be presented with an emphasis on the studies which have confirmed as against those which have failed to confirm the *Semantic Feature Hypothesis*.

H. Clark (1970b, 1976) states that there is a three stage developmental sequence in children's learning of *more* and *less*. He characterises these stages in terms of the meanings associated with the *unmarked (nominal* and *contrastive)* and the *marked (contrastive)* terms. In stage one children only understand the

the *nominal* sense, here both terms are treated as if they mean "a quantity of" or "some" (see also Brush, 1976). At the second stage, the child treats both terms as referring to the extended end of the scale. As it is only the *nominal* term *more* which refers to the extended end of the scale, the *unmarked (more)* and *marked (less)* terms are now treated as synonyms. In the final stage, children fully understand the meanings of both terms and can use them in their complete contrastive sense.

E. Clark (1973c, 1977b) also characterises the child's acquisition of *more* and *less* in terms of three developmental stages. She does this by discussing the components or features which characterise the meanings of *more* and *less*, and which the child must acquire before he gains full understanding of these terms. For E. Clark, the first meaning component attached to *more* and *less* is *(+Amount)*. At the next stage the child procures the feature *(+Polar)* for the word *more* and generalises this to also refer to *less*, which he knows contains the feature *(+Amount)* as does *more*. It is only at the final stage that the child acquires the feature *(-Polar)*. He learns that *less* refers to the opposite end of the dimension, and so he can correctly differentiate the two terms.

E. Clark calls this her *Full Semantics Hypothesis* and contrasts it with the *Partial Semantics Hypothesis* (E. Clark, 1973b, 1975, 1977b), which realises the importance of non-linguistic strategies in the child's acquisition of word meaning. This latter hypothesis proposed that initially the child has only partial lexical entries for *more* and *less* characterised by the feature *(+Amount)*. At this time he also possesses a non-linguistic strategy, based on his perceptual preference for choosing the greater of two amounts. Consequently his early comprehension of *more* and *less* is determined by the combination of this non-linguistic strategy with his partial semantic knowledge, which means that at some stage in their acquisition *less* is treated as a synonym of *more*.

Experimental studies which have found that children treat *more* and *less* as synonyms at some stage during language development have been conducted by Donaldson and Balfour (1968), Donaldson and Wales (1970), Palermo (1973, 1974), and Holland and Palermo (1975). These studies have used both discrete and continuous substances to look at the comprehension of *more* and *less* by 3:0 and 5:0 year old children. All have been consistent in finding that:

(1) *More* is understood before *less*.

(2) *Less* is treated as a synonym of *more* before it is fully understood.

The former finding has also been replicated by Estes (1976), Pike and Olson (1977) and Olson and Nickerson (1978). All of these studies found that *more* was easier to comprehend than *less* for young children. (Estes, however, used the terms *more* and *fewer* in a variety of stimulus contexts). The former two studies attributed this difference to perceptual rather than linguistic difficulties. Estes (1976) saw this as evidence of a response bias for greater magnitudes, in line with H. Clark (1970b). However, Pike and Olson (1977) stated that this difference was due to the mental representations of young children being in the form of perceptual features rather than the contrasts which exist between the terms of a semantic field.

As regards the second finding of the synonymity of *more* and *less*, Holland and Palermo (1975) concluded that this confusion is superficial in nature because children can be taught to discriminate *more* and *less*. Such confusion results from a response bias to choose the greater of two extents and is evidence that the child's responses are due to:

> "....the complex interaction between language and its context in determining the interpretation of task demands...."
> (Sinha & Walkerdine, 1978, p. 369)

Research by Harasym, Boersma and Maguire (1971) also provides evidence for the confusion of *more* and *less* at some stage during their acquisition. Their major finding was that non-conservers, in the Piagetian sense, do not appear to distinguish *more* and *less* on a semantic differential rating task. However, unlike Palermo (1973) they found that it is the *more* profile which changes with age and not the *less*, which remains stable. Such a finding seems to support the conclusion that it is the meaning of *more* which is confused with that of *less*, and not the reverse as predicted by the *Semantic Feature Hypothesis*. Further contradictory evidence has been provided by O'Dowd (1980) in a similar semantic differential study which failed to find any developmental trends in the profile differentiation of *more* and *less*.

Studies which have reported contrary findings in this area have mainly questioned the validity of the conclusion that *less* is treated as a synonym of *more*. However, some have also called into doubt the priority of *more* in the acquisition of this word pair. Griffiths, Shantz and Siegel (1967), Harasym et al. (1971) and Schwam (1980) have all reported evidence supporting the prior acquisition of *less*. Griffiths et al. (1967) found that young children used *more* and *less* with equal probability when solving conservation problems in the areas of number, length, and weight. Further Harasym et al. (1971) concluded from their study into the relationship between quantitative terms *(more/less)* and conservation ability in grade 1, 2, and 3 children that their subjects were more capable in their use of *less*. Schwam (1980) provides additional interesting evidence that whilst *more* is comprehended before *less* by hearing children, the reverse is true of deaf children. Deaf children were highly accurate in comprehending *less* in sign language but not so with *more*. Such a result was replicated by hearing subjects in their comprehension of the signs for *more* and *less*. These data were seen as an indication of the greater equivalence between sign and word meaning for *less*, for this sign the distance between the two hands decreased.

Many studies have been conducted with children in the 3:0 to 5:0 year age group which have found that children do not treat *less* as a synonym of *more* at any stage during their acquisition of these terms (Weiner, 1974; Townsend, 1974, 1976; Kavanaugh, 1976b; Wales, Garman & Griffiths, 1976; Carey, 1978; Trehub & Abramovitch, 1978; Wannemacher & Ryan, 1978; Estes, 1979).

These studies have used a variety of contexts, stimuli and methodologies, yet have still failed to find evidence of the *less* is *more* phenomenon. That this finding was due to context effects and was task dependent was most amply demonstrated by Kavanaugh (1976b). He gave his subjects a comprehension and a construction task, and found that whilst the former task yielded results consistent with *less* being treated as *more*, the latter which involved two error choices did not. Wales et al (1976) also concluded that "task variation" affects whether children distinguish *more* and *less* in comprehension. The subjects in their study, who were from three different language cultures (English, Indian and Bornean), appeared to be inconsistent in their usage of *more* and *less*. Only sometimes did they respect the contrast. Trehub and Abramovitch (1978) and Estes (1979) further concluded that *less* is treated as being equivalent to *more* due to a non-linguistic preference to choose the greater of two amounts when presented with stimulus arrays. Indeed, Estes (1979) stated that this preference was context dependent and may be highlighted or lessened by the earlier requests of the experimenter. This conclusion is further emphasised by Carey (1978) who found a response bias to add in response to instructions containing *more*, *less*, and *tiv* (a nonsense syllable). Donaldson and McGarrigle (1974) likewise found the context of the experimental task to be important. Their preschool subjects switched between cues based on *length* and *fullness* in making judgments of *more*.

2.4.2 *Same/Different*

> "Achieving mastery of the relational terms *same* and *different* looks like a task of considerable complexity."
> (Donaldson & Wales, 1970, p. 240)

This quote reflects the problems children will encounter in coming to a full (adult) understanding of this comparative pair. Such difficulty is also seen in the results of research done in this area. Here again the major contentious issue is whether children do treat *same* and *different* as synonyms at some point during their acquisition of them.

Donaldson and Wales (1970) assessed preschool children's understanding of *same* and *different* in a classification task which involved four sets of objects. They found that most children did not appear to discriminate between the two instructions, *"Give me one that is the 'same' in some way"* and *"Give me one that is 'different' in some way."* This result supports the idea that these children were treating *different* as having the same meaning as *same*. Webb, Oliveri and O'Keeffe (1974) also found that children treated *different* as synonymous with *same* at an early stage of development. Their experimental tasks required subjects to select one object which was *different* from another and to provide justification for their choices. The data collected suggested a four-stage model for the development of *different*. At first children treated *different* as meaning *same*. The next two stages saw children using a basis of similarity in their choice of a *different* object. Only at the final stage did they come to realise that *different* is defined by both identity and similarity relations.

The importance of identity and similarity relations in the comprehension of both *same* and *different* is further seen in the meanings assigned to *same* by Donaldson and Wales (1970). Such meanings are also mirrored in the data of Griffiths et al. (1967) who reported that subjects only achieved a 40% correct response rate to *same* due to the ambiguity, "identity or equivalence", of its meanings. Furthermore, Karmiloff-Smith (1977) found that her 3:0 year old subjects interpreted *same* as meaning the "same kind". Only by 5:0 years of age have children developed the two meanings of *same* as "same one" and "same kind".

Experiments which have failed to corroborate the confusion of *different* with *same* have been conducted by Fein and Eshleman (1974) and Joseph (1975). The former study found that both 5:0 and 9:0 year old subjects could distinguish *same* and *different* in a task which required them to "....*Touch the same (or different) block*". The basis for their choice of the *different* object was the same at both age levels, they selected a different object. However, their judgments of *same* varied with age. Younger subjects chose on the basis of relative value and older subjects on the basis of individual size. Joseph (1975) also reported that few of her experimental subjects treated *same* and *different* as synonyms as would be predicted by E. Clark (1973c).

Two other studies have also failed to report the synonymous interpretation of *same* and *different* by young children. In a series of experiments, Wales et al. (1976) studied the comprehension of *same* and *different* by children from English, Indian and Bornean language cultures. Their major finding was that children can distinguish *same* and *different* (or not *same*) but that they do so with their own criteria. If we use adult criteria in deciding whether or not a child has learnt this distinction we often fail to notice the subtleties which exist in his language.

A final study by Glucksberg, Hay and Danks (1976) showed the important effect of experimental task on the responses given. These authors replicated Donaldson and Wales' (1970) study with both child and adult subjects, and found that both groups responded in like fashion to *same* and *different*, treating them as synonyms. However, when young children were given a task which specified the relevant attributes of sameness and difference their responses to both terms were correct, indicating that they knew the relevant distinction.

These studies seem to demonstrate the importance of task variables such as instructions, stimuli, and criteria of correctness, in assessing children's comprehension of *same* and *different*. As was the case with *more* and *less* different methodologies can, and often do, yield different results.

2.4.3 *Bigger/Smaller*

Two studies have looked at children's acquisition of the pair *bigger/smaller*. Only one of these has supported the prior acquisition of the *unmarked (bigger)* as opposed to the *marked (smaller)* term. This study (Olson & Nickerson, 1978) investigated the verification of sentences using the terms *bigger* and *smaller* for both story and picture stimuli by 5:0 and 7:0 year old children. These researchers found that *bigger* questions were handled better than *smaller* questions in correspondence with the prior acquisition of the *unmarked* term. However, Sinha and Walkerdine (1974) failed to find any significant differences between their 3:0 year old subjects' responses to *bigger* and *smaller* in a selection task.

Marschark (1977) conducted a study to examine children's comprehension of the superlative forms *biggest* and *smallest*. His experimental subjects, 3:0 and 4:0 year olds, were required "to point to the *biggest/smallest*" and then "point to the next *biggest/smallest*" in a set of wooden dowels. From his finding that performance on the *unmarked* adjectives was superior to that on the *marked* he concluded:

> "....seriation ability within the size dimension appears to be acquired asymmetrically according to an unmarked-marked trend also seen in the acquisition of polar adjectives."
> (Marschark, 1977, p. 1051)

2.5 NONSIMULTANEOUS ACQUISITION OF ANTONYMS

The above studies lead to a consideration of what Richards (1979) sees as E. Clark's second developmental principle, the *nonsimultaneous (asymmetric) acquisition* of semantically contrasting terms or antonyms. The *unmarked* member of antonym pairs is said to have both a *nominal* and a *contrastive* sense, whilst the *marked* member has only a *contrastive* sense. Due to the earlier learning of the *nominal* sense and of the *+Pole* contrast, based on children's perceptual preference for greater extent, *unmarked* terms are acquired before their *marked* counterparts.

But, just how general is this finding in the semantic fields constituting the English language? Research on comparative terms has produced conflicting results. The results from further fields of semantically related terms will now be considered.

2.5.1 Dimensional Adjectives

The first studies to be discussed will be those which have found results in accord with E. Clark's (1973c) prediction of asymmetry in the acquisition of antonym pairs. These studies have looked at the child's acquisition of *dimensional* adjectives in their nominal, comparative, and superlative forms. Rubin (1973), McNair (1973), Brewer and Stone (1975), Siegel (1977) and Smith et al. (1979) have all studied the comprehension of *dimensional* terms, in their nominal form, by children in the 3:0 to 6:0) year age group. The pairs studied have been *big/little* or *small, tall/short, wide/narrow, long/short, thick/thin* and *deep/shallow*. In such pairs the first member is the *unmarked* positive term and, on the basis of the *Semantic Feature Hypothesis*, is the one expected to be first in acquisition.
All studies have involved a selection task in which the subject is required to choose or *"Point to the X one"* in an array of stimulus objects (where X is a *dimensional* term). These studies have agreed in their finding that there are more correct responses

to the *unmarked* or positive member of such pairs, indicating its priority in acquisition with respect to the *marked* or negative term. Markowitz (1975) has also reported a similar finding in his study of the comprehension of spatial adjectives in their nominal, comparative and superlative forms by moderately retarded subjects. An identical finding has been described by Nelson and Benedict (1974) who tested children's comprehension of the relative adjective pairs *tall/short* and *fat/skinny* in both nominal and comparative forms. Their subjects were found to perform better on positive than negative terms as was indicated by more correct responses and shorter response latencies to the former terms.

Other studies which have looked at the asymmetric acquisition of *dimensional* adjectives in their comparative and superlative forms have been conducted by Donaldson and Wales (1970), Wales and Campbell (1970), Ehri and Ammon (1974), O'Dowd (1976) and Hosley (1978). Again, all studies have looked at children's comprehension of *dimensional* adjective pairs in tasks where they had to select *"The Xer or Xest one"*. These studies have also been consistent in reporting that the positive pole term is acquired before the negative pole term which leads to the conclusion that:

> "....children do operate in terms of the polarities assumed in most theoretical discussions; ...."
> (Donaldson & Wales, 1970, p. 264)

Even though Ehri and Ammon (1974) used a slightly different instructional format which involved both an assertion and a transformational question incorporating a *dimensional* term, they still reported results in support of H. Clark's (1969) *Principle of Lexical Marking*. Townsend and Erb (1975) further relate that their training procedure facilitated performance on *taller* and *fatter* but not *shorter* and *thinner* questions. This result they saw as confirming the general difficulty children have with negative adjectives.

At this point it is relevant to note that two of these studies appear to provide only partial support for E. Clark (1973c). Hosley (1978) only found the positive polarity effect for one, story retelling, of his two experimental tasks. In the second task, picture selection, he failed to find any difference between the comprehension of positive and negative adjectives. Furthermore, O'Dowd (1976) although reporting the prior acquisition of the *unmarked* adjectives concluded that this was due to the greater frequency of such terms rather than to their simpler semantic nature. Such a conclusion is at odds with the *Semantic Feature Hypothesis* as well as Huttenlocher and Higgins' (1971) discussion of *markedness*.

Some of the above studies, Wales and Campbell (1970), McNair (1973), and Siegel (1977), have also described the primacy of *unmarked* terms in the productive speech of young children. Wales and Campbell (1970) noted that their child subjects produced *unmarked* adjectives almost twice as frequently as *marked* adjectives when replying to questions. Siegel (1977) also found that the asymmetry of *big* and *little* found in comprehension was mirrored in her language production tasks.

A final study by Klatzy, Clark and Macken (1973) was designed to determine if the acquisition of polar *dimensional* adjectives by children was due to linguistic factors, such as differences in adult frequency or usage, or to difficulties at a conceptual level. Their preschool subjects were required to learn nonsense syllables, CVC labels, assigned to the positive and negative ends of the four dimensions of *height, width, length* and *thickness*. It was found that the CVC labels for the positive ends of the dimensions took less time to learn (fewer trials) and produced fewer errors during the learning period. These results confirmed the hypothesis that a conceptual mechanism causes the asymmetry in the learning of positive and negative adjectives. Such a mechanism can:

> "....deal with extension or relative extension on a dimension more easily than with relative lack of extension."
> (E. Clark, 1974, p. 122).

Townsend (1974, 1976) although noting superior performance on *unmarked* rather than *marked* adjectives failed to conclude that this was due to an asymmetry in acquisition. In his earlier study, Townsend (1974) examined 3:0 to 5:0 year olds' understanding of *taller* and *shorter* when placed in five different question contexts, and found that *taller* was easier to comprehend than *shorter*. However, the responses to the *marked* term were frequently above chance level indicating that the asymmetry found in former studies may have been due to an experimental artefact. Townsend (1976) further studied children's interpretation of positive and negative adjectives, in both their comparative and superlative forms, in a five choice situation. He discovered that correct responses were only more frequent on some *unmarked* adjectives *(thicker, taller, more)* whilst on others they did not differ between the *unmarked* and *marked* terms *(Higher/lower)*. From this he concluded that to test more adequately the theory of *marking*, a situation must be provided which enables the child to make an incorrect response which differs from the response appropriate to the *unmarked* comparative. Indeed, such choice situations are necessary to clearly determine the extent of the *marking* effect with respect to asymmetry of acquisition, and its attendant confusion of the meanings of the members of antonym pairs.

Ehri (1976) has studied adjective language development in 4:0 to 8:0 year olds in a series of tasks designed to assess lexical development, coordination, comparison and seriation with respect to adjectives. Her results for the *Object Description Task*, designed to elicit production of adjectives, demonstrated that positive terms were produced more frequently than negative terms by these subjects. Such a finding is in line with the prior production of *unmarked* or positive terms found by Wales and Campbell (1970), McNair (1973), and Siegel (1977). However, in the adjective comparison task, which utilised various comparative constructions for *big* and *little*, Ehri found no difference between positive and negative adjectives.

Other studies which have failed to report an asymmetry in the acquisition of *unmarked* and *marked* terms have been conducted by Illebrun (1974), Bartlett (1974), Coots (1976), Dunckley (1976) and Layton and Stick (1979). All of these studies have found no evidence of the prior acquisition of the *unmarked* term when *dimensional* adjectives have been examined in a series of tasks. Illebrun (1974) has shown that both normal and deviant language subjects, when matched for Mean Length of Utterance, evidenced no difference in terms of ease of comprehension for the nominal, comparative, and superlative forms of *unmarked* and *marked* adjectives. Further, Dunckley (1976) and Coots (1976) failed to find any polarity difference when their preschool subjects were required to learn CVC labels for both the positive and negative ends of the dimensions, *size, height, width* and *depth*. Such a finding is at odds with the conceptual asymmetry reported by Klatzy et al, (1973) which is said to underlie the supposed linguistic asymmetry. Finally, Layton and Stick (1979) produced data which showed that the confusion of meaning between positive and negative terms can go either way. They found that their subjects substituted the positive and negative terms of two pairs (*big/small* and *large/little*) for each other with equal frequency. Such a finding is contrary to the earlier comprehension of positive or *unmarked* terms with respect to their *marked* counterparts. This lack of confusion is also supported by Ehri (1976) who concluded that polar confusion is not a general phenomenon, but depends on the lexical history of the particular negative adjective being studied.

Eilers et al. (1974) have also failed to find support for the prior comprehension of the *unmarked* term of *dimensional* adjective pairs. Indeed, in both their comprehension studies they found that young children made more errors on *unmarked* than *marked* adjectives. Their first experiment involved a selection task in which 2:0 and 3:0 year old subjects had to choose the *big, little, long, short, wide* or *narrow* one from an object pair. The second experiment was comprised of two sections, one of which replicated the first experiment whilst the second tested the non-semantic preferences of 2:0 and 3:0 year olds. Their finding that subjects preferred to choose objects corresponding to the *marked* adjectives conflicts with H. Clark's (1970b) prediction of young children's preference for greater extent. On the basis of these results, Eilers et al. concluded that children pass through two developmental stages in the acquisition of *unmarked-marked* pairs. At the first stage, 2:6 to 3:6 years, they use a strategy which results in their treating the *unmarked* term as a synonym of the *marked*. Only at the second stage, after 3:6 years, do they adopt the strategy postulated by E. Clark (1973c) which results in the assignment of the meaning of the *unmarked* adjective to the *marked*.

A final study by Bartlett (1976) has provided further evidence contrary to the asymmetrical development of *unmarked-marked dimensional* adjective pairs. In her first experiment, Bartlett utilised a forced choice paradigm and stimuli which varied on one, two or all dimensions. Her experimental subjects only performed worse on negative adjectives *(little, short* and *narrow)* when the stimuli varied on two or all dimensions. No such difference was found with one dimensional stimuli. Bartlett concluded that these data failed to support the idea that the subjects do not yet possess the *(-Polar)* semantic feature of these terms. The data from this experiment also corroborates the earlier finding of Townsend (1976) that polar asymmetry depends on the *dimensional* pair studied. In a second experiment, Bartlett looked at 2:0 and 3:0 year olds' understanding of *big* and *little* in a selection task and failed to find any difference in performance which could be attributed to polarity. Consequently, Bartlett concluded that her data provided experimental evidence for a "Semantics Acquisition Hypothesis", which predicts that *Polar* features are acquired before *dimensional* features. This conclusion is further supported by Carey (1978) with respect to children's comprehension of *more* and *less* but goes against one of E. Clark's (1973c) major predictions.

Again, it can be seen that the findings in the semantic field of dimensional adjectives are contradictory. Some support the *Semantic Feature Hypothesis* fully, others partially, and still others not at all. This same inconsistency is to be found in all of the other areas to be discussed below.

2.5.2 Contrastive Pairs

Several of the studies discussed above have also investigated children's acquisition of other antonym pairs in the English language (e.g. *light/dark, happy/sad, clean/dirty, hot/cold, hard/soft)*. These studies (Nelson & Benedict, 1974;

Ehri, 1976; Townsend, 1976; Smith et al., 1979) have all only reported slight differences, if any, favouring the earlier comprehension of the positive members of such pairs. These differences were not as large nor as significant as those found for *dimensional* pairs. This result calls into question the validity of applying the notion of *markedness* to such antonym pairs.

Two other studies have looked at children's acquisition of contrasting terms. The first, conducted by Kuczaj (1975), studied children's acquisition of the meaning of *always* (positive) and *never* (negative). The major finding was that correct responses were more frequent to *never* than to *always* sentences. Such a finding was interpreted as a corroboration of E. Clark's (1973b) *Partial Semantics Hypothesis* in that when first attaching a meaning to the two terms children use different strategies, and the choice of this strategy is determined by the child's prior experiences. In the second experiment, Webb and Abrahamson (1976) tested 4:0 and 7:0 year olds' comprehension of *this* and *that* under the two conditions of *same* perspective and *different* perspective. The prediction that comprehension of *that (unmarked)* would be superior to comprehension of *this* was not confirmed in the *same* perspective condition. This resulted from a non-linguistic bias for young children to choose the nearer toy as well as no reported difference for older subjects.

Contradictory findings have also been reported in studies on adult subjects. Clark and Card (1969) tested adult subjects' memory for comparative sentences containing *unmarked* and *marked* adjectives. They found that constructions with *unmarked* adjectives were recalled verbatim more frequently than those with *marked* adjectives. A second result, that *marked* adjectives were often recalled as their *unmarked* counterpart, lends credence to the *Semantic Feature Theory* prediction that the latter adjectives are stored in memory with one less semantic feature than the former. However, Brewer and Lichenstein (1974) have called this theory into question on the basis of findings of two experiments. In the first experiment, subjects had to recall sentences containing one member of an antonym pair (e.g. *tall*) or its negation (e.g. *not tall*). Forty antonym pairs were used in this study. The results appeared to support the "theory of memory for *marked* semantic features" in that lexical shifts from *marked* to *unmarked* terms were significantly more frequent than the reverse. Nevertheless, the authors hold that the "memory-for-meaning" theory was more adequate as an explanation of the results since it predicted the finding of a large number of "meaning preserving" antonym shifts whereas the *marking* theory does not. The former hypothesis received further confirmation in the second experiment where the homogeneous stimulus lists prevented antonym shifts which preserved meaning by inhibiting subjects' use of *not*.

Asymmetries have also been found in the processing of *right (unmarked)* and *left* by adult subjects (Olson & Laxar, 1973). Their experimental tasks involved word-picture verification by right-handed subjects, and demonstrated that these subjects responded more quickly to *right* than to *left*. Such a result is taken as evidence of a postulated difference between the mental representations of *right* and *left*, with the former being simpler. However, a contrary result is reported by Glushko and Cooper (1978) who found that the effect of *lexical marking* in a sentence-picture verification task decreased as the time between the stimuli (spatial description and test picture) increased.

2.5.3 Locatives

E. Clark (1973b) conducted a study to examine the young child's comprehension of *in, on* and *under,* the results of which confirm her *Partial Semantics Hypothesis*. In the first experiment, children aged 1:6 to 4:5 years were required to put a toy *in, on,* or *under* a reference point object. The major finding was that children younger than 3:0 showed a developmental trend in their acquisition of these responses, with *in* being acquired first, then *on,* and lastly *under*. The children's responses indicated that *in* was always responded to correctly, errors with *on* only occurred when the reference point was a container, (children gave an *in* response), and *under* was seldom responded to correctly, being treated as if it meant *in* or *on*. E. Clark accounts for these results in terms of the following two ordered rules which children use in their comprehension of these locatives:

Rule 1 : "If the RP is a container, *X* is inside it".

Rule 2 : "If the RP has a horizontal surface, *X* is on it".

In Rules 1 and 2, RP represents the reference point with respect to which the child has to place *X*, the object. These rules accounted for 90% of the errors made by subjects, and received further confirmation in a second experiment where subjects had to copy an object configuration. Such rules are the non-linguistic strategies the child uses to aid comprehension when he only has partial semantic knowledge. They are based on the child's perceptual knowledge of objects and relations in the world. This point is further emphasised by Windmiller (1976) who states that the child's understanding of spatial locatives is paced by his conception of space. However, such rules are gradually supplemented by full semantic knowledge as the child develops. Data from E. Clark's third experiment on *in, on* and *under* demonstrate this. Despite this, the initial non-linguistic strategies may be used as the basis for the later acquired linguistic hypotheses about word meaning.

Further data which support the prior acquisition of *in* and *on* with respect to *under* have been reported by Ames and Learned (1948) and Washington and Naremore (1978) who studied the productive speech of young children. However, this asymmetry in acquisition has not been reported by all researchers in the area. Sinha and Walkerdine (1974), Hodun (1975) and Washington and Naremore (1978) have all found that *in, on* and *under* were acquired by their subjects at similar times when given in comprehension tests. But it is important to note that many of their subjects were older than E. Clark's. They were 2:6 years old and above, the age when children begin to acquire full adult meanings for these terms according to E. Clark (1973b).

Sinha and Walkerdine (1974) have also reported a finding contradictory to E. Clark's model with regard to the child's manipulation of objects in the experimental setting. E. Clark found that her subjects often righted an upturned glass to place an object *in* it when asked to copy a configuration with the object *on* the glass, whilst Sinha and Walkerdine failed to find such a response. In a similar situation, where children were told to *"Put the ball in the cup"*, their subjects either put the ball *on top of* the cup or banged it on top of the cup's surface. Such a finding is at odds with the supposed prior acquisition of *in*.

Two other studies have cited findings which call into question the data and conclusions of E. Clark (1973b). Wilcox and Palermo (1974) questioned the generality of the strategies proposed by E. Clark by stating that:

> "....the contextual support for the linguistic statements presented to the children by Clark was such that the children had no alternative to the specific non-linguistic strategies...."
> (Wilcox & Palermo, 1974, p. 247)

In their experiment children 1:6 to 2:11 years had to put an object *in/on/under* another in three contextually congruent and three contextually incongruent tasks. Here congruency was defined in terms of contextual support or lack of such support for the linguistic statement. Wilcox and Palermo's results for the congruent tasks replicated Clark, but those for the incongruent did not. Furthermore, on all tasks subjects performed better with *in*, than *on*, and their performance on *under* either equalled or bettered than on *in*. In fact, *in* and *on* were both treated as synonyms of *under*. Noting that their stimuli and contexts, unlike those of E. Clark, favoured *on* and *under* rather than *in* responses, Wilcox and Palermo concluded that the child's interpretation of a word in a particular situation is determined by contextual factors as well as linguistic and non-linguistic strategies.

Grieve, Hoogenraad and Murray (1977) reported further problems with the original study of children's comprehension of *in, on,* and *under* which may have confounded the results. In the first task of their study, children were merely required to point to the arrangement specified by the instruction. The aim of this task was to eliminate any problems which might be due to object manipulation. The remaining four tasks, all involving object manipulation, varied the noun phrases used to refer to the objects in the comprehension task, since it was held that these influenced the child's construal of the task. Grieve et al.'s results confirmed that children do initially understand *in* and *on* prior to *under* but failed to find confusions amongst these terms. They also found that comprehension of these locatives was better in the pointing rather than the manipulation tasks. Further, the noun phrase used to refer to the objects to be manipulated strongly affected the responses given. Children often made errors when the noun phrases used proposed an unusual arrangement of objects, e.g. *table under chair* or *table on cup*. Such errors were not made when the nature of the relation between the two objects was seen to be normal or canonical e.g. *chair under table*. On the basis of these results, Grieve et al. concluded that the interpretation of *in, on* and *under* by 2:0 and 3:0 year olds is affected by both the context in which the instructions occur and their language.

Other prepositions which have been studied are *up/down, at the top of/at the bottom of, over/under* and *above/below*. E. Clark (1977b), in looking at the errors made on such prepositional pairs, concluded that most children's responses could be accounted for by a non-linguistic strategy of placing objects on the topmost or next-to-top surface. That such a non-linguistic strategy exists is further supported by E. Clark (1980) who found that *top* was acquired before *bottom* in line with children basing their comprehension on the strategy of choosing the topmost surface. These latter studies provide additional confirmation for the *Partial Semantics Hypothesis*, E. Clark (1973b), whereby children's initial comprehension of a word is determined by partial semantic knowledge aided by the use of a non-linguistic strategy.

In conclusion, the research reviewed in the current chapter has demonstrated that E. Clark's (1973c) *Semantic Feature Hypothesis* is only partially confirmed. While it is generally found that semantic features are acquired in the order from general to specific, support for both the asymmetrical acquisition of antonym pairs and the overextension of the meaning of the *unmarked* to the *marked* members of such pairs has been contradictory. Indeed, this contradiction has been found in a variety of semantic fields most of which can be characterised in terms of spatial dimensions or components. Therefore, an important area yet to be considered is the research data on antonym pairs which can be said to have a temporal meaning. This will lead to a discussion of terms which have both a spatial and a temporal sense. It is predicted that it is such antonym pairs, that is *spatio-temporal*, which will cause most comprehension difficulties for children since they possess a dual meaning. Consequently, they are expected to be somewhat later acquisitions. The following chapter will review the rather limited research that has been done on *spatio-temporal* terms in the light of the *Semantic Feature Hypothesis*.

CHAPTER 3.

RESEARCH ON THE SEMANTICS OF *SPATIO-TEMPORAL* PAIRS

This chapter will review the work which has been conducted on the antonym pairs comprising the *spatio-temporal* semantic field in the light of the predictions made by the *Semantic Feature Theory*. Such a field is relatively complex as the antonym pairs within it, *in front (of)* or *ahead (of), behind, before, after, first* and *last* can be characterised as having both a spatial and a temporal sense. Therefore, these terms can be expected to give rise to comprehension problems in children. However, before discussing studies which have investigated children's acquisition of such terms in their dual sense and how this may be affected by contextual constraints, the work which has examined these terms in only one of their senses will be considered. Such research has looked at the spatial sense of the pair *in front of* or *ahead of/behind* and the temporal sense of *before/after,* indicating that these are respectively the dominant senses of such pairs.

3.1 SPATIAL/RELATIONAL ANTONYMS : *IN FRONT OF/BEHIND*

H. Clark (1973) and E. Clark (1973c) hold that *in front of* is prior in acquisition to its antonym *behind*. They base this prediction on the principle of *markedness* whereby the *unmarked* or positive term (*in front of*) is acquired before the *marked* or negative (*behind*). For E. Clark (1973c) the positive is roughly equivalent to "within the field of vision" and the negative to "not within the field of vision" (E. Clark, 1973c, p. 106). This asymmetry of *front* and *back* in the perceptual field is what H. Clark (1973) refers to as a property of P-space and according to his *correlation hypothesis* it will be further reflected in L-space (the linguistic system). Such a conclusion is elaborated by E. Clark (1973c) who states that the asymmetries present in the perceptual capacities of the human organism are reflected in asymmetries among the pairs of words which describe spatial relations in English. Consequently, *front* (and its prepositional derivatives) are assigned a positive feature of meaning whilst *back* (and its prepositional derivatives) are assigned a negative component.

Only two studies have been conducted which provide support for this prediction of asymmetry in acquisition. Windmiller (1976) studied children's comprehension of *in front of* and *behind* in a series of tasks designed to look at the acquisition of spatial prepositions. She found that her youngest subjects gave more correct responses to *in front of* than *behind* on a locative placement task. However, this result held only when checkers were used as stimuli. When the experimental stimuli were cars, performance on *in front of* and *behind* was similar. E. Clark (1980) similarly provided experimental support for the prior acquisition of *in front of*. Her preschool subjects (1:6 to 4:11 years) were required to place one object *in front* or *in back* of another. The major finding was that children less than 2:5 years performed better on *in front of*. But after this age, performance differences between the two prepositions levelled off.

Both of these studies provide only partial corroboration of the prediction of asymmetry of acquisition which leads to the conclusion that the applicability of this principle to the prepositions *in front of* and *behind* may have limited validity. Such a conclusion is strongly supported by the many studies which have either failed to find any difference in acquisition or have found a difference in favour of *behind*.

Studies which have failed to find any difference in children's acquisition of *in front of* and *behind* have been conducted by Harris and Strommen (1972), Hodun (1975), Kuczaj and Maratsos (1975) and Sinha and Walkerdine (1974). Harris and Strommen (1972) found that their subjects made a high percentage of placement responses to *front* and *back* which indicated that they conceptualised these terms as opposites. Correct responses were just as likely to *front* as to *back* with both featured, e.g. *toy bugs*, and featureless, e.g. *wood blocks*, objects. This finding was also reported by Kuczaj and Maratsos (1975) in a similar experimental task. These authors concluded that the simultaneous acquisition of *front* and *back* can be attributed to the relative simplicity of the dimension of opposition they characterise. Sinha and Walkerdine (1974) also failed to find any evidence for the greater difficulty of *behind* in an orientation test. Indeed, their subjects used a variety of response strategies in comprehending both *in front of* and *behind*.

Several other studies have reported a result in direct conflict to H. Clark's (1973) prediction regarding the acquisition of *in front of* and *behind*. Collins (1974) found that the positive spatial members of the pairs *in front/in back* and *ahead/behind* were more difficult than their negative counterparts for children with normal and deviant language development. Similarly both Pierart (1977) and Washington and Naremore (1978) have described the prior acquisiton of *behind* in children's receptive as well as their productive speech (the former study being done in French). Other studies, Cox (1979) and Tanz (1980), have cited evidence from comprehension studies with both featured and featureless objects which indicates that:

> "....'*back*' is lexicalised earlier than, or is dominant over, '*front*'."
> (Harris & Strommen, 1979, p. 201).

These contradictory results have led to a questioning of the validity of H. Clark's (1973) conceptualisation of *in front of* and *behind* (or *front* and *back*). Harris and Strommen (1979) hold that the *unmarked-marked* distinction cannot be applied to *front* and *back* because the senses associated with this distinction (*nominal* and *contrastive*) cannot be clearly employed with these two terms. Furthermore, Cox (1979) stated that it is *behind* which should be seen as the positive term and *in front of* as the negative term. She based this conception on the notion that placing an object *in front of* or *behind* another occurs in front of the subject and so is at the positive end of the horizontal-frontal dimension. Consequently, *behind* is positive because it is placed further toward the positive end of the dimension. Other writers (e.g. Tanz, 1980) have questioned the supposition of "perceptual positiveness" as a predictor of acquisition order on the grounds that *in back of* is used more frequently in communication and carries more communicative force, therefore it is acquired earlier.

The conflicting results with this antonym pair might further be predicted by the ambiguous nature of such expressions as *in front of* and *behind* (Wales, 1979). This ambiguity arises because many objects, e.g. an aeroplane, have an intrinsic front, that is they have a part which is usually defined as "the front". Therefore, how is *front* to be defined? In terms of the properties of the object (*"intrinsic" front*) or with respect to the speaker (*"egocentric" front*)? H. Clark (1973) has also noted this ambiguity by stating that there are two fronts and backs in English, that is, the inherent *front* and *back* and the egocentric *front* and *back*. Such a confusion of meaning is further reflected in data which support the earlier acquisition of *front* and *back* with featured (fronted) objects rather than featureless (non-fronted) objects. This result again demonstrates the strong influence that contextual factors have on children's comprehension of antonym pairs.

3.2 TEMPORAL ANTONYMS : *BEFORE/AFTER*

E. Clark (1970, 1973a) maintains that three principles account for the development of the child's ability to produce and comprehend temporal events. *Order-of-mention*, the first, states that events which are described in their order of occurrence are simpler. The second principle, *derivational simplicity*, maintains that sentences in which the subordinate clause occurs second are easier to produce and comprehend than those in which it occurs first. Thirdly, a sentence is simpler to understand and describe if the first event is also the theme, this is the *choice of theme* principle.

The interaction of the above three principles in children's acquisition of sentence forms for temporal order has been studied by E. Clark (1970, 1973a). E. Clark looked at the spontaneous productive speech of 15 nursery school children and found that coordinate clauses are acquired first, followed by subordinate clauses in second position, and lastly subordinate clauses in first position. These data are consistent with E. Clark's hypothesis that the interaction amongst the three principles determines the development of the child's description of temporal events.

Experimental support for the first of these principles, *order-of-mention*, has been provided by many workers. Collins (1974) found that subjects with both normal and deviant language development could comprehend *before* and *after* sentences where *order-of-mention* and *order-of-occurrence* were congruent with greater ease than where they were incongruent. The importance of *order-of-mention* as an aid to the comprehension of temporal sentences has also been reported for French children (Ferreiro & Sinclair, 1971) and mentally retarded subjects (Clem, 1976).

Hatch (1971) examined children's responses to instructions containing *before* and *after* as temporal markers which sequenced the two events to be acted out. She discovered that all subjects responded more accurately when *order-of-mention* corresponded to the order in which the actions were to be performed. This result has been consistently replicated by other experimenters using a similar experimental paradigm (Bever, 1970; Coker, 1975; Body, 1978; Ehri & Galanis, 1980). Flores D'Arcais (1978) has also reported the importance of the *order-of-mention* strategy in children's processing of clausal and final sentences.

Only two experimenters have failed to demonstrate the importance and consistency of this principle (Amidon & Carey, 1972, and Amidon, 1976). Amidon and Carey (1972) found that children attended more to the information contained in the main clause, irrespective of its position, in processing temporal sentences. Amidon (1976) reported that the ease of comprehension was not affected by the order in which events were mentioned.

E. Clark (1971) investigated 3:0 and 4:0 year olds' comprehension of *before* and *after* to see if her prediction that *before* will be acquired prior to *after* was borne out. The children's task was to carry out instructions containing *before* and *after* as conjunctions. The four basic construction types used for these sentences were *S1 before S2, Before S2,S1; S2 after S1; After S1,S2* (where *S1* and *S2* refer to two events or actions). A second experimental task required children to use the two terms, *before* and *after*, in their replies to questions. The data from both tasks supported the prior acquisition of *before* and the following three-stage developmental model:

<u>Stage 1</u> - neither *before* nor *after* is understood.

<u>Stage 2</u> - *before* is understood but not *after*.

<u>Stage 3</u> - both *before* and *after* are fully comprehended.

From these results, E. Clark concluded that the theory of *markedness* with respect to the antonym pair *before/after* is upheld. *Before* is acquired first as it is positive or *unmarked*, containing the feature *(+Prior)* and being related to the positive preposition *in front of*. *After*, the negative or *marked* term which contains a *(-Prior)* component and is related to *behind*, is acquired last (see also H. Clark, 1973).

Further experimental support for the acquisitional precedence of *before* has been reported by Bever and Morrisey (1970), Weil (1970), Ferreiro and Sinclair (1971) and Feagans (1980a) using similar experimental paradigms to test children's comprehension. Ehri and Galanis (1980) have also found that 3:0 to 5:0 year old subjects took longer to learn sentences of the form *S1 after S2*, than those of the form *Before S2, S1*. Therefore, they have further demonstrated the primacy of *before* in children's development of word meanings for the pair *before/after*. Finally Weil and Stenning (1978) re-examined children's ability to both comprehend and imitate sentences containing the temporal markers *before* and *after*. In both tasks, the *after* sentences were found to cause children more difficulty than the *before* sentences.

Many studies have been conducted which have failed to uphold E. Clark's prediction of the prior acquisition of *before*. These studies have reported either no difference in acquisition or else the priority of *after*, therefore indicating the strong influence of task or contextual factors on children's comprehension of these terms.

Barrie-Blackley (1973) found that 5:0 and 6:0 year olds made fewer errors on *after* than *before* sentences when given both a comprehension and a repetition task employing E. Clark's (1971) experimental paradigm. Furthermore, Ames (1946) has noted the productive priority of *after* in observations of young children's spontaneous speech. However, Harner (1976) has reported contradictory findings. *Before* was comprehended better than *after* when it was used as a conjunction, but the reverse was true when the two words appeared as adverbs in sentences. This finding she sees as indicating that:

> "....a linguistic theory such as Clark's is not an adequate explanation of how the child understands the terms in varying contexts." (Harner, 1976, p. 79.)

A final study (Amidon, 1976), has also provided evidence of the easier nature of *after* with respect to *before*. This experiment involved a comprehension task similar to E. Clark's (1971) as well as a question answering task. On both tasks, subjects made more errors on *before* than *after* sentences. Consequently, these results conflict with the earlier data of E. Clark (1971).

Many studies have failed to report any difference in children's comprehension of these terms (Amidon & Carey, 1972; Collins, 1974; Coker, 1975; French & Brown, 1977; Coker, 1978; Kavanaugh, 1979; Harner, 1980; Townsend & Ravelo, 1980). All of these researchers have found no difference between *before* and *after* using a variety of tasks, and so have been led to conclude that context plays an important part in children's acquisition of these terms:

> "....the basic internal relations of the lexicon are pretty well developed at an early age. Later developments involve the ability to apply these meanings in varying contexts, and the gradual acquisition of the contextual rules which determine socially appropriate usages."
> (Sinha & Walkerdine, 1974, p. 30.)

These latter authors also questioned the validity of the application of the *markedness* principle to the pair *before/after*, and, consequently called into doubt their asymmetry in acquisition.

Amidon and Carey (1972) studied 5:0 and 6:0 year olds' comprehension of *before* and *after* in a task where they were required to move familiar objects in response to instructions. Their subjects were given two experimental tasks. In the first, training, the five experimental groups differed with respect to whether they received feedback about the correctness of their response and intonational emphasis on the temporal marker. The second task consisted of a post-test with similar instructions to see the effects of training. Feedback was found to have a facilitative effect. However, there were only slight differences in the number of errors subjects made on *before* and *after* constructions, a result which contradicts E. Clark's (1971) findings. On the basis of their subjects' greater attention to the main clause of the sentence, irrespective of its position, these authors also questioned the importance of *order-of-mention* as a processing strategy.

Johnson (1975) attempted to sort out the conflict between E. Clark's (1971) study and Amidon and Carey's (1972) study. Eighteen 4:0 and 5:0 year old children had to complete three tasks involving the use of *before/after* sentences whose form was similar to the four basic types used by E. Clark (1971). The three tasks were *Comprehension, Picture Command* and *Command*, with the first being a replication of E. Clark and the last of Amidon and Carey. Performance on the *Comprehension* task was found to be superior to that on the *Command* task. The error types on the two tasks also differed, that is, reversals were more common on the former and omissions on the latter. On the basis of these results Johnson concluded that the test items' language interfered with children's manifestation of their comprehension of temporal order information, and such interference was evidenced by the change in error patterns. This demonstrated a contextual effect.

Coker (1978) also cited research which aimed to resolve the contradictions between E. Clark's and Amidon and Carey's studies. Her subjects were required to perform tasks in which *before* and *after* occurred as prepositions and as conjunctions. Coker's results varied from a difference favouring *after*, to no difference at all, to the relative ease of *before*. Therefore, she concluded that children use either a semantic strategy *(order-of-mention)* or a syntactic strategy (direct attention to the main clause) when processing sentences containing *before* and *after*. The use of these strategies is determined by task requirements, and so there is no fixed acquisition order for *before* and *after*. Rather, their acquisition is dependent on context of use.

French and Brown (1977) and Kavanaugh (1979) provide further experimental support for the importance of context in the child's acquisition of *before* and *after*. Their experimental tasks required children to act out events described in *before* and *after* sentences where the actions described were either *logical* (one order only) or *arbitrary* (reversible). They found, in opposition to E. Clark (1971), no evidence of any difference between *before* and *after* in the number of errors made. A further consistent finding was that *logical* sentences were easier to comprehend than *arbitrary* sentences. Both of these results emphasise the important role played by context in the acquisition of language.

Two experiments which have been conducted with adult subjects corroborate E. Clark's (1970, 1973a) predictions.

Clark and Clark (1968) found evidence for the *order-of-mention* strategy when adults had to recall sentences describing two events using *before* and *after* as temporal markers. In another study Smith and McMahon (1970) reported that their adult subjects responded to *before* sentences with fewer errors and a shorter latency than to *after* sentences. Their task required subjects to answer a question about the first event when presented with *before/after* sentence constructions. Both of these experiments yield confirmatory evidence for one aspect of E. Clark's hypothesis, and so strengthen, somewhat, its foundering empirical basis.

3.3 SPATIO-TEMPORAL TERMS : *IN FRONT OF (AHEAD OF) BEHIND; BEFORE/AFTER; FIRST/LAST*

> "Linguistic time has been variously described as linguistic space or as a spatial metaphor."
> (Hodun, 1975, p. 1)

This quote mirrors the close connection which holds at a linguistic level between time and space. Indeed, writers (Miller & Johnson-Laird, 1976 and Wales, 1981) have noted that the temporal expressions in the English language borrow heavily from the spatial. Such a close connection between the two fields of time and space, as expressed in language, will lead to initial difficulties in children's comprehension of terms which have both a spatial and a temporal sense, that is, *spatio-temporal* terms. It can also be predicted that the linguistic designations for space will precede those for times in acquisition, for the latter are held to have a linguistic basis in spatial words.

The spatial basis for time conception has also been commented on by various authors who see motion as being the primitive notion which underlies both space and time.

> "Comprehension of space as well as of time grows out of the comprehension of movement." (Meyer, 1940, p. 132)

Piaget (1969) further discussed the importance of motion by stating that time can be represented as the coordination of motions at varying speeds. Furthermore, Beilin (1975) and Miller and Johnson-Laird (1976) comment upon the close relationship which exists between time and space when they are conceived of in terms of motion which consists of changes both spatially and temporally. Consequently, the understanding of motion in a spatial sense is the basis from which the child constructs his idea of time.

H. Clark (1973) has placed the concepts of time and space, and their linguistic expressions, in a developmental framework. For H. Clark, time is based on a spatial metaphor where time is viewed in terms of locatives and/or movements on an unidimensional line. H. Clark stated that there are two spatial metaphors underlying time. These are the *moving time* and *moving ego* metaphors. The *moving time* metaphor sees "events as moving forward (pastward) past a stationary ego" whereas the *moving ego* metaphor states that the speaker moves "forward (futureward) past stationary events" (H. Clark, 1973, p. 52). Of these two spatial metaphors, only one has received strong experimental support. Both Feagans (1980b) and Wales (1981) found that adults preferred the *moving ego* conception of time.

H. Clark (1973) further elaborated his hypothesis with respect to relational prepositions in English by noting that such terms are derived from the spatial *front/back* dimension. The pairs *before/after, ahead/behind* and *in front/in back* are all related to this one dimensional continuum which moves through the speaker from front to back. Those terms deriving from *front (before, ahead, in front)* are deemed to be positive or *unmarked* and their counterparts negative or *marked* because they are related to *back.* This results in the prior acquisition of *before*, *ahead*, and *in front* based on the principle of *markedness* which predicts the developmental precedence of *front*, the positive term, in the spatial dimension. Consequently, there is an asymmetry in the acquisition of these relational prepositional pairs. However, H. Clark's (1973) major prediction with respect to verbal expressions of time and space is concerned with the developmental priority of these terms based on the spatial metaphor that is held to underlie time conceptualisations. H. Clark (1973) not only stated that time expressions should follow space expressions developmentally, but he also predicted, based on his *complexity hypothesis*, that terms which can be used in both a spatial and a temporal sense will be acquired in their spatial sense first.

This latter prediction is the one to be considered in children's acquisition of *spatio-temporal* terms. However, before a discussion of the experimental findings for these terms, research which has shown the dependence of the child's conception of time upon his knowledge of space will be examined.

Productive speech data in support of the priority of space as opposed to time words has been provided by Ames (1946) and Ames and Learned (1948). These workers recorded the spontaneous speech of children in the 1:6 to 4:0 year age range at regular six monthly intervals. The data indicated a six month interval between growth in the spatial and temporal vocabularies of their subjects. Spatial terms were more frequent in these subjects' lexicons at 2:6 years whereas temporal words only demonstrated a growth spurt later, at 3:0 years. Grimm (1975) has reported a similar finding from his study of the prepositions produced by German children between 2:0 and 7:0 years of age. He found that only those prepositions which his subjects used locatively were also used temporally. Grimm's data also indicated that locative prepositions were used far more frequently than temporal prepositions. Both these findings led Grimm to conclude that the temporal notion develops from the spatial notion in the common orientation system of space and time. Finally E. Clark (1971) noted that two of her youngest subjects gave locative answers, e.g. *"here"* or *"right here"* to temporal *(when)* questions in her productive task. This finding supports the earlier acquisition of spatial expressions, and the consequent mis-interpretation of temporal expressions as being spatial due to their spatial metaphor basis.

Several other studies have shown how the child's conception of time is affected by spatial cues in the stimulus arrays, and, therefore, have demonstrated the spatial basis of time. Lovell and Slater (1960) found that normal and educationally subnormal children understood better the equality of synchronous intervals when given spatial guidemarks (equal interval line marks) on the two vessels in a situation where the water level in one went down as it rose in the other. Berndt and Wood (1974) noted that their 5:0 and 7:0 year old subjects used a distance model, where longer distance equalled longer time, when judging the relative time for which two trains travelled. Furthermore, in making duration judgments children relied on the relative salience of beginning versus end points, that is, spatial locations (Levin, Gilat & Zelniker, 1980). Children's duration judgments were also affected by interfering movement cues (Levin, Israeli & Darom, 1978). This result supports the importance of motion in children's understanding of an aspect of time. In a final study Wales (1981) discovered that it was harder for children to process temporal information in contexts where there was more interfering spatial information, therefore, demonstrating the existence of a common linear, spatial structure which underlies temporal comprehension.

Davidson and Klich (1980) have provided evidence which indicates the priority of spatial ordering in an Aboriginal culture. Their subjects, 75 full-blood Aborigines between 9:0 and 16:4 years, were given two free recall tasks using either pictures or natural objects. On the basis of their subjects' preference for spatial over temporal order in free recall they concluded that such ordering is due to cultural and environmental factors. This shows the importance of space in another culture where there is less emphasis on time.

All of these experiments have established both the importance of space over time and the dependence of the latter on the former. The studies which have considered the development of terms with both spatial and temporal meanings will now be discussed.

Two studies have found the priority of space over time in such *spatio-temporal* words. Hodun (1975) examined the role of spatial information in preschool children's acquisition of temporal relations. Three tasks were used to assess children's understanding of the terms *before, after, ahead* and *behind*. These tasks varied in terms of the information they provided on order and movement. Hodun found that the pair *ahead/behind* was easier for subjects to comprehend than *before/after*, and also that children performed worse on those tasks where spatial and temporal cues conflicted. Furthermore, the youngest subjects (4:5 years) performed better in contexts where there was a static display (spatial) rather than a sequence of two events. These results were taken as evidence for the developmental priority of spatial relations as well as the facilitative effect of spatial information on temporal comprehension. Wales (1981) has also studied the comprehension of spatial and temporal terms in 3:0 and 5:0 year old children. His task involved spatial arrangements of two dolls, and the child was asked to indicate which was *in front of/behind* or *before/after* a designated doll. He found that subjects performed better on the spatial *(in front of, behind)* terms, and also that only if subjects correctly comprehended the spatial word did they get its corresponding temporal counterpart correct e.g. *behind* - *after*. These results demonstrate the dependence of temporal relations on the spatial.

Certain researchers have questioned the priority of the spatial dimension over that of time. Navon (1978) stated that certain dominance criteria serve to delineate a conceptual hierarchy amongst the dimensions we as humans apprehend. For Navon, the temporal dimension dominates all others whilst the spatial dimension dominates all but the dimension of time. This is the reverse of that predicted by H. Clark (1973), but has received partial support from several experimental studies.

Friedman and Seely (1976) investigated children's understanding of seven *spatio-temporal* terms *(before, after, first, last, ahead, behind* and *together with)* in two spatial and two temporal tasks. They found that *before, after, first,* and *last* were comprehended better in temporal tasks by the youngest (3:0 year olds) subjects whilst *behind* was easier to comprehend in spatial tasks. Experimental subjects also reinterpreted temporal tasks in a spatial sense for the terms *ahead* and *behind*. Similarly, reinterpretations of spatial as temporal tasks occurred for the terms *before, after, first,* and *last*. These findings are taken as support for the prior spatial acquisition of some terms but the primacy of temporal meanings for others. They also indicate that:

> "....both time and space, as categories of understanding, develop gradually and over the same developmental periods. (....)Therefore, one concept is unlikely to depend on the prior learning of the other."
> (Harris & Strommen, 1979, p. 192)

Feagans (1980b) conducted two experiments to look at the relationship between *before* and *after* in their spatial and temporal senses. In the first experiment 60 adult subjects were required to place temporal *before* and *after* on a time line and then give spatial synonyms for these terms by looking at their diagrams. On their diagrams most subjects placed the marker, a triangle, for temporal *before* in front of that for temporal *after* (a circle), indicating the predominant use of the *moving ego* metaphor. Therefore, the synonyms they gave for temporal *before* and temporal *after* were respectively based on back axis, e.g. *in back of, behind, after,* and front axis, e.g. *in front of, ahead, before,* spatial terms. These results led Feagans to conclude that most adults equated temporal *before* with spatial *after* and temporal *after* with spatial *before*. This is contrary to H. Clark's (1973) prediction that temporal *before* and *after* are based on their spatial analogues. In the second experiment 3:0, 5:0 and 7:0 year old children had to put a train together in the order specified by spatial sentences incorporating *before* and *after*. The result of better performance on *after* than *before* sentences by 3:0 year olds was taken as indicative of the priority of spatial *after*, in conflict to what is predicted by H. Clark (1973). These results do not so much question the priority of space but rather the spatial basis of the temporal terms *before* and *after*. This basis does not seem to be their spatial counterparts but instead their spatial opposites.

In a final study, Richards and Hawpe (1980), tested children's comprehension of the word pairs *before/after*, *first/last* and *ahead/behind* in spatial, temporal, and spatial/temporal tasks. Their major findings were as follows:

(1) *Before* and *after* were comprehended better in temporal and spatial/temporal tasks and worse in spatial tasks.

(2) *First* and *last* were comprehended better in temporal tasks.

(3) *Ahead* and *behind* were responded to worse in temporal tasks than in either spatial or spatial/temporal tasks.

From these results, Richards and Hawpe concluded that each antonym pair is acquired in one of its dual senses before the other. The pairs *before/after* and *first/last* are both acquired in a temporal sense first, whilst the pair *ahead/behind* is first understood in a spatial sense. Furthermore, this acquisition order is determined by the linguistic community's usage of these various terms. Such a conclusion received experimental support from adult definitions of these word pairs. These pairs were defined in the sense that was predominant for young children, e.g. *before/after* - temporal definition. Collins (1974) further corroborates the dominant temporal sense of the pair *before/after*. Both her normal and deviant, in terms of language development, subjects found *before* and *after* easier to comprehend in temporal than spatial order sentences.

The results of all of these experiments question the priority of spatial conceptions for time words and therefore contradict H. Clark's (1973) prediction that temporal words will be learnt in their spatial sense first. However, they provide only limited support for Navon (1978) as they only establish the priority of the time dimension for certain English words but not for others.

3.4 CONTEXTUAL EFFECTS : NON-LINGUISTIC AND LINGUISTIC

> "Determination of the meaning of a word for a particular speaker, such as a child, requires careful and extended observation of the speaker's use and comprehension of the word in a variety of linguistic and non-linguistic contexts."
> (Dale, 1976, p. 170)

This quote emphasises the importance of context, both verbal and non-verbal, in the child's comprehension of word meaning. Therefore, in any study of children's comprehension of words it is important to look at what effect these contextual factors have. Just how powerful are the effects of context?

The importance of non-linguistic factors on the comprehension of antonym pairs has been amply demonstrated in the studies reviewed so far. This research has shown that the effect of task variables, such as the objects used as stimuli, can be powerful. Such a result has been reported for comparative terms *(more/less)*, *dimensional* adjectives, and spatial/relational terms. The form and the language of the experimental instructions has also been found to affect the results obtained. For the locatives *in*, *on* and *under*, Wilcox and Palermo (1974) discovered that children's responses were strongly affected by whether the stimulus context supported or failed to support the language of the instruction. French and Brown (1977) and Kavanaugh (1979) have reported a similar strong effect for children's comprehension of *logical* versus *arbitrary* sentences conjoined by the temporal markers *before* and *after*. Indeed, Sinha and Walkerdine (1974) comment that:

> "The major factors affecting difficulty of comprehension are not to be found in any intrinsic difference between the two terms, but in the frames within which the relational term is located."
> (Sinha & Walkerdine, 1974, p. 28)

Brewer and Lichenstein (1974) have further noted the importance of linguistic factors on adults' comprehension and recall processes. The results they obtained were affected by the set of stimulus terms subjects had to recall.

The importance of context for the comprehension of *spatio-temporal* terms has been reported by the researchers in this area. Both Hodun (1975) and Wales (1981) have noted the facilitative effect a non-linguistic spatial context has on children's comprehension of temporal terms. Friedman and Seely (1976) and Richards and Hawpe (1980) have also commented upon the significant influence of non-linguistic context on their subjects' comprehension of terms with both a spatial and a temporal sense. Both studies reported that their subjects understood spatially dominant terms best in spatial contexts and worst in temporal, whereas the reverse was true of temporally dominant words. Furthermore, Richards and Hawpe (1980) concluded that one sense of *spatio-temporal* terms "is learned by analogy to the other, as a consequence of its correlation with the other sense, ..." and "the analogy is accomplished by experience within contexts representing the intersection of space and time, ..." (Richards & Hawpe, 1980, pp. 29-30). Finally, Feagans (1980b) provided evidence of the effect of non-linguistic context on adults' provision of synonyms for temporal *before* and *after*. Her subjects were required to give synonyms for *before* and *after* based on their spatial configurations of these terms on a time line. Those subjects who gave spatial *after* synonyms, e.g. *behind* for *before* always placed *before* to the left of *after* on their diagrams, while those who positioned *before* to the right of *after* invariably gave a spatial *before* synonym, e.g. *in front, ahead*.

The above results all point to the importance of linguistic and non-linguistic factors in children's comprehension of word meaning. For young children, 3:0 to 5:0 years, non-linguistic context exerts a strong influence on the responses they give to antonym pairs in experimental situations. Linguistic factors also seem to play a part as the language of the instructions affects children's understanding of such terms. The effect of these latter factors seems to increase with age, becoming dominant in the primary school years. This point is emphasised by Olson and Nickerson (1978) who studied changes in children's comprehension processes during the school years in terms of their ability to confine interpretation to the information given in a written text. In their study of the comparative relations *more/less* and *bigger/smaller* these researchers found that context had a similar effect on children's interpretation of the relations studied. Olson (1977) further stressed this point by noting that the development of comprehension involves the ability to rely on the speech signal alone in assigning meaning to an utterance.

The importance of linguistic context in the primary school period can be related to the major aspect of semantic development which occurs during this time, which is a greater understanding of the semantic relations between words. Anglin (1970) stated that young children can readily appreciate the concrete relations binding words, but have difficulty in comprehending the more abstract relations which exist between words. This understanding only develops as part of the maturation process. Swartz and Hall (1972) conducted an experiment where 5:0, 7:0, 9:0 and 11:0 year old subjects were required to give definitions for common nouns. They found evidence of a shift from concrete to abstract definitions with age, thus providing support for the predicted concrete to abstract development. It is the use of words in a wider variety of contexts by both the child and others which allows the comprehension of these abstract relations to develop.

The importance of context to language comprehension in this period is obvious. That this is a linguistic context is evidenced in Sinha's statement that "the 'sense' of a word is a relation which it contracts with other words" (Sinha, 1979, p. 3). This is a further reflection of the school age child's learning to confine interpretation to the information in the text (Olson & Nickerson, 1978).

The main aim of this thesis is to discover how sentence structure affects the school age child's comprehension of antonym pairs from the *spatio-temporal* semantic field. By school age the child's comprehension is determined by both this structure and the meanings or senses of the individual lexical items. The child's awareness of verbal context gradually increases over the school years, probably as a result of the increasing emphasis on reading and writing skills as the major means of communication. It is this greater sensitivity on the child's part which causes sentence structure or linguistic context to be such an important variable in the comprehension processes during the school years.

Having established the importance of linguistic context for children's semantic development in the school years, it is now necessary to define and delineate the area of importance to this study. Based on the above discussion the aims are:

(1) To examine the development of the *spatio-temporal* semantic field in primary school age children. To discover whether *Prototype Theory* or *Semantic Feature Theory* is more applicable to this development. In conjunction with this, to examine how adults conceptualise these terms so as to have a comparative basis for children's developing comprehension.

(2) To examine what effect sentence context has on the comprehension of terms with both a spatial and a temporal sense.

(3) To examine the effect of delayed language development on the acquisition of these antonym pairs. Are such children merely <u>delayed</u> or, in reality, <u>different</u> in their development?

CHAPTER 4.

UNDERSTANDING OF THE ANTONYM RELATIONSHIP IN THE *SPATIO-TEMPORAL* SEMANTIC FIELD

Before discussing in detail the effects of linguistic context on children's comprehension of the antonym pairs which comprise the *spatio-temporal* semantic field, it is necessary to establish that children in the age group being considered do in fact grasp the essential nature of the antonym relationship. E. Clark (1972) found that her 4:0 and 5:0 year old subjects demonstrated knowledge of this relationship at chance level only. Heidenheimer (1975) stated that by the age of 6:0 the child:

> ".... produces antonyms with such regularity (....) that it seems reasonable to claim that he has developed a cognitive strategy of contrastive opposition."
> (Heidenheimer, 1975, p. 757)

Further, Heidenheimer (1978) reported a similar finding of the strength of the antonym operation in the semantic processing of 6:0 year olds whilst that of synonymy is held to be a somewhat later acquisition.

The Heidenheimer study designates 6:0 years of age as being the time when the child comes to grasp the nature of opposites which comprise antonym pairs in his language. Therefore, children of primary school age, 7:0 years and over, should be able to demonstrate knowledge of the antonymic relation in the word field of *spatio-temporal* terms.

The aim of the experiment described within this chapter is to look at the primary school age child's knowledge of the antonym relation in the semantic field of *spatio-temporal* terms. The actual study was an extension of E. Clark's (1972) research on the comprehension of the antonymic relationship by 4:0 and 5:0 year olds. One of the major aims was to see how well the results of this study support those of E. Clark (1972), or could be seen as a natural developmental progression from her results, given that the present experimental subjects come from an older age group.

Another purpose was to discover if the results of the present study would corroborate E. Clark's (1973c) *Semantic Feature Theory*. This theory holds that the child gradually acquires the full adult meaning of a word by adding semantic features to his initial partial lexical entries. Therefore, in the area of antonym pairs, the theory predicts that the child passes from a stage of partial, incomplete understanding where he has knowledge of only one member (the positive or *unmarked* term) to one of complete or full comprehension. At this final stage, the child understands the meaning of both members of the antonym pair, and he knows that they are joined by a contrastive relation of opposition.

When applied to the *spatio-temporal* terms used in this study, the theory predicts that children will acquire the positive or *unmarked* (e.g. *in, on*) before the negative or *marked* (e.g. *out, off*) members of each pair. This will be reflected in the differential error rates for positive as opposed to negative terms.

The *Semantic Feature Theory* makes a further prediction of acquisition order for terms which comprise semantically related fields. It is held that these terms are acquired in the order from general to specific, where the generality of a term is specified by its feature composition. Those terms, within these hierarchically organised fields, which possess few and broad features are acquired before those which require more specific semantic features for their definition. Indeed, E. Clark (1973c) states that in feature hierarchies:

> ".... the top feature, being the most general in the definition of the word, is acquired first with the other features being acquired in the order of their hierarchical dependence."
> (E. Clark, 1973c, p. 75).

This notion of *"top-to-bottom"* acquisition order can be applied to the field of *spatio-temporal* terms. However, it is important to note that the prediction of acquisition order is more difficult to make for terms in this semantic field because the relationships between them are less systematic. Nevertheless, H. Clark (1973) stated that *in* and *on* will be acquired before *above, over, ahead* and *in front of*. He based this prediction on the notion of semantic complexity defined in terms of how these prepositions specify location. The former terms are merely positional and are held to be the most neutral

English prepositions. Therefore, they are acquired earliest. However, the latter are directional as they can only indicate location by specifying a direction from a position. As a result they are more complex semantically and so are acquired later. E. Clark (1972) has made further predictions in the area of *spatio-temporal* terms. She first posits that *in* and *on* are simpler than *over* and *above* as the former simply refer to position whereas the latter require specification not only of the reference point object but also of the area(s) which exists between it and the object being placed. Further, of those terms which refer to the vertical axis, *up* is simpler than *above* and *over* as it can only specify direction on the vertical axis. Finally, *in front of* is held to be simpler than *before, first* and *early* as the former term provides the spatial basis for the latter temporal terms.

There are several major experimental studies which have looked at the development of the antonymic relationship in child language. Each of these will now be discussed.

E. Clark (1972) was concerned with the child's awareness of the membership of words in semantic fields or more specifically his ability to recognise that particular words are related in meaning. E. Clark stated that children are able to form semantic fields prior to the acquisition of the full (adult) meanings of words. To investigate this 15 boys and 15 girls aged between 4:0 and 5:6 years were asked to supply the *"opposite"* of the word spoken by the experimenter in an experimental task which was presented in the nature of a "word-game". Two semantic fields, *dimensional* and *spatio-temporal*, constituted the 18 antonym pairs used as experimental stimuli. The results confirmed the hypothesis that the order of acquisition of pairs within each field is determined by their semantic complexity. This was reflected in both the differential error rates for pairs as well as the substitutions made amongst the terms within a particular field. The predicted order of acquisition for terms in the *spatio-temporal* field was verified in the data and this order is illustrated in Table 4.1 below.

TABLE 4.1. Predicted order of Acquisition of Word Pairs in the *Spatio-Temporal* Semantic Field based on E. Clark (1972).

(1)	*(in/out)* *(on/off)*	before	*(above/below)* *(over/under)*
(2)	*up/down*	before	*(above/below)* *(over/under)*
(3)	*in front/in back*	before	*ahead/behind*
(4)	*in front/in back*	before	*(first/last)* *(early/late)* *(before/after)*

The major conclusion drawn from this study was that the child sets up semantic fields early by grouping words that are related in meaning. Indeed, semantically related words are grouped even before the child has full knowledge of the sense of such words. This was evidenced by the substitutions children made in a particular semantic field. For example the pair *big/small* was substituted 80% of the time for other *dimensional* terms. Consequently, E. Clark concluded that these *dimensional* and *spatio-temporal* pairs are learnt as pairs and not as single lexical items.

Kavanaugh (1976a) provided data which also pointed to the early acquisition of a contrastive relation in semantic processing. He found that his 3:0 to 5:5 year old subjects gave relational responses above chance level when performing a choice task which involved comparative sentences of the form *"The girl is X-er than the boy"*. Kavanaugh took this as evidence that preschool children are able to process comparative sentences in terms of the relational information they contain. Further he concluded that the data:

> "....suggest that the comprehension of comparative sentences is determined by the nonlinguistic ability to represent objects of comparison along a single dimension."
> (Kavanaugh, 1976a, p. 317)

Three other experimental studies have reported results contrary to those of E. Clark (1972). In the first of these, Heidenheimer (1975) studied the acquisition of the antonym response by children. The major hypothesis was that the learning of this response was dependent on the prior acquisition of what Heidenheimer referred to as a "strategy of negation". Eighty experimental subjects, 40 boys and 40 girls, aged between 4:0 and 6:9 years completed a simple word association task. Fifteen antonym pairs (e.g. *alive/dead; thick/thin)* which could be characterised by the *unmarked* - *marked* dichotomy were used as experimental stimuli in this study. The major finding was the emergence of a negation response in which the child merely prefixed the stimulus word with *not*, e.g. *not pretty*. This response strategy was primarily used by younger subjects before the antonym response became prominent. Heidenheimer cited such a finding as evidence that each member of an antonym pair is first learnt as a single lexical item before being learnt in its relational sense. Therefore, her results and conclusion are contrary to those of E. Clark (1972). However, in support of E. Clark's (1972) results, Heidenheimer reported that antonym responses to *marked* or negative terms were just as frequent as to *unmarked* or positive terms.

In a second study, Heidenheimer (1978) looked at both antonym and synonym categorisations in older children. It was predicted that the antonym relation would be learnt earlier than the synonym relation on the basis that the latter is more difficult to process semantically. The 72 experimental subjects who fell in the age range 6:3 to 10:11 years, were required to perform both a word association and a false recognition task. In both tasks the experimental stimuli were 10 word triads, e.g. *begin/end/start; sour/sweet/bitter,* where the first words were the stimuli for the word association task as well as the critical stimuli for the false recognition task. The second and third words of these sets were respectively the antonym and synonym foils for the false recognition task.

From the evidence of antonym responding at the youngest ages and the increase of synonym responses with age found in both tasks, Heidenheimer concluded that the developmental sequence which was predicted on the basis of complexity of processing was verified by the later emergence of the synonym operation. This was seen as evidence in conflict with E. Clark's (1972) proposal that semantic fields, characterised by commonality of features, are well organised even in young children. Consequently, the synonym response should have primacy in children's semantic processing and not emerge as a later development in the school years as found by Heidenheimer (1978).

A final study conducted by Friedman and Seely (1976) looked at children's understanding of *spatio-temporal* terms. Their subjects were 39 children aged between 3:0 and 5:0 years whose task was to respond to instructions containing 7 *spatio-temporal* terms in both spatial and temporal contexts. The 7 terms used in this experiment were *before, after, first, last, ahead of, behind* and *together with*. The finding of most relevance here was that there was no significant difference between *marked* (negative) and *unmarked* (positive) terms with respect to correctness of response in any experimental situation. This is further evidence in contradiction to one of E. Clark's (1973c) major predictions, but is corroborated by a similar finding in the data of E. Clark (1972) and Heidenheimer (1975).

Within the context of these findings, the following three hypotheses were tested in the present experiment:-

(1) Primary school age children will make a larger proportion of *"adult correct"* responses than errors in an antonym elicitation task. These responses are in terms of dictionary definition, e.g. *big - small*. This will be evidence of these children's understanding of the antonym relationship. The combined effects of greater semantic knowledge and formal education will produce such comprehension results.

(2) The most common type of error responses will be those which can be categorised as *"semantically appropriate"*. Such responses share semantic features with the correct opposite. This again will be the result of developmental effects.

(3) The negative *(marked)* member of the antonym pair will evoke more errors than the positive (*unmarked*) member. The *Semantic Feature Theory* provides the basis for this hypothesis with its prediction that the positive member of an antonym pair is learnt first by children.

4.1 METHOD

4.1.1 Subjects

In this experiment the subjects were 60 monolingual Year 3 children, 30 males and 30 females, attending a suburban primary school in an upper middle class area. The ages of the experimental subjects ranged from 7:2 years to 8:11 years with a mean of 7:7. On form (a) of the *Peabody Picture Vocabulary*

Test (P.P.V.T.) these subjects' verbal comprehension I.Q.'s varied between 78 and 145, with 60% of the children scoring in the "normal" range of 85-115 I.Q. points. (Appendix I-A provides mean chronological age and mean *P.P.V.T.* scores for each sex group.)

4.1.2 Experimental Design

The 10 *spatio-temporal* antonym pairs listed in Table 4.2 were used as experimental stimuli. These 10 pairs were the same as those used by E. Clark (1972) except that *behind* was substituted for *in back* as the opposite of *in front*. This was done because of lack of use of *in back* in Australia.

TABLE 4.2. List of 10 *Spatio-Temporal* Pairs used in the Study.

In/Out	*In front/Behind**
On/Off	*Ahead/Behind*
Up/Down	*First/Last*
Over/Under	*Early/Late*
Above/Below	*Before/After*

**In back* in E. Clark's (1972) study.

These 19 terms were printed in heavy black print on separate pieces of square white cardboard. From these terms, two experimental lists (L1 and L2) were constructed. As can be seen from Table 4.3 each list was composed of half the positive and half the negative terms in such a way that the positive and negative members of the same pair did not occur in the same list (except *ahead/behind* due to *behind* occurring as the opposite for both *in front* and *ahead*).

TABLE 4.3. The Two Experimental Lists (L1 and L2) used.

L1		L2	
In	*Behind*	*Out*	*In front*
Off	*Ahead*	*On*	*First*
Up	*Last*	*Down*	*Late*
Under	*Early*	*Over*	*Before*
Above	*After*	*Below*	

These two lists were then combined in the two orders A (L1, L2) and B (L2, L1). Fifteen subjects of each sex received each order.

4.1.3 Procedure

Subjects were seen individually by the experimenter (E) in an area set apart from the classrooms. After putting each subject at ease, form (a) of the *P.P.V.T.* was administered.

The experimental task was then given to each child in the nature of what was called a *"word game"*. First, E checked that each child knew what the term "opposite" meant by asking them to define it. If the child could not do this, E gave an explanation by using examples such as *full/empty* and *slow/ fast*. (However, unlike E. Clark's (1972) subjects, most of the present experimental subjects understood what an "opposite" was before starting the experiment proper.) Once E had ensured that the subjects knew the meaning of the term "opposite", the experimental task was begun. E prefaced this by saying,

"You play the game like this. If I say good,

you say....?

Now, if I say sad, you say....?

And if I say quiet, you say....?

The subject was then given each of the 19 stimulus terms and asked for its opposite. Each stimulus term was presented orally and visually. Not only could the subject read it from the card, but E also stated it aloud as each stimulus card was presented. Before presentation of the particular experimental order the cards within each list were shuffled to ensure randomisation.

Children were encouraged to respond throughout the task by use of verbal reinforcers such as *"good"* etc.. However, no corrections were made to the children's responses. E merely marked down the response and proceeded to the next stimulus.

4.2 RESULTS

The children's responses to the opposites task were classified in the following three categories based on E. Clark (1972):

(1) *Adult correct*, which consisted of the opposites shown in Table 4.2.

The next two categories were the error response classifications.

(2) *Semantically Appropriate*, which were responses of the same pole as the correct opposite and which, shared semantic features with it, e.g. *high-little*.

(3) *Other errors,* which were all other incorrect responses such as synonyms, negations, e.g. *not high,* and *"don't know"*. These error responses were grouped as a category because singly they constituted such small numbers whose separate analysis would yield no valid or strong conclusions.

On the basis of these categories three independent raters as well as E classified all of the errors made by the experimental subjects. Ninety per cent agreement was found between these raters and E. Therefore, E's own ratings of subjects' errors were used in the data analysis.

The largest proportion of responses made by subjects fell in the *adult correct* category (81.1%). The errors, which comprised the other 18.9% of responses, were mainly composed of *semantically appropriate* responses (72.2% of error responses) with very few responses of the *other error* type (27.8%). Table 4.4 below clearly illustrates the strong tendency for these experimental subjects to respond with the correct opposite and, therefore, make few errors on this experimental task. (Raw data for each sex X presentation order group is given in Appendix I-B).

TABLE 4.4. Classification of all Subjects' Responses

	Adult Correct	*Semantically Appropriate*	*Other Error*
Number	924	156	60
Percentage of Total	81.1	13.7	5.2

When the children's responses to each word pair were considered, Table 4.5, it can be seen that the pairs which yielded the most errors in the experiment were *above/below* (61), *ahead/behind* (41 averaged) and *over/under* (30). This table also indicates that the largest number of errors made by subjects on any word pair can be classified as *semantically appropriate*.

TABLE 4.5. Classification of Subjects' Responses to Each Word Pair.

	Adult Correct	*Semantically Appropriate*	*Other Error*
In/Out	120	-	-
On/Off	110	2	8
Up/Down	116	3	1
Over/Under	90	25	5
Above/Below	59	57	4
*In front/Ahead/Behind**	113	53	14
First/Last	110	1	9
Early/Late	108	6	6
Before/After	98	8	14

*The figures in this line include child responses to three terms as stimuli and not two as the other lines do, as *behind* was the correct opposite for both *in front* and *ahead*.

When response type was considered in relation to sex and I.Q. score on form (a) of the *P.P.V.T.*, no differences were found for either variable. This is evident in Tables 4.6 and 4.7 following.

TABLE 4.6. Sex X Response Type.

	Males	Females
Adult Correct	465	459
Semantically Appropriate	72	84
Other Error	33	27

TABLE 4.7. I.Q. Score *(P.P.V.T.)* X Response Type (percentage*).

P.P.V.T. score range	76-85	86-95	96-105	106-115	116-125	126-135	136-145
Adult Correct	63.2	78.5	81.6	74.8	86.6	88.2	88.2
Semantically Appropriate	24.5	16.7	12.8	20.5	8.9	9.2	5.3
Other Error	12.3	4.8	5.6	4.7	4.5	2.6	6.5

*These figures are reported as percentages because of the unequal numbers in each I.Q. *(P.P.V.T.)* group.

These differences also proved to be nonsignificant when response type was correlated with both sex and verbal I.Q. variables separately (Kendall Correlation Coefficient).

Experimental order (A or B) similarly had no effect on the type of response given. Such a result was to be presumed as this variable was part of the normal randomisation procedure and therefore, was not expected to affect the results.

A three factor analysis of variance (Subjects X Response Type X Stimulus Term 'positive or negative') was performed on all terms except *in front/ahead/behind*. These latter three words were excluded because *behind* appeared in only one list but was the opposite response for both *in front* and *ahead*. The results of this analysis are given in Table 4.8 and reveal a significant main effect for response type (F = 2361.9, d.f. = 1,236, α = 0.05) and a significant interaction effect for response type X stimulus term (F = 17.48, d.f. = 1,236, α = 0.05). However, no significant effect for the other main variable of stimulus term was found.

TABLE 4.8. Three-factor A.O.V. (Subject X Response X Stimulus Term).

Source	D.F.	S.S.	M.S.	F.
Subjects	236	209.28	-	-
Response Type	1	2094.5	2094.5	2361.9*
Stimulus Term	1	.50	.50	.56
Response Type X Stimulus Term	1	15.50	15.50	17.48*

*Significant at α = 0.05, F 1,236 = 3.89

A Chi-square Analysis (see Hays, 1963) of the response data for the terms *in front/ahead/behind* yielded a significant value (X^2 = 13.5, d.f. = 4, α = 0.05). This demonstrated that *behind* produced the largest number of *adult correct* responses.

4.3 DISCUSSION

The data from this experiment supported the first two hypotheses in relation to the type of responses. It was found that the largest proportion of responses made by experimental subjects could be classifed as *adult correct*, and this proved significant using an analysis of variance. Such a result was true for children of both sexes. It was also unaffected when the variables of experimental order and stimulus term (positive or negative) were taken into account. In support of hypothesis two, most of the errors made by child subjects could be classified as *semantically appropriate*. This was most clearly seen for the pairs *above/below* and *over/under* on which the subjects made the most errors. When these error data were examined closely subjects were seen to be giving, as opposites, terms which occurred on the vertical axis but which were not the correct opposite in terms of dictioniary definition, e.g. *above-down* or *under-up*. Indeed such *semantically appropriate* responses were most prevalent amongst the terms in this area (i.e: *up/down; above/below; over/under)*, and of these, over half were substitutions of a more complex by a simpler term, e.g. *below-down*. This latter finding provides support for E. Clark (1972) who predicted that the pair *up/down* should be substituted for *above/below* and *over/under* as the former pair has a simpler specification on the vertical axis. However, few other substitutions of semantically simple for more complex terms occurred in the experimental data. Some substitutions even went in the opposite direction to that predicted, e.g. *behind-before*. Consequently, there is only limited support for E. Clark's (1973c) general to specific development in the present experimental data.

The data do support those reported by E. Clark (1972), although the percentage of *adult correct* responses is almost twice that which she found (81.1% vs. 49%). This latter finding can be attributed to the fact that E. Clark's subjects were younger (4:0 to 5:6 years) than those used in the present experimental study. Therefore, they were at an earlier developmental level with respect to these *spatio-temporal* antonym pairs. The present subjects, being 3:0 years older, should demonstrate a clearer understanding of the antonymic relationship. This is clearly reflected in children's responses to the question *"Do you know what an opposite is?"*. Only 11 of the present 60 experimental subjects did not, but none of E. Clark's (1972) subjects did. Another finding which corroborates a developmental increase in children's comprehension of the antonym relation is that the present experimental subjects gave a similar number of *semantically appropriate* responses as did E. Clark's (1972) (13.6% vs. 14%). This demonstrates that the increase in correct responding has not just been in terms of *polarity*, in which case *semantically appropriate* responses might be expected to increase as did *adult correct* responses. It has been in terms of meaning also. Children not only demonstrated a greater awareness of the *+Pole/-Pole* distinction but they also showed evidence of grasping the notion of correct opposite (dictionary definition), that is, that members of an antonym pair exist in a direct one-to-one relationship of opposition to each other.

All of these findings lead to the conclusion that by the time children have reached primary school age (7:0 years and over), they do understand the meaning and polarity relations which exist among pairs of opposites in the *spatio-temporal* semantic field. Such a result supports Heidenheimer (1975, 1978) who reported data which confirmed the acquisition and comprehension of the antonym relationship by children 6:0 years and over.

The third hypothesis regarding the differential error rate to positive and negative terms received no confirmation in the data. No significant effect for type of stimulus term was found when a three-way analysis of variance was performed on the experimental data. Even the significant interaction effect for Response Type X Stimulus Term obtained in the analysis of variance leads to an interpretation of no difference between positive and negative terms. This interaction was caused by the positive terms producing a slightly larger number of *adult correct* responses, and the negative terms a slightly larger number of *semantically appropriate* responses. However, when these two response categories were added for each type of term there was very little difference. As *semantically appropriate* responses can be considered "correct" in that they share semantic features with the *adult correct* response, this result further supports the conclusion of no difference between positive and negative terms.

These findings are in opposition to one of the major predictions of the *Semantic Feature Hypothesis*, that the positive members of antonym pairs are acquired before their negative counterparts. However, they do support the results reported by E. Clark (1972) herself and Heidenheimer (1975). These authors found no differences between *unmarked* (positive) and *marked* (negative) terms with respect to antonym elicitation, for both types of terms yielded similar numbers of opposites when given in word tasks. Therefore, the results of these researchers as well as the present experimental data question the applicability of this principle of the *Semantic Feature Hypothesis* to word tasks involving opposites, and so limit its generality. However, Friedman and Seely (1976) have also failed to find any differences between the positive and negative members of antonym pairs on a somewhat different task which involved the comprehension of *spatio-temporal* terms in spatial as well as temporal contexts. Consequently, the validity of this prediction can be questioned on a number of grounds. Perhaps it is task and/or context dependent.

E. Clark's (1972) other major prediction with respect to the acquisition of *spatio-temporal* terms only received partial confirmation from the experimental data. Only her first two predictions in this area (see Table 4.1) were relation which holds between these word pairs in the *spatio-temporal* semantic field. From now on, any confusions or errors children make with such word pairs can be seen to be due to their increasing awareness of the varying contexts in which these terms may be used. Such incomprehension primary school age children evidence can be ascribed to the dual meaning (spatial and temporal) of these words, and how contextual effects determine which sense is applicable. It is this meaning in context which must now be mastered.

CHAPTER 5

CHILD AND ADULT CONCEPTIONS OF *SPATIO-TEMPORAL* TERMS

Children of primary school age appear to have a firm grasp of the antonym relationship which exists among word pairs in the *spatio-temporal* semantic field. This has been amply demonstrated in the former experiment where over 80% of the children's responses to an "opposites" task could be classified as *adult correct*. These subjects gave the direct opposite, listed in Table 4.2 (p. 117) to the *spatio-temporal* terms studied significantly more often than would be expected by chance. Consequently, any errors or misinterpretations which children of primary school age make with *spatio-temporal* terms can be attributed to the dual meaning of these terms, and how aware they are of this dual meaning.

Therefore, it is important to examine children's conceptualisation of *spatio-temporal* terms. Do children realise that such terms have both a spatial and a temporal sense? Or do they initially perceive such terms as having only one meaning? Is it only with development that children understand that both a spatial and a temporal sense is necessary to adequately characterise their meaning?

The major purpose of the present study is, therefore, to examine children's perception of the meanings of words from the *spatio-temporal* semantic field. However, only a limited subset of those terms studied in the previous experiment will be investigated. These are the terms *in front, ahead, behind, before,* *after, first* and *last*. The external validation for this choice is both theoretical and semantic, that is dictionary definition, in nature.

Of the pairs listed in Table 4.2 those selected for examination in the present study seem to embody both a spatial and a temporal sense most clearly. This conclusion is supported when the multiple dictionary definitions for these terms, listed in Table 5.1, are considered. All seven terms are defined as having a movement, position and time sense. The many and varied definitions for each term quite clearly utilise notions of time and space in attempting to capture the essential meaning of the term as it is used by speakers of the English language. The definitions also demonstrate that these *spatio-temporal* terms are often used as synonyms for each other, e.g. *ahead* is equivalent to *before*; *after* is equivalent to *behind*. Furthermore, it is noteworthy that *before* and *after* are used in adverbial definitions for *first* and *last* respectively. This occurs for both spatial and temporal meanings.

H. Clark (1973) discusses the close relationship which exists between spatial and temporal terms in the English language. For H. Clark the temporal terms of English have a quite specific spatial basis. The relational prepositions which are used to describe time, such as *before, after, ahead, behind, in front* and *in back*, are derived from the spatial notions of *front* and *back*. Thus, H. Clark concludes that a spatial metaphor underlies the English temporal prepositions and contributes to their meaning.

TABLE 5.1. Dictionary Definitions of *Spatio-Temporal* Terms. (Funk & Wagnalls, 1974).

AHEAD (synonym of *in front of*)

- at the head or front
- in advance
- onward, forward
- without restraint, headlong
- *before*, in front of (Webster, 1968)

BEFORE

Adj.
- *in front, ahead*
- preceding in time, previously
- earlier, sooner

Prep.
- *in front of; ahead of*
- face to face with, in the presence of
- prior to, in time, earlier or sooner than
- in advance of as in rank, attainment, etc.
- demanding the attention of
- in the cognizance or power of
- *driven in front of*, moved by

Conj.
- previous to time when; sooner than
- in preference to; rather than

FIRST

Adj.
- numbering: the ordinal one
- *prior to all others in time: earliest*
- *nearest or foremost in place* from a given point
- highest or foremost in character, rank, etc.

Noun
- that which comes or is first; the beginning
- a winning position in a contest

Adv.
- *before all others in order as in coding, time, place or rank*
- *before or in preference to*, some proposed act or anticipated event; sooner
- for the last time

BEHIND

Adj.
- in, toward or at the rear; backward; looking behind
- in a previous place, condition, etc.
- *in a time gone by*
- in reserve; to be made known
- in arrears; not according to schedule
- *retarded in time*, as a train or clock

Prep.
- at the back or farther side of
- to or toward the rear
- *following after*
- *remaining after*
- *later than*
- sustaining, supporting
- inferior to as in position, accomplishments, etc.
- not yet revealed or made known about

AFTER

Adj.
- farther aft; toward the stern (Nautical)
- following in time or place, subsequent; later

Adv.
- at a later time
- in the rear; *behind*

Prep.
- *in the rear of*; farther back than; following
- subsequently to; at a later period than
- in succession to; following repeatedly
- as a result of; subsequently to and because of
- notwithstanding; subsequently to and in spite of
- next below in order of importance
- in search or pursuit of
- according to the nature, wishes or customs of
- in imitation of; in the manner of
- in honour, remembrance or observance of
- in relation to, concerning

Conj.
- following the time that

LAST

Adj.
- next before the present; most recent
- least fit or likely; most remote
- beyond or above all others; utmost
- beneath all others

Adv.
- *after all others in time or order*
- at a time next preceding the present
- in conclusion; finally

Noun
- the end; conclusion

Consequently, when terms such as *in front, ahead, behind, before* and *after* are considered as single lexical items it can be concluded that they have both a spatial and a temporal sense.

Traugott (1978) further emphasises the fact that the language system of temporal terms has an underlying spatial base. She states that this spatial basis is locative in nature. Further, in agreement with H. Clark (1973), Traugott sees the temporal pairs as having an asymmetrical foundation in the *front/back* axis which is defined in terms of the human body's perceptual apparatus. As evidence for this Traugott cites common examples:

> "....we look forward to the years ahead, we look back on the past, all that is past lies behind us." (Traugott, 1978, p. 378)

Such expressions make use of the notion of an asymmetrical perceptual plane running through the body which classifies everything that is visible as being *in front* whilst the "invisible" constitutes the *back*. In drawing such an analogy, Traugott relies heavily on H. Clark's (1973) earlier conceptualisation of a spatial metaphor for time language. Consequently, she further elaborates the close connection which exists between the two meaning systems of space and time in the English language. In addition, Traugott affirms the dual spatial and temporal meaning of terms classified as *spatio-temporal*.

Beilin (1975) provides additional theoretical support for the attribution of both a spatial and a temporal sense to the pairs *before/after* and *first/last*. He states this clearly by noting that for these pairs in some contexts, linguistic time is interchangeable with reference to space. Indeed, for Beilin, the time and space lexicons are very closely connected by what he calls "a common metric" for referring to both time and space.

Other research workers in this area have also noted that both spatial and temporal senses can be attributed to the word pairs *ahead/behind, before/after* and *first/last*. Indeed, in their investigation of young children's comprehension of *spatio-temporal* terms both Friedman and Seely (1976) and Richards and Hawpe (1980) selected just these pairs for analysis. This is indicative that adults can and do perceive these terms as having two different but related usages. Adults are clearly aware of both the spatial and temporal meanings of such word pairs.

However, it is important to realise that one of the meanings of *spatio-temporal* terms is regarded as being dominant. This notion of one meaning dominating the other has strong theoretical and empirical support. The linguist Bennett (1975) ascribes either spatial or temporal meaning components to the terms *in front of, behind, before* and *after*. Table 5.2 illustrates the components he sees as characterising these terms when they are used as prepositions. This table indicates that *in front of* and *behind* are assigned a spatial meaning whereas a temporal meaning is attributed to *after*. However, the "time" and "place" components have both been omitted from the analysis of *before*. The reason for this according to Bennett, is that both spatial and temporal uses of *before* are prevalent. This results in the

TABLE 5.2. Componential Analysis of English Prepositions. (Bennett, 1975)

In front of	"locative anterior place"
Behind	"locative posterior place"
Before	"locative anterior"
After	"locative posterior time"

sense of *before* being mainly determined by the context of use rather than by any properties which inhere in *before* itself. Pierart (1977) also provides minor evidence of a strong spatial sense for *before*. Her study investigated the French child's acquisition of the spatial relationship markers *devant* and *derrière*. The English equivalents of these terms are respectively *in front of* or *before* and *behind*. Thus, it can be concluded that in French, as well as in English, *before* has a clear spatial sense.

Richards and Hawpe (1980) further discuss the dominant sense of the antonymous pairs *ahead/behind, before/after* and *first/last* from both a grammatical and semantic viewpoint. These authors conclude that *ahead* and *behind* are mainly spatial expressions with a secondary temporal sense. If they are to be used temporally then they are frequently marked by appending the noun *time*. In contrast, the terms *before* and *after* are predominantly used, both grammatically and semantically, in a temporal sense. For the final pair, *first/last*, a dominant meaning is more difficult to determine. These terms appear to be used with equal validity and ease in either a spatial or a temporal sense. Consequently, the dominant meaning for *first* and *last* is more flexible and ambiguous in nature. It can be classified as neither spatial nor temporal as is the case for the former two pairs.

Several investigations into the semantic field of *spatio-temporal* terms have provided empirical support for the dominance of one sense of these words. Friedman and Seely (1976) tested 3:0 to 5:0 year olds' understanding of the words *before, after, first, last, ahead of, behind* and *together with* in both spatial and temporal tasks. In these tasks the child was required either to place or to move dolls in response to experimental instructions incorporating the 7 *spatio-temporal* terms. There were two major findings in this study. First, younger subjects comprehended *before, after, first* and *last* at an above chance level in temporal tasks, whilst similar comprehension performance for *ahead of* and *behind* was found on the spatial tasks. The second major finding was that *before, after, first* and *last* were often reinterpreted in a temporal sense in spatial tasks, while *ahead of* and *behind* were given a spatial reinterpretation in temporal tasks. From these results, Friedman and Seely concluded that *ahead of* and *behind* are first understood in a spatial sense whereas the temporal sense is prior in children's acquisition of *before, after, first* and *last*. Such data and conclusions support the notion of one dominant sense for these dual-meaning *spatio-temporal* terms.

Richards and Hawpe (1980) in a study of adults and children, have also examined young children's comprehension of the word pairs *before/after, ahead/behind* and *first/last* in three different tasks. These tasks involved non-linguistic contexts which were either spatial, temporal or spatial/temporal in nature. In both the spatial and spatial/temporal tasks the child placed an object in relation to one or more fixed objects in accordance with the experimental instructions. The temporal task required the subject to push buttons in an order determined by experimenter commands. In all tasks the 6 *spatio-temporal* terms were used in the instructions. The results obtained indicated that in spatial contexts children's performance on the pair *ahead/behind* was superior to that on other pairs. For the pair *before/after* subjects achieved superiority of performance in the temporal contexts or tasks. This latter finding was also replicated for the pair *first/last*. On the basis of these results, the authors concluded that the pairs *before/after* and *first/last* are initially acquired in a temporal sense. Only later in development is their spatial sense also understood. However, for the pair *ahead/behind* the spatial meaning is primary with the temporal being a later acquisition. This developmental data was reflected in the definitions adult subjects gave for these *spatio-temporal* terms. Definitions for *ahead* and *behind* were mainly spatial whilst those for *before* and *after* were predominantly temporal. However, for *first* and *last* the definitions given by adults were more frequently ambiguous. Therefore, they were difficult to classify as favouring either a spatial or a temporal sense.

Hodun (1975) further illustrates this notion of a dominant meaning for adults. Her 32 adult subjects were required to rate the terms *ahead, behind, before* and *after* on a 12 point scale characterised as a spatial to temporal continuum. Hodun's major finding was that *ahead* and *behind* were judged to be primarily spatial, thus confirming the idea that these terms have a dominant spatial sense. *Before* and *after* were rated as being more neutral in meaning with both spatial and temporal aspects. Nevertheless, with respect to the pair *ahead/behind* they were perceived as being temporal, which is indicative of this being their dominant sense.

The work of these theoreticians and researchers emphasises the dual meaning which underlies the *spatio-temporal* terms in English as well as the dominance of one of these meanings for a particular pair. This latter fact would be expected to influence acquisition order of the two senses attributed to *spatio-temporal* terms. According to H. Clark (1973) spatial perceptions are the basis of temporal perceptions. From which the *Correlation Hypothesis* postulates that temporal language is based on spatial language. Furthermore, H. Clark's *Complexity Hypothesis* states that:

> "....spatial expressions should appear before time expressions, and in particular, each term that can be used both spatially and temporally should be acquired in its spatial sense first."
> (H. Clark, 1973, p. 57)

Therefore, H. Clark predicts that *spatio-temporal* terms are first acquired in their spatial sense. Only later do children come to realise that they also embody a temporal meaning. In contrast, the work of Hodun (1975), Friedman and Seely (1976) and Richards and Hawpe (1980) predicts that each *spatio-temporal* term is first learnt in its dominant sense as reflected by its usage in the linguistic community. Consequently, *ahead* and *behind* are first learnt spatially, and *before* and *after* are first given a temporal meaning. However, for *first* and *last* the prediction, based on dominant usage is more difficult to make. Nevertheless, the experimental data of both Friedman and Seely (1976) and Richards and Hawpe (1980) points to the developmental priority of a temporal meaning for these words.

To test which of these predictions was true a study was conducted using the technique of data collection and analysis known as *Multidimensional Scaling (M.D.S.)*. This is a quantificational approach to the representation of meaning which has been developed primarily by Shepard (1962) and Kruskal (1964). In such a method, subjects are typically required to give judgments of similarity for all pairs constituting the semantic domain of interest. These data, when analysed, yield a dimensional space which is held to characterise people's conceptions of these terms in psychological or semantic space. *M.D.S.* techniques have been used successfully to study a variety of semantic fields such as colours, prepositions and verbs.

Prepositions have been studied by H. Clark (1968) and Fillenbaum and Rapoport (1971). H. Clark (1968) investigated the meaning and use of 33 common English prepositions using sentence-composition, free association and grouping tasks. When the data were subjected to *M.D.S.* analysis (Kruskal, 1964), H. Clark found that the prepositions could be conceptualised in terms of two dimensions. These two dimensions grouped terms according to similarity in meaning. The closer two terms were in dimensional space, the more similar they were in meaning, e.g. *between, among*. However, Fillenbaum and Rapoport (1971) questioned the applicability of this method of analysis to the word field of prepositions. These researchers asked their adult subjects either to construct labelled tree diagrams or to perform a grouping task with 29 prepositions similar to those used by H. Clark. Although a two dimensional representation derived from a *M.D.S.* analysis fitted the data of the former group, it could not adequately describe that of the latter. For both groups, a cluster analysis yielded a better representation of semantic space. Therefore, according to Fillenbaum and Rapoport it is the preferred method of analysis for the word field of prepositions.

Pierart and Costermans (1979) have investigated the semantic space of 13 French prepositions of space localisation. Their subjects were 100 French adults aged between 18:0 and 20:0 years whose task was to rate each of the 78 possible pair combinations on a 5 point similarity scale. This scale ranged from *"very similar"* at one end to *"completely different"* at the other. When these data were subjected to a *M.D.S.* analysis they yielded a 7 dimensional solution. These dimensions, 3 of which were bipolar and 4 unipolar, were found to characterise adequately the semantic features associated with each of the 13 prepositions. They also received confirmation when a cluster analysis was performed on the data. The bipolar dimension labelled *sagitality* was the one isolated in this data which has most relevance to the present study. This dimension distinguished the terms *devant (in front of)* and *derrière (behind)*. The study conducted by Pierart and Costermans also demonstrated the applicability of both *M.D.S.* and cluster analysis to the prepositional word field in contradiction to Fillenbaum and Rapoport (1971) but in corroboration of H. Clark (1968).

Other studies which have used the *M.D.S.* technique to investigate semantic fields have been conducted by Rips, Shoben and Smith (1973) and the already cited work of Fillenbaum and Rapoport (1971). The former authors used a rating task to obtain judgments of semantic similarity for the domains of birds and mammals. They found that the data from both domains could be represented as a two dimensional space, where the horizontal dimension was labelled *size* and the vertical, *predacity*. Fillenbaum and Rapoport (1971) have also demonstrated the usefulness and applicability of the *M.D.S.* technique to a variety of semantic fields. These workers used three different methods to obtain their data. Each method required the subject to judge similarity by either constructing tree diagrams or undirected graphs or by grouping words. Their results indicated the relevance of the *M.D.S.* model to highly structured domains such as colurs. In these domains a dimensional solution adequately represented the data. However, for semantic fields with ill-defined boundaries, such as the *HAVE* verb family, such an analysis yielded uninterpretable dimensions. Consequently cluster analysis was seen to be the better method to use to provide an adequate representation of the semantic space of such ill-defined domains.

The above studies all point to the usefulness and applicability of the *M.D.S.* method to the semantic field of *spatio-temporal* words. Such a word field may be characterised as well-defined since it is small compact and highly structured with definite boundaries delineated in terms of a dual spatial/temporal sense. Therefore, it meets the criteria of applicability postulated by Fillenbaum and Rapoport (1971), for which they also provide support. These authors further emphasise that this technique has seldom been used to investigate how semantic structures develop. Its use has been heavily concentrated in the area of the adult subjective lexicon and the properties which characterise it. Of the studies reported above, only that of H. Clark (1968) obtained data from child subjects, thus emphasising the limited use of this technique with children.

Therefore, the present study aims to use the method of *M.D.S.* to study the semantic field of *spatio-temporal* terms. The purpose is to investigate children's conceptualisations of the meanings of these words, and how they differ from those of adults. Based on the above discussion, the following predictions were tested:-

(1) Two dimensions will be found which adequately characterise the terms *in front, ahead, behind, before, after, first* and

last in semantic space. These will be labelled spatial and temporal in correspondence with the dual meanings associated with *spatio-temporal* terms.

(2) This dimensional space will be more distinct in the adult that in the child data.

a) Distinction of these antonymous word pairs on the two dimensions will be more characteristic of adults as they are more aware that such words have both a spatial and a temporal sense.

b) For children, the *spatio-temporal* terms will be more fully represented on the spatial than on the temporal dimension. This prediction is based on H. Clark (1973) who postulated that the spatial sense of *spatio-temporal* terms is learnt before their temporal sense.

5.1 METHOD

5.1.1 Subjects

This experiment used subjects from both child and adult age groups. The child subjects were 56 monolingual Year 3 students (27 males and 29 females) attending an upper middle class suburban primary school. These experimental subjects ranged in age from 7:10 to 9:2 years with a mean age of 8:4. On form (a) of the *Peabody Picture Vocabulary Test (P.P.V.T.)* the verbal comprehension I.Q. of these subjects ranged from 83 to 135, with a mean of 111. (Appendix II-A provides the mean chronological ages and mean *P.P.V.T.* scores for each sex group.)

There were 259 monolingual adult subjects who participated in the present study. These subjects were Psychology I students (125 males and 134 females) with a mean age of 21:2 years who completed the task as part of a course requirement.

5.1.2 Experimental Design

The seven *spatio-temporal* terms *in front, ahead, behind, before, after, first* and *last* constituted the experimental stimuli for this task. These were presented to subjects in booklet form. The first three pages of these booklets contained instructions and examples for adult subjects, whilst the first two pages of the children's books comprised examples only. The last seven pages of the booklets for each age group were the actual experimental sheets whose format was the same for both age groups as illustrated in Appendix II-B(1).

On each experimental page, one of the seven words appeared at the top and was labelled the *"standard word"*. The remaining six words, *"comparison words"*, appeared on the left-hand side of the page, with a 5 point rating scale opposite each. Randomisation was achieved by varying the order of presentation of pages on which each word appeared as the *"standard"*. The list order of the *"comparison words"* also varied randomly for different *"standard words"*.

There were only minor differences between the mode of presentation for child and adult subjects. These differences were concerned with the format of the instructions and the nature of the examples given. Child subjects were given their instructions orally, by the experimenter, and for them physical objects, in the form of drawings, were used as illustrations of the rating scale. However, adult subjects received written instructions and verbal or word examples. Appendices II-B(2) and II-B(3) list the instructions and examples given to both groups of subjects.

5.1.3 Procedure

The experimental task was a paper and pencil task which required subjects to rate word pairs for similarity of meaning. A 5 point rating scale was used to obtain these subjective similarity judgments. Each of the points on this scale was assigned a numerical value of 1 to 5 with a similarity judgment associated with each number as follows:-

1 - *very alike*

2 - *alike*

3 - *almost alike*

4 - *a little bit alike*

5 - *not at all alike*

The use of such a scale corresponds with previous work on tones (Gandour, 1978) and prepositions (Pierart & Costermans, 1979). Both of these studies used rating scales to obtain similarity judgments from their subjects which were subsequently analysed by the *M.D.S.* technique.

The subject's task was to pair the *"standard word"*, which appeared at the top of each experimental page, with each of the *"comparison words"*, and to rate them for "degree of similarity". Once the subject had made this judgment he was required to place a cross in the appropriate space of the scale which appeared opposite each *"comparison word"*.

The experimental task was essentially the same for child and adult subjects. However, there were minor variations in procedure. Adult subjects were seen in large groups of 50-60 whilst children were seen in pairs. This difference was necessary to ensure that each child fully grasped the nature of the rating task. Children were also given verbal, and not written, instructions as well as verbal encouragement throughout. Both of these modifications were necessary to ensure the younger subject's comprehension of the experimental task. These were the only modifications deemed to be required in the experimental procedure.

All subjects, both child and adult, completed the task in 15-30 minutes without any problems. Indeed, once they had received the instructions and completed the examples, very few subjects asked for further clarification of the experimental task. They simply proceeded to rate each of the six words which appeared on the experimental pages without hesitation, passing smoothly from one page to the next.

5.2 RESULTS

5.2.1 Method of Analysis

The data yielded square 7 x 7 matrices where each cell corresponded to a measure of similarity between the two objects representing that row and column of the matrix. According to Gower (1966) and Shepard (1972) such data is readily analysable via *M.D.S.* techniques where the similarity measures are seen as constituting the proximity data for the analysis.

Principal Coordinate Analysis (Genstat, 1977) was the method of analysis used. This technique is based on the work of Gower (1966) who states that *Principal Coordinate Analysis (P.C.O.)* will yield the coordinates of a set of n points in multidimensional space given input data in the form of an n x n matrix whose cells represent measures of similarity between the individual elements. The output from this analysis shows the configuration of the n-units in a small dimensional space. This spatial representation reveals any grouping patterns which exist amongst the elements for which similarity measures were obtained.

For the purpose of this study, the group data for child and adult subjects were transformed into symmetrical matrices which provided the input to the *P.C.O.* program. Data were analysed in group form rather than individually for each subject because of the constrained nature of the word field studied. However, despite the fact that only a few *spatio-temporal* terms were examined *M.D.S.* was still seen as a viable technique of analysis in line with Rips' et al (1973) similar use of this technique with a small number of elements. These authors applied *M.D.S.* analysis to a small subset of both bird (6) and mammal (6) terms. They found solutions which were readily interpretable in two dimensions labelled *size* and *predacity* in support of their earlier findings for larger groups of these two categories. Furthermore, the delimited nature of the semantic field studied was expected to yield a compact solution. According to Fillenbaum and Rapoport (1971) subregions of a domain render simple structures.

5.2.2 Dimensional Solutions

Both the child and adult data, when subjected to *P.C.O.* yielded a two dimensional plot of semantic space for the 7 *spatio-temporal* terms. These dimensional plots or solutions are represented in Figures 5.1 and 5.2, for children and adults respectively.

When the amount of variance accounted for by these two dimensions was considered, it was found that this percentage was greater for the adult (81.3%) than the child (66.1%) data. However, for both child and adult populations the first dimension constituted the largest percentage variance as can be seen in Table 5.3. This table also illustrates that for both age groups the second dimension is less differentiated in terms of the percentage of variance it accounts for in the similarity data for the 7 *spatio-temporal* terms.

TABLE 5.3. Percentage Variance Attributed to the First Two Dimensions of the *P.C.O.* Solutions for Child and Adult Groups.

	1st Dimension	2nd Dimension
Children	51.1	15.0
Adults	70.1	11.2

The first dimension found in the similarity data distinguished and grouped *in front*, *ahead*, *before* and *first* on one side of the scale, and *behind*, *after* and *last* on the other. This result was similar for both groups of subjects. On the second dimension

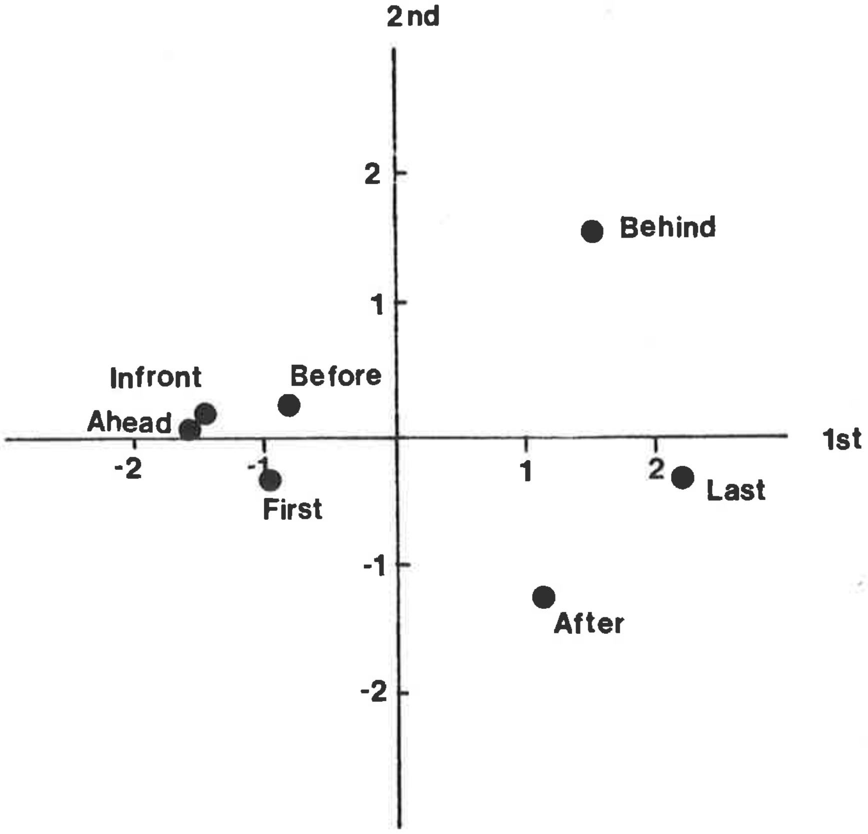


FIGURE 5.1. Dimensional Solution for Child Subjects from *P.C.O.*

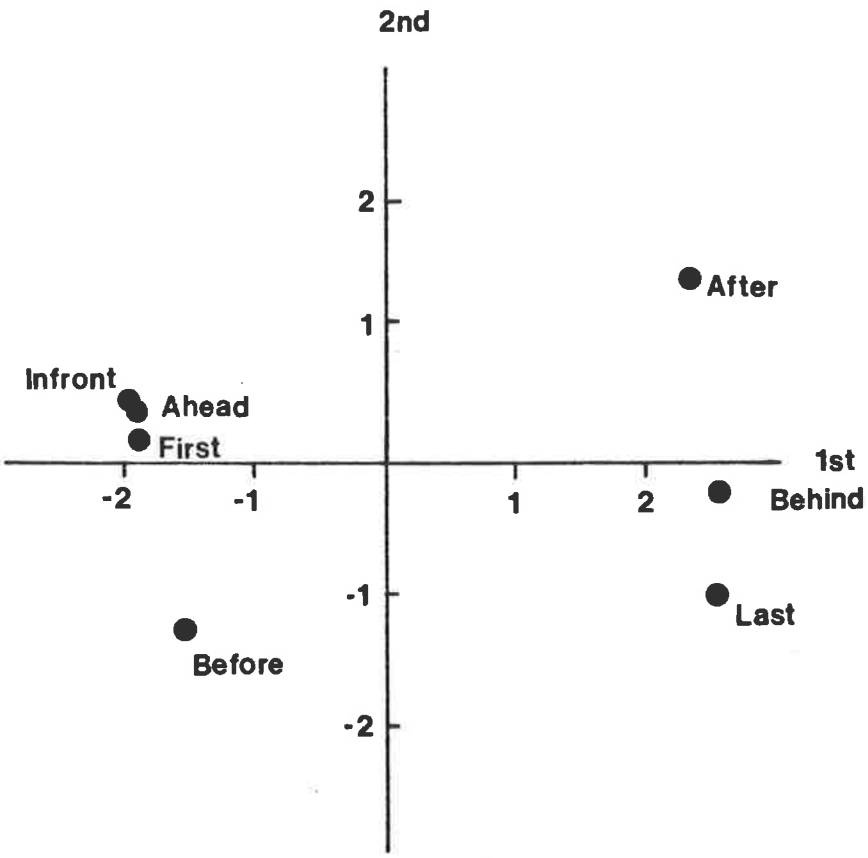


FIGURE 5.2. Dimensional Solutions for Adult Subjects from *P.C.O.*

separation of the terms was more difficult to discern, especially for child subjects. However, in the adult population this dimension clearly differentiated the terms *before* and *after*.

5.2.3 Frequency Data

The frequency with which each word pair was given a particular rating by both child and adult subjects appears in Appendices II - C(1) and II - C(2) respectively. These data appear as numerical values from 1 to 5 which indicate each of the spaces on the similarity rating scale as discussed in the procedure section above.

The frequency data were pooled for each age group to yield mean and standard deviation scores as illustrated in Tables 5.4 and 5.5. Table 5.4 indicates that the mean similarity ratings for children tend to congregate around the middle of the scale. Most subjects appeared to rate the word pairs in the third and fourth spaces of the scale whilst very few used the end points of 1 and 5. In contrast to the child data, Table 5.5 illustrates that adult subjects made infrequent use of the midpoint (3) of the rating scale. Their ratings showed a tendency to fall at the extreme or end points.

Further comparisons of Tables 5.4 and 5.5 demonstrated that there was more variability in the children's than in the adults' ratings of each word pair. This is evidenced by the larger standard deviations for child subjects' similarity ratings. These values mainly varied between 1.00 and 2.00 for children, whereas for adults they were much smaller, taking values of 1.00 or less in most cases.

	Infront	Ahead	Behind	Before	After	First	Last
Infront		$\bar{X}$ = 1.84 SD = 1.30	$\bar{X}$ = 3.32 SD = 1.74	$\bar{X}$ = 2.39 SD = 1.42	$\bar{X}$ = 3.41 SD = 1.42	$\bar{X}$ = 1.64 SD = 1.10	$\bar{X}$ = 3.70 SD = 1.57
Ahead	$\bar{X}$ = 2.07 SD = 1.57		$\bar{X}$ = 3.59 SD = 1.49	$\bar{X}$ = 2.34 SD = 1.40	$\bar{X}$ = 3.20 SD = 1.59	$\bar{X}$ = 2.12 SD = 1.32	$\bar{X}$ = 3.79 SD = 1.56
Behind	$\bar{X}$ = 3.79 SD = 1.44	$\bar{X}$ = 3.77 SD = 1.48		$\bar{X}$ = 3.61 SD = 1.50	$\bar{X}$ = 2.89 SD = 1.61	$\bar{X}$ = 3.75 SD = 1.22	$\bar{X}$ = 2.77 SD = 1.60
Before	$\bar{X}$ = 2.52 SD = 1.41	$\bar{X}$ = 2.36 SD = 1.39	$\bar{X}$ = 3.14 SD = 1.55		$\bar{X}$ = 3.16 SD = 1.55	$\bar{X}$ = 2.45 SD = 1.51	$\bar{X}$ = 3.57 SD = 1.47
After	$\bar{X}$ = 3.43 SD = 1.41	$\bar{X}$ = 3.45 SD = 1.61	$\bar{X}$ = 2.91 SD = 1.66	$\bar{X}$ = 3.43 SD = 1.48		$\bar{X}$ = 3.18 SD = 1.54	$\bar{X}$ = 2.87 SD = 1.47
First	$\bar{X}$ = 1.71 SD = 1.12	$\bar{X}$ = 2.20 SD = 1.57	$\bar{X}$ = 3.73 SD = 1.46	$\bar{X}$ = 2.50 SD = 1.68	$\bar{X}$ = 3.23 SD = 1.54		$\bar{X}$ = 3.50 SD = 1.85
Last	$\bar{X}$ = 4.27 SD = 1.29	$\bar{X}$ = 4.48 SD = 1.03	$\bar{X}$ = 2.66 SD = 1.69	$\bar{X}$ = 3.77 SD = 1.63	$\bar{X}$ = 3.00 SD = 1.55	$\bar{X}$ = 3.68 SD = 1.73	

TABLE 5.4. Child Mean Similarity Ratings for Each Word Pair.

	Infront	Ahead	Behind	Before	After	First	Last
Infront		$\bar{X}$ = 1.44 SD = 0.75	$\bar{X}$ = 4.86 SD = 0.57	$\bar{X}$ = 2.32 SD = 1.22	$\bar{X}$ = 4.56 SD = 0.92	$\bar{X}$ = 1.63 SD = 0.86	$\bar{X}$ = 4.81 SD = 0.67
Ahead	$\bar{X}$ = 1.42 SD = 0.71		$\bar{X}$ = 4.83 SD = 0.62	$\bar{X}$ = 2.23 SD = 1.20	$\bar{X}$ = 4.54 SD = 0.85	$\bar{X}$ = 2.16 SD = 0.90	$\bar{X}$ = 4.85 SD = 0.60
Behind	$\bar{X}$ = 4.80 SD = 0.53	$\bar{X}$ = 4.84 SD = 0.52		$\bar{X}$ = 4.56 SD = 0.84	$\bar{X}$ = 2.45 SD = 1.26	$\bar{X}$ = 4.79 SD = 0.57	$\bar{X}$ = 2.39 SD = 1.12
Before	$\bar{X}$ = 2.54 SD = 1.14	$\bar{X}$ = 2.47 SD = 1.26	$\bar{X}$ = 4.48 SD = 0.94		$\bar{X}$ = 4.72 SD = 0.71	$\bar{X}$ = 2.58 SD = 1.23	$\bar{X}$ = 4.58 SD = 0.85
After	$\bar{X}$ = 4.70 SD = 0.68	$\bar{X}$ = 4.60 SD = 0.76	$\bar{X}$ = 2.36 SD = 1.27	$\bar{X}$ = 4.77 SD = 0.63		$\bar{X}$ = 4.69 SD = 0.63	$\bar{X}$ = 2.99 SD = 1.08
First	$\bar{X}$ = 1.86 SD = 0.89	$\bar{X}$ = 2.10 SD = 0.95	$\bar{X}$ = 4.85 SD = 0.48	$\bar{X}$ = 2.56 SD = 1.11	$\bar{X}$ = 4.70 SD = 0.66		$\bar{X}$ =4.88 SD = 0.62
Last	$\bar{X}$ = 4.90 SD = 0.38	$\bar{X}$ = 4.89 SD = 0.45	$\bar{X}$ = 2.49 SD = 1.08	$\bar{X}$ = 4.66 SD = 0.76	$\bar{X}$ = 2.84 SD = 1.19	$\bar{X}$ = 4.87 SD = 0.64	

TABLE 5.5. Adult Mean Similarity Ratings for Each Word Pair.

When the frequency data were pooled for each subject group for each word pair, it was found that the last scale space (5) which represented *not at all alike* in meaning, accounted for the largest number of subject ratings of direct antonym pairs, e.g. *in front/behind*. This difference was underlined more in the adult than the child data. It was also more marked for the pair *first/last*. These differences are illustrated graphically in Figures 5.3 (a-d). Figure 5.3 (c) further indicates that children spread more evenly than adults amongst the 5 rating scale values for the pair *before/after*.

The validity of the rating scale technique as a method of data collection for similarity data was evidenced by the small number of rating changes subjects made for "same-word" pairs depending on which word appeared as the *"standard"*, e.g. *behind-before* versus *before-behind*. When extreme rating changes, those which went from one end of the scale to the other (1↔5), were considered, only 3.1% of the children's total ratings and 0.3% of those of the adults showed such changes. These percentages were also found to be negligible when all rating changes that occurred were taken into account. For children these changes constituted 8.3% and for adults 2.9%. Tables 5.4 and 5.5 further reflect the stability of rating assignments for "same-word pairs". Mean values for both child and adult subjects changed relatively little when each word of such pairs appeared as the *"standard"*.

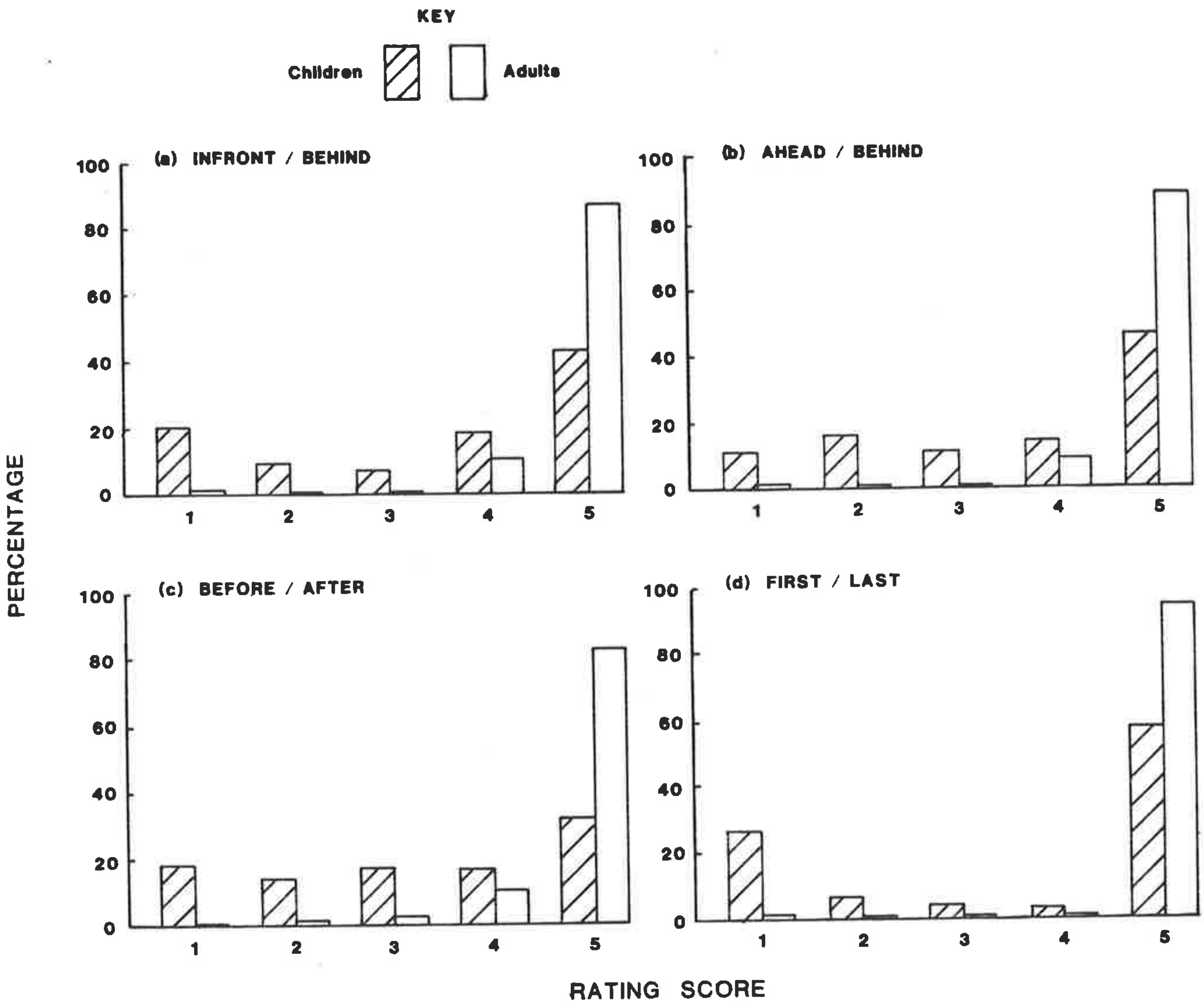


FIGURE 5.3. Frequency (as a percentage) of Each Rating Score for Antonym Pairs.

5.3 DISCUSSION

A two dimensional solution was found to be the best representation for the 7 *spatio-temporal* terms, *in front, ahead, behind, before, after, first* and *last*, in semantic space. For both children and adults the amount of variance accounted for by the first two dimensions of the multidimensional space was large, demonstrating that these two dimensions gave the best interpretation of the data. Therefore, they provided an adequate characterisation of how these 7 terms were perceived in terms of semantic similarity. Both children and adults indicated in their judgments of similarity between pairs of these terms that they were conceptualised as existing in a two dimensional psychological or semantic space. These two dimensions were labelled spatial (1st dimension) and temporal (2nd dimension) in support of the first prediction regarding the dual meaning of *spatio-temporal* terms in the English language. Such a finding mirrors the duality of meaning assigned to these terms by linguists (Traugott, 1978) and theoreticians (H. Clark, 1973 & Beilin, 1975). It also underlines the importance and relevance of the multiple dictionary definitions of the 7 *spatio-temporal* terms studied. Such definitions clearly contrast the spatial and temporal usages of these terms, and assign both to each of the terms *ahead, behind, before, after, first* and *last* as is evident in Table 5.1. Consequently, the present data provide experimental support for the notion that the *spatio-temporal* terms are conceived as having a dual sense by speakers of the English language.

In corroboration of the second prediction, it was found that the dimensional space was more differentiated in adult than child subjects. This was most apparent when the percentage of variance associated with each dimension was considered for each age group separately (Table 5.3). For adult subjects, the first two dimensions accounted for 81.3% of the variance whereas for children this percentage was less, being 66.1%. These figures demonstrate that for children the two dimensions, spatial and temporal, were less fully articulated in their conceptions of the semantic space of these *spatio-temporal* terms. Tables 5.4 and 5.5 further indicate that the variability of child ratings was greater than that of adults. In the former population the standard deviation values associated with each mean score were greater thus demonstrating that the *spatio-temporal* concepts were less stable for children than adults. Consequently, support is again found for the clearer distinction of *spatio-temporal* terms in adult as opposed to child semantic space.

A further indication of this developmental difference is found by an examination of the graphical plots of the dimensional solutions for each subject population (Figures 5.1 and 5.2). These graphs illustrate clearly that the first dimension, which accounts for the majority of the variance in the data of both age groups, more fully differentiates amongst the terms for the adult in contrast to the child age group. This dimension, labelled as spatial, distinguishes the terms into two groups. The composition of these two groups is respectively *in front, ahead, before, first* and *behind, after, last*. Such separation of the terms into two distinct groups is more characteristic of adults than children. Figure 5.2 also indicates that in the adult population the second dimension distinguishes *first* from *last* as well as *before* from *after*. However, for children only the pair *before/after* is differentiated on the second or temporal dimension.

This comparison of the child and adult distribution of the terms in two dimensional space leads to the postulation of the following developmental sequence for the 7 *spatio-temporal* terms studied. At first *in front, ahead, behind, first* and *last* are acquired in a spatial sense. This is in correspondence with H. Clark's (1973) prediction that terms with both a spatial and a temporal meaning will be learnt first in their spatial sense. However, in contradiction to H. Clark (1973) both the spatial and the temporal senses of the terms *before* and *after* seem to be equally well understood by children. Children appeared to distinguish these terms on both spatial and temporal dimensions with equal facility.

As development progresses, children acquire more knowledge of the semantics of their language and so changes occur in the conceptualisation of these terms in semantic space. These changes are mainly concerned with the perception of the terms *first* and *last*. Adults realise that these terms have a temporal as well as a spatial sense. This is evident from the differentiation of these terms on both dimensions in the adult configuration (Figure 5.2). Older subjects also more clearly differentiate the terms *before* and *after* in two dimensional semantic space. For these subjects, the dual meaning of this *spatio-temporal* pair has been more firmly grasped and understood.

However, there is little indication in the adult data that *in front, ahead* and *behind* are discriminated on any but a spatial dimension. This differentiation on the spatial dimension is more marked than in the child data. However, like the child subjects, adult subjects have failed to indicate in their similarity judgments that they conceive of these three terms as having a strong temporal meaning.

The above hypothesised developmental sequence, based on the experimental data, provides only partial support for the second prediction. For, although the dimensional plot is more differentiated for adults than children, the expected form of this differentiation is only found for the terms *first* and *last*. It is only this pair which adults distinguished on both dimensions whilst children differentiated them on only one, the spatial as predicted. The terms *in front, ahead* and *behind* did not yield a strong temporal dimension in the adult data as was expected. Indeed, these terms appeared to be distinguished equally well by children and adults in a spatial sense. As regards *before* and *after*, temporal and spatial differentiation was just as evident for children as adults, thus contradicting the prediction that only the spatial sense would be found in the child data.

Consequently, it may be concluded that only some of the terms, *in front, ahead, behind, first* and *last*, are learnt in their spatial sense first as predicted by H. Clark (1973). However, this finding for *ahead* and *behind* is in line with Richards and Hawpe's (1980) discussion which emphasises the dominant meaning of these terms as being spatial. Bennett's (1975) componential analysis of the prepositions *in front of* and *behind* is also supported by this result. An important component assigned to these terms in their prepositional usage is "place" indicating a dominant spatial sense. Further experimental support for the present finding is provided by the work of Hodun (1975) and that of Friedman and Seely (1976). The former researcher found that *ahead* and *behind* were rated as primarily spatial in meaning by adult subjects. The latter workers reported that child subjects frequently gave a spatial reinterpretation of these terms in temporal tasks. Thus, both results demonstrate the importance and primacy of the spatial sense for *ahead* and *behind*.

However, the data for the words *before* and *after* fail to support either H. Clark's (1973) theory of the spatial basis for time or the work of researchers (Friedman & Seely, 1976; Richards & Hawpe, 1980) who hold that the dominant meanings of these terms is temporal. The present data indicate that both adults and children readily conceive of these terms as having both a spatial and a temporal sense. For these terms the temporal sense does not appear to be dominant nor is the spatial sense acquired first as predicted by H. Clark (1973). Although such a finding is contrary to the predictions and results of the major workers in this area, it does receive somewhat limited support from both Bennett (1975) and Hodun (1975). Bennett (1975) acknowledges the fact that the spatial and temporal usages of *before* are equally prevalent in his componential analysis of this term as a preposition (Table 5.2). In this analysis Bennett assigns neither a "place" nor a "time" component to this preposition, stating that the context of use strongly affects which meaning is assigned to *before*. Further evidence for the dual nature or meaning of *before* and *after* is provided by Hodun (1975). Her adult subjects, when required to rate *before* and *after* on a spatial to temporal continuum, tended to perceive them as somewhat neutral in meaning. They were conceived of as having both spatial and temporal aspects, a finding further corroborated in the present dimensional solutions for these terms.

The dimensional solution was the major emphasis of the present study. However, a consideration of the frequency data enables the postulation of conclusions regarding the validity of the measuring instrument and the strength of the antonymy relation which holds among pairs of this set of *spatio-temporal* terms.

In the results section it was noted that only a small percentage of the ratings made for "same-word pairs" by children and adults changed as a result of different *"standard words"*. The highest percentage of such changes was 8.3% for child subjects. This indicates that they constituted a small proportion of the entire ratings made and so can be considered to be negligible in effect. This lack of rating change for each word pair is also evident from a consideration of Tables 5.4 and 5.5 which provide mean and standard deviation data for each word pair at each age level. Again, it is noticeable that both values changed very little for "same-word pairs" as the word used as *"standard"* changed. Such data provide support for the utilisation of the rating scale technique as a means of obtaining similarity judgments from both children and adults. The results also question the applicability of criticisms levelled at similarity judgments by Torgerson (1965) and Clark and Clark (1977). These authors challenge the validity of such subjective similarity data. For them, such judgments change over time due to their sensitivity to context, instructions and the stimulus pair being compared. However, when the small number of rating changes made by age groups in the present experiment are considered, these criticisms tend to lose some of their force. Thus the rating scale technique which was used to gather the similarity data is seen to be valid. Therefore, it can be expected to provide data whose dimensional solution adequately represents the subjects' conceptualisation of these 7 *spatio-temporal* terms in semantic space.

The strength of the antonymy relationship which exists among word pairs in the English language is demonstrated for both 7:0 to 8:0 year old and adult subjects in this experiment. When the percentage of subjects giving a particular rating value to antonymous pairs is considered it is found that the majority gave a rating of 5 (equivalent to *not at all alike*). This finding is evident for both child and adult subjects, although it is more noticeable for the latter age group, especially for the pair *before/after*. It is also more prominent for the pair *first/last* than for any of the other antonym pairs. Such data indicate that 7:0 to 8:0 year old children are aware of the semantic relation of antonymy which holds between pairs of terms in the *spatio-temporal* word field. For these children, the notion of "opposite" is a well-established conception as was demonstrated more fully in the earlier study.

Consequently, it can be postulated that any difficulties children now have in their comprehension of the 7 *spatio-temporal* terms will be due to contextual factors, in particular linguistic factors. This confusion will result from the way these terms are clustered in semantic space as represented in Figures 5.1 and 5.2. More specifically, the words *in front, ahead, before* and *first* form a close knit group in the child data. Therefore, they can be expected to cause comprehension problems for children when they are placed in different linguistic contexts. Bennett (1975) clearly states the dependence on linguistic context of the meaning assigned to the preposition *before*. *Before* has both spatial and temporal senses, and this meaning difference lies in the context of use rather than inhering in *before* itself. By analogy, it is predicted that the negative counterparts or antonyms of these positive terms will give rise to similar interpretation difficulties in varying contexts. This notion is given further credence by Friedman and Seely's (1976) oldest subjects, the 5:0 year olds, who were able to take non-linguistic context into account when interpreting instructions involving *spatio-temporal* terms.

Therefore, it is important to consider just how important linguistic context is for the comprehension of terms which have a dual meaning. By placing *spatio-temporal* terms in different contexts it will be possible to gauge the extent of this effect. However, it is only possible to undertake such research with the terms *in front, ahead, behind, before* and *after*. *First* and *last* are excluded from this analysis for a variety of reasons. Firstly, these latter terms are ambiguous in meaning according to Richards and Hawpe (1980), and, therefore it is difficult to assign them either a dominant spatial or a temporal sense. Such ambiguity of meaning seems also to be reflected in the present adult data where the second dimension differentiates *first* and *last* in the opposite direction to that of the temporally dominant pair *before/after*. The assignment of a dominant meaning is easier for the terms *in front, ahead* and *behind* (spatially dominant) and *before* and *after* (temporally dominant). These dominant senses were clearly evident in the definitions adult English speakers gave for these terms (Richards & Hawpe, 1980). However, the main reasons for the exclusion of *first* and *last* are grammatical. *First* and *last* can only take one argument, e.g. "*X is first.*", whereas the other terms can take two, e.g. "*X is before/in front of Y.*". Hence *first* and *last* do not fit grammatically with the other terms or with the nature of the sentence task which will be used to test for the effects of linguistic context.

In conclusion, the present data have illustrated that both children and adults are aware of the dual meaning of a limited subset of *spatio-temporal* terms. However, their conceptualisations of both senses for any one term is not equivalent, one sense is seen as being dominant. Therefore, it is necessary to look at the effects of linguistic context on the semantic interpretation given to these dual meaning terms. The question to be considered is if with the aid of an appropriate sentence frame subjects will be able to give a non-dominant interpretation to such terms as *in front, ahead, behind, before* and *after*.

CHAPTER 6.

THE EFFECT OF SENTENCE CONTEXT ON PRIMARY SCHOOL CHILDREN'S COMPREHENSION OF *SPATIO-TEMPORAL* TERMS

The preceding experiments have demonstrated that children of primary school age do have an adequate understanding of the antonym relationship which exists between word pairs in the *spatio-temporal* semantic field. Furthermore, it has been shown that both children and adults distinguish such terms on two dimensions, labelled spatial and temporal, in semantic space. However, the dimensional solutions for the two age groups differ. For children, the positive or *unmarked* terms *in front, ahead, first* and *before* formed a tightly knit cluster, whilst only the first three terms were found to cluster in the adult data. Adults clearly distinguished *before* from the other three terms in the dimensional plot which represented their conceptualisation of *spatio-temporal* terms in semantic space. Consequently, it can be seen that some development has occurred. Children do differ from adults in being less aware of the semantics of their language, in particular of *spatio-temporal* terms.

Therefore, it is important to look at children's growing awareness of the semantic system which characterises the word-field of *spatio-temporal* terms. Just when do changes in their awareness of such terms occur? It is also necessary to investigate the effects of linguistic context on children's comprehension of these words. By 7:0 years of age children have grasped the nature of the relation of antonymy which exists between *spatio-temporal* word pairs, but are not yet aware of the many semantic subtleties which characterise the English language and which enable adults to use and comprehend language with such facility. Children can only come to know such subtleties by experiencing language in a wide variety of contexts, both linguistic and non-linguistic.

Bierwisch (1970) clearly emphasised the importance of linguistic context as an aid to comprehension by stating that:

> "....the semantic interpretation of a given sentence might depend in part on the particular linguistic or extralinguistic context in which it occurs."
> (Bierwisch, 1970, p. 183)

This point is further stressed by Sinha and Walkerdine (1974) and Sinha (1979) who stated that the sense of a word is determined by its relation to the other words which occur in the sentence with it. Therefore, the meaning of a word is not something which inheres in the word itself, such as is provided by a dictionary definition. A word's meaning is also affected by its use in a linguistic context, by its relation to other sentence constituents. Olson and Nickerson (1978) declared that it is this meaning or sense which children acquire during the school years, once they begin to use written language with more variety and skill. During these years, linguistic context comes to play a major role in children's comprehension of the English language.

Three studies have been concerned with the young child's ability to make judgments about the syntactic or semantic correctness of sentences. De Villiers and De Villiers (1972, 1974) asked 2:0 and 3:0 year old children to answer questions about the semantic and syntactic acceptability of simple imperatives. The results of both studies indicated that children were able to judge semantic anomaly before syntactic anomaly (word-order reversal). Furthermore, the ability to correct sentences judged as wrong was found to increase with age. Gleitman, Gleitman and Shipley (1972) have also examined the ability of children to make metalinguistic judgments, that is to reflect upon linguistic rules. In the first part of their research they found that 2:0 year olds were able to judge and partially correct sentences which were telegraphic in form as well as those which reversed word-order. Furthermore, 5:0 and 7:0 year olds showed an increasing ability to explain why such sentences were deviant in both syntactic and semantic terms.

These studies have all demonstrated that the capacity to reflect upon language and linguistic rules increases with age. Adult-like performance seems to be achieved by the middle school years. Therefore, school age children are aware of linguistic rules and so should be able to grasp the nature of a task in which sentence context will affect the semantic interpretation given to a particular word.

Several experiments have been conducted which have shown the direct effects of linguistic context on language processing. Although these studies have used a variety of tasks, they have all demonstrated the subjects' ability to utilise contextual constraints, of a linguistic nature, in comprehending language. Klein, Klein and Bertino (1974) examined 10:0 and 12:0 year old's use of contextual information in a word boundary task. Their experimental tasks required subjects to recognise the word boundaries in prose passages which were either coherent or random in order. On the basis of the subjects' better performance on coherent passages, Klein et al. concluded that these children did use contextual information to predict later aspects of a written message. Furthermore, this ability increased with age, as evidenced by the superior performance of 12:0 year olds. Schvaneveldt, Ackerman and Semlear (1977) investigated the effect of semantic context on the word recognition ability of 7:0 and 9:0 year olds. Their subjects had to judge letter strings, presented on slides, as words or non-words. The slides for words consisted of pairs of associated or unassociated words, whilst the non-word letter strings were paired with either words or non-words on the slide stimuli. The results demonstrated that semantic context facilitated the speed and accuracy of responses, indicating that such contexts enabled subjects to access more easily the knowledge they had about the form of related words.

Rosenberg and associates have conducted a series of studies to look at the effects of semantic integration on subjects' ability to recall sentences. Rosenberg and Jarvella (1970a, b) have discussed word meaning in terms of *"linguistic contextual features"*. Such features are *inherent*, that is, the linguistic contexts which comprise the word's dictionary definition, and *experiential*, the linguistic correlates of the experiences which usually accompany the word. It is the former features which are most relevant to the present research, for these are the features which reside in the sentence context and which affect the interpretation given to a word. These *linguistic contextual features* are used by Rosenberg and Jarvella to define the semantic integration of a sentence. Sentences are either *semantically well-integrated (SWI)*, where the contextual features are always associated with the subject, e.g. *The dog chased the cat*, or *semantically poorly-integrated (SPI)* whose word combinations occur as infrequent responses to their subjects, e.g. *The editor owned the castle*. Such *SWI* and *SPI* sentences formed the basis of several research studies which have demonstrated that adult subjects have a better recall of *SWI* sentences.

Two developmental studies have also utilised the basic *SWI* and *SPI* distinction in their research. Vanevery and Rosenberg (1970) required their 6:0 and 12:0 year old subjects to recall *SWI* and *SPI* sentences presented on index cards. Recall performance was not only found to be superior for *SWI* sentences, in corroboration of the adult data, but also increased with age. Older subjects recalled both more words and more complete sentences than younger subjects indicating their awareness of the semantic integration which exists in a sentence. In a second study, Rosenberg, Jarvella and Cross (1971) examined the ability of children in the 5:3 to 9:1 age range to recall *SWI* and *SPI* sentences. Unlike the former researchers, Rosenberg et al. found no developmental increase in the ability to use information on semantic integration. Their 5:0 year old subjects were just as aware of semantic constraints as their older subjects, as was evidenced by a superior recall performance on *SWI* sentences for all age groups. Therefore, Rosenberg et al. concluded that even

5:0 year olds are capable of utilising the contextual features represented in semantic integration.

However, a study by Muma and Zwycewicz-Emory (1979) using a different methodology has again shown that there is an age difference in children's ability to utilise contextual information. In this experimental task, 5:0 and 9:0 year old, and adult subjects had to fill in the blanks of four different noun frames (N_; _N; _N_; N_N) where the stimuli were either animate or inanimate nouns. The major finding was that only the responses of 9:0 year olds and adults evidenced a differentiation of linguistic contexts. These older subjects gave different word categories for different blank positions, e.g. adjectives if the blank preceded the noun (_N); intransitive verbs if the blank came after the noun (N_), whilst 5:0 year olds merely gave noun responses to all blank positions. Consequently, it was concluded that older subjects were more affected by contextual constraints than younger subjects in this linguistic production task.

Children's awareness of semantic anomaly or ambiguity has been examined in two research studies. In the first of these, James and Miller (1973) investigated the ability of 4:0 to 7:0 year old children to identify, explain, and convert semantically anomalous sentences. The 32 sentences comprising the experimental stimuli were either semantically meaningful or semantically anomalous according to criteria of adjective-noun or verb-noun violations. Performance on all tasks improved with age indicating that older children, 6:8 to 7:3 years, have a greater understanding of the selection restrictions which operate in sentences. The ability to detect linguistic ambiguity was the focus of a second study by Shultz and Pilon (1973). Shultz and Pilon defined linguistic ambiguity on the three levels of the lexicon, phonology, and syntax of the language. Of interest to the present research is their data on lexical ambiguity, that is defined as the case in which more than one meaning exists for a particular word, e.g. *club*. In the experimental task, 6:0, 9:0, 12:0, and 15:0 year old subjects had to describe what each of 24 ambiguous sentences, only 6 of which were lexically ambiguous, meant. They were also required to select a picture which represented this meaning and to justify their choice. It was found that subjects' ability to detect lexical ambiguity increased steadily with age. Such a result corresponds to the data of other studies which have shown a developmental increase in the ability to use contextual information.

The results of the above studies have demonstrated that children of primary school age, 7:0 years and over, are aware of the semantic constraints which exist in sentences, and of their effect on language comprehension. Children of this age are coming to terms with the notion of lexical ambiguity. Consequently, it is useful to examine the effects of linguistic context on single word interpretation. In particular, are children capable of realising that lexical ambiguity is resolved by the linguistic context in which a particular term occurs?

It is important to investigate lexical ambiguity for terms which comprise semantically related fields. In such fields, relatedness is defined in terms of the features or components of meaning which such words share. Bowerman (1978b) has discussed the speech errors produced by her daughters which demonstrate an early awareness of the semantic relatedness which exists among words from a particular domain. For example, at 3:9 Eva stated, "Can I have any reading *behind* dinner?", when her mother was preparing the meal; the appropriate word to use in this situation was *after*. Such errors are likened to adult slips of the tongue, where the correct word is replaced by a semantically related one. As such, they are indicative of the child's perception of the semantic similarities which exist between words from the same semantic domain. However, as the child is, as yet, unable to isolate the relevant linguistic aspects which have significance for a word usage in a particular context, he makes such semantically related errors. Indeed, the confusion cited earlier of *behind* and *after*, is evidence of the child's inability to distinguish position in time from position in space in a non-linguistic context. Therefore, it is relevant to investigate whether a similar inability will also be present for older children in linguistic contexts, for by school age such contexts are held to strongly determine comprehension (Olson & Nickerson, 1978).

The purpose of the present study was to look at the primary school age child's acquisition of *spatio-temporal* terms in different linguistic, in particular sentential, contexts. The terms to be studied are *in front of, ahead of, behind, before,* and *after*. The terms *first* and *last* were omitted from the present investigation because of their ambiguity of meaning for adult subjects (Richards & Hawpe, 1980), as well as their grammatical difference with respect to the other words. This latter difference meant that *first* and *last* could not be appropriately used in the sentence frames tasks to be employed in further research on the semantics of *spatio-temporal* terms.

The double meaning attributed to the five *spatio-temporal* terms *in front of, ahead of, behind, before* and *after* is evident from a perusal of their dictionary definitions appearing in Table 5.1 (p. 132). H. Clark (1973) and Traugott (1978) have further noted the close connection which exists between the two senses of these words. Both these workers have stated that the temporal terms of the English language have a spatial basis in the *front-back* axis defined by the human perceptual apparatus. Therefore, they have affirmed that a dual spatial and temporal sense can be assigned to *spatio-temporal* words.

However, there is strong empirical evidence to support the notion that one of the two meanings of such *spatio-temporal* terms is dominant. This is apparent in Table 5.2 (p. 135) which illustrates Bennett's (1975) componential analysis of the prepositions *in front of, behind, before* and *after*. Bennett has assigned the former two terms a strong spatial sense whilst the latter two are seen as being primarily temporal in meaning. Furthermore, his attribution of the sense, spatial or temporal, of *before* to its context of usage indicates the important role of linguistic context in comprehension. This underlines the importance of looking at how contextual constraints affect the semantic interpretation of dual meaning terms.

Hodun (1975) and Richards and Hawpe (1980) have also reported that *ahead* and *behind* are assigned a dominant spatial sense whilst *before* and *after* are seen as being primarily temporal in meaning. Further, the results of the previously reported *M.D.S.* study demonstrated that both child and adult subjects conceptualized *spatio-temporal* terms as existing in a two dimensional semantic space. In this space, *in front, ahead* and *behind* are distinguished on the spatial dimension whilst *before* and *after* are characterised by primary distinction on the temporal dimension.

Several studies have investigated children's comprehension of *spatio-temporal* terms. These have used a variety of tasks to gain insight into this understanding. However, although some have used contextual support as an aid to comprehension, this has always been of a non-linguistic nature.

In a study reviewed earlier, E. Clark (1972) examined children's knowledge of the *dimensional* and *spatio-temporal* fields in an "opposites" task and found that young children do group words that are related in meaning. An aspect of her results which is relevant to the present discussion is the finding that 4:0 and 5:0 year old subjects learnt the pair *in front/in back* prior to the pair *before/after*. Furthermore, in this task, children used *in front* as a substitute for its temporal equivalent *before*. These results support the conclusion that the spatial sense of *spatio-temporal* terms is learnt before their temporal sense. Such a conclusion is further corroborated by Wales (1981) who found a superior performance on *in front/behind* with respect to *before/after* in a task which required comprehension of a description of a spatial arrangement. He also reported that children found it harder to process temporal information in situations where there were conflicting spatial cues.

Hodun (1975) has studied the role of spatial information in 4:0 and 5:0 year olds' acquisition of temporal relations. The experimental task required the comprehension of sentences of differing syntactic complexity which were presented in contexts which varied the availability of spatial and/or temporal movement information. Hodun's major finding was that performance on *ahead* and *behind* was superior to that on *before* and *after*. However, comprehension of these latter terms did vary contextually, being best in spatial contexts and not differing between contexts which provided temporal cues alone or both spatial and temporal cues. Furthermore, contexts where spatial and temporal cues conflicted were found most difficult by child subjects. Therefore, Hodun concluded that young children's comprehension of temporal sequence, is aided by their comprehension of spatial sequence, in corroboration of H. Clark (1973).

However, some research studies have questioned the primacy of the spatial sense for all *spatio-temporal* terms. The results of such work partially support Navon's (1978) theoretical orientation which is in direct opposition to H. Clark's (1973) prediction that space perceptions precede those of time. In his discussion of how people perceive and conceptualise stimuli which vary along several dimensions, Navon stated that the world is not perceived as a multidimensional space in which all dimensions are of equal status. Rather, it is seen as a "hierarchy of dimensions" in which time dominates space and the latter dominates all other dimensions. Furthermore, the psychological reality of this hierarchy is validated by a discussion of several empirical phenomena. Firstly there is the phenomenon of orderliness, people seek "order" or "lawfulness" in a set of two dimensional stimuli. Secondly, in relation to change, Navon noted that the sentences of our language which describe variation over time and space, give time-relations a greater scope than location markers. Finally, he stated that our language marks statements about location for time but not those of time for space, e.g. *"The sun is at zenith at noon"*, but not *"The sun is at noon when at zenith"* (Navon, 1978, p. 227).

Partial confirmation for Navon's alternative conceptualisation of perceptual preferences comes from two studies conducted on children's comprehension of *spatio-temporal* terms. Both Friedman and Seely (1976) and Richards and Hawpe (1980) have reported results which indicated the developmental priority of the temporal sense for the terms *before* and *after*. These studies also demonstrated that child subjects, when asked to comprehend *spatio-temporal* terms in varying non-linguistic contexts, assigned a dominant spatial sense to *ahead* and *behind* and a dominant temporal sense to *before* and *after*. Richards and Hawpe (1980) further found that adult subjects provided definitions for these terms which confirmed the children's dominant interpretations.

The above discussion indicates the importance of looking at children's comprehension of *spatio-temporal* terms in varying contexts. Indeed, Hodun (1975) has clearly stated that young children can comprehend both spatial and temporal relations given the appropriate experimental task and context. Therefore, the aim of the present study is to investigate children's comprehension of the terms *in front of, ahead of, behind, before* and *after* in both spatial and temporal sentential (linguistic) contexts. The major purpose is to see how linguistic context will affect the primary school age child's interpretation of these dual meaning *spatio-temporal* terms. Will the child assign the dominant meaning to the term, regardless of context? Or will context influence his interpretation and allow the secondary meaning of the term to be comprehended? The following predictions were tested in the present experiment:-

(1) Where there is a conflict between sentence context and dominant lexical meaning of the term, e.g. a spatial context and a temporal term, more errors will be made. Performance on such <u>incongruent</u> sentences will be poorer than on <u>congruent</u> sentences where context and meaning are the same (Hodun, 1975).

(2) Subjects will make more *semantically appropriate* errors than other types of errors on <u>incongruent</u> sentences. Such errors are of the same pole as the correct opposite and share semantic features with it, e.g. *in front of - after*.

(3) Positive or *unmarked* terms, e.g. *before*, will cause fewer errors than negative or *marked* terms, e.g. *after*, as predicted by E. Clark (1973c).

(4) Terms with a dominant spatial sense, e.g. *in front of*, will result in less errors than those with a dominant temporal sense, e.g. *after*. This is predicted by H. Clark's (1973) *Complexity Hypothesis*.

(5) Performance on this sentence frames task will increase with age. Both the number and nature of errors made on incongruent sentences will change with age demonstrating a greater contextual influence.

6.1 METHOD

6.1.1 Subjects

In this experiment the subjects were 200 monolingual children attending an upper-middle class suburban primary school. The experimental subjects were taken from Years 3, 4, 5, 6, and 7, and ranged in age from 7:4 to 13:2 years. There were 40 subjects, 20 males and 20 females, at each year level. On form (a) of the *P.P.V.T.* these subjects' verbal comprehension I.Q.'s varied between 86 and 145, with an overall mean of 110.4. The mean values and ranges for age and verbal I.Q. scores appear in Table 6.1. Appendix III-A provides the mean chronological ages and mean scores for each year on form (a) of the *P.P.V.T.*

TABLE 6.1. Mean Values and Ranges of Age and I.Q. (*P.P.V.T.*) for Subjects at Each Year Level.

	AGE*		*P.P.V.T.* - I.Q.	
	Mean	Range	Mean	Range
Year 3	8:0	7:4 - 9:2	109.2	88 - 140
Year 4	9:1	8:8 - 9:11	113.5	88 - 135
Year 5	10:4	9:7 - 11:4	110.1	89 - 145
Year 6	11:3	10:7 - 11:10	108.6	87 - 137
Year 7	12:2	11:9 - 13:2	110.4	86 - 145

* Age values are given in years and months.

6.1.2 Experimental Design

The experiment involved the use of the 5 *spatio-temporal* terms *in front of, ahead of, behind, before*, and *after*. These terms were placed in simple sentence frames that elicited either a spatial or temporal context. In these sentence frames the copular usage of the verb *"to be"*, which seems to evoke a spatial meaning, especially when used in its present tense form *(is)*, was used to create a spatial context. Similarly the past tense form of the verb *"to come"*, that is *came*, which seems to elicit a temporal contrast, indicated the temporal context in these sentence frames.

From these simple sentence frames the 10 sentence pairs, which comprised the experimental stimuli, were constructed. These pairs took the following form:-

"A is/came spatio-temporal term B"

"So B is/came ________________ A"

Appendix III-B lists the 10 sentence pairs used in this experimental study. The nouns *"John"* and *"Paul"* were used in such sentence pairs rather than the names of cartoon characters (or super heroes) to ensure familiarity and neutrality for all subjects.

Presentation of the sentence pairs was both visual and oral for all subjects. Each sentence pair was written in heavy black print in the middle of a rectangular piece of white cardboard whose dimensions were 20 cm x 17 cm. On these cards, the complete sentence of each pair appeared first, and beneath was the sentence which had (an) element/s missing from it. Each card was presented individually to the subject so he could see and read it as the experimenter read each sentence pair aloud.

There were 10 random presentation orders for the sentence pairs worked out on the basis of a Latin-square design. Of the 40 subjects at each year level, 4 subjects, 2 males and 2 females, received each presentation order.

6.1.3 Procedure

All subjects were seen individually by the experimenter in a quiet room set apart from the classrooms. The subject and the experimenter sat side by side at a desk on which the stimulus materials were placed for the subject to see.

After putting each subject at their ease, form (a) of the *P.P.V.T.* was administered. Then the experimental task was given to the subject in the nature of what was a "word game". The task was introduced by the following instructions:-

> *"This is a word game which we are going to play. You play it like this. First I will say a sentence which I want you to listen to very carefully. This sentence is complete - all the words are in it. Then I will say a second sentence. However, there is something missing from this second sentence, and I want you to tell me what is missing."*

In addition to reading each sentence pair aloud the experimenter presented it visually on a stimulus card which the subject could read.

Before commencing the experimental task, the experimenter provided examples utilising the pairs *over/under* and *below/above*.

The subject was required to master these examples before being presented with the experimental pairs. At the same time the experimenter reminded the subject to listen carefully and to supply the word/s which was missing from the second sentence of each pair.

The 10 experimental sentence pairs were then presented one at a time to each subject with a pause between each pair. Presentation order of the experimental stimuli varied between subjects according to which of the 10 random orders they had been assigned to.

Subjects were verbally encouraged to respond throughout the task by the experimenter. However, at no time during experimentation were the subjects' responses corrected. The experimenter simply marked down the subject's response on the data sheet and gave reinforcement by such statements as *"good"* before proceeding to the next stimulus pair.

6.2 RESULTS

The results of the experimental task will be considered in two sections. In the first section the overall performance of the subjects on the task as well as the statistical analyses performed on the data will be discussed. The second section will examine in detail the types of errors made on each sentence pair. In both sections, the data will be considered from the perspective of each individual year level as well as from that of the total group, where the data from all years are combined.

The response data of this experiment were classified as correct or incorrect on the basis of the antonym relation. A correct response was defined as the "direct opposite" of the *spatio-temporal* term appearing in the first sentence of each pair, e.g. *before-after*. All other responses were classified as errors.

6.2.1 Analysis of Correct Responses

There were 10 sentence pairs in the experimental task responded to by 40 subjects at each year level. Therefore, there were 400 possible correct responses at each year. It was found that all subjects in each year performed at better than chance level, that is, all years managed to achieve more than 200 (50%) correct responses. Table 6.2 lists the number and percentage of correct responses for congruent sentences, that is, those where sentence context and dominant adverbial meaning are the same, and incongruent sentences, that is, those in which context and adverbial meaning differ, for each year.

TABLE 6.2. Correct Responses for Each Year on Congruent versus Incongruent Sentence Pairs.

	CONGRUENT		INCONGRUENT	
	Number	Percentage	Number	Percentage
Year 3	146	73	108	54
Year 4	180	90	130	65
Year 5	179	89.5	145	72.5
Year 6	176	88	144	72
Year 7	185	92.5	150	75

Table 6.2 indicates that the number of correct responses made on both congruent and incongruent sentence pairs showed a steady but not linear increase with age. This increase was most notable from Years 3 to 4. Thereafter, a performance plateau was reached with only small variations in the number of correct responses occurring. At all year levels congruent sentence pairs were responded to more correctly than incongruent sentence pairs. This difference was marked at each year level. Table 6.2 further demonstrates that it is the Year 3 subjects who are the poorest performers on this task.

These conclusions are also supported when the number of correct responses given by subjects in each year group to each sentence pair in isolation are considered. Such data appear in Table 6.3 and indicate the same developmental age trend of a general tendency for number of correct responses to increase, as well as a similar superior performance on each congruent sentence pair.

TABLE 6.3. Number of Correct Responses x Experimental Sentence Pair at Each Year Level.

	1	2*	3*	4	5	6*	7*	8*	9	10
Year 3	32+	26	20	28	27	23	25	14	26	33
Year 4	38	27	26	35	35	27	27	23	34	38
Year 5	39	31	32	34	34	30	24	28	36	36
Year 6	40	22	35	33	36	29	30	28	35	32
Year 7	38	25	33	38	37	31	31	30	36	36

* Denotes an incongruent sentence pair.

\+ Possible maximum in each cell = 40.

Raw data, in terms of number of correct responses, for each year appear in Appendix III-C.

The difference found in the frequency data between congruent and incongruent sentence pairs also proved to be significant when a three-factor analysis of variance (A.O.V.) was performed on all pairs for each year group separately. In this A.O.V. the three factors or variables were Subjects x Spat (Spatial or Temporal Dominant Adverb) x Cong (Congruent or Incongruent Sentence Pair). The significant results of these analyses appear in Table 6.4. (Appendix III-D(1) gives the full results of each A.O.V. for the different Year Levels.)

TABLE 6.4. Significant Results of Three-way A.O.V. (Subjects x Spat x Cong) on the Data for Each Year.

	Source	D.F.	S.S.	M.S.	V.R.
Year 3	Spat	1,39	0.54	0.54	4.19
	Cong	1,39	1.11	1.11	21.28
Year 4	Cong	1,39	2.46	2.46	49.30
Year 5	Cong	1,39	1.25	1.25	30.56
Year 6	Spat	1,39	0.53	0.53	4.45
	Cong	1,39	1.03	1.03	17.64
Year 7	Cong	1,39	1.35	1.35	36.02

Significant values at α = 0.05, $F_{1,39}$ = 4.10

As indicated in Table 6.4 there is a significant main effect for the congruency (cong) factor in all year groups. Only for Years 3 and 6 did the lexical variable (spat) achieve significance as a main effect.

A second three factor A.O.V. (Subjects x Mark (*unmarked* or *marked* adverb) x Cong) was performed on the data for each year group to determine the effect of *markedness*. (Full results of these analyses appear in Appendix III-D(2)). Again, a significant main effect was found for the congruency variable at all year levels ($F\ 1,39 = 4.10$, $\alpha = 0.05$). However, *markedness* (mark) did not achieve significance as a main effect for any year group. Nevertheless, a significant interaction effect of mark x cong was found in the Year 3 data ($F = 9.13$, d.f. = 1,39, $\alpha = 0.05$).

Three significant effects were found when the data for all years were combined and subjected to a four factor A.O.V. (Gr (grade) x Subjects x Spat x Cong). There were two main effects of grade ($F = 5.86$, d.f. = 4,195, $\alpha = 0.05$) and congruency ($F = 146.61$, d.f. = 1,195, $\alpha = 0.05$). The other significant effect obtained was caused by the interaction of grade with the lexical variable (spat) ($F = 2.94$, d.f. = 4,195, $\alpha = 0.05$). Results of this A.O.V. appear in Table 6.5.

TABLE 6.5. Four-way A.O.V. (Gr x Subjects x Spat x Cong) Results.

Source	D.F.	S.S.	M.S.	V.R.
Gr	4,195	3.40	0.85	5.86*
Spat	1,195	0.03	0.03	0.30
Cong	1,195	7.00	7.00	146.61*
Gr x Spat	4,195	1.26	0.31	2.94*
Gr x Cong	4,195	0.20	0.05	1.04
Spat x Cong	1,195	0.002	0.002	0.04
Gr x Spat x Cong	4,195	0.21	0.05	1.10

*Significant at $\alpha = 0.05$; $F\ 1,195 = 3.89$; $F\ 4,195 = 2.41$

Chi-square analyses were performed on the number of correct responses at each year level considered in relation to sex, I.Q. *(P.P.V.T.)* and presentation order. (Results of these analyses appear in Appendix III-E). A significant sex effect was found in these data for subjects in Years 3 ($X^2 = 7.29$) and 6 ($X^2 = 4$; Crit $X^2 = 3.84$, d.f. = 1, $\alpha = 0.05$). At Year 3 females achieved a higher percentage of correct responses (70%) than males (57%), whilst at Year 6 the males scored more correct responses (84%) than the females (76%). The only significant difference with respect to verbal I.Q. was found for Year 7 children ($X^2 = 6.07$; Crit $X^2 = 3.84$, d.f. = 1, $\alpha = 0.05$). In this group children with verbal I.Q.'s in the range 86-116 had a greater percentage of correct responses (86.5%) than those whose verbal I.Q. was greater than 116 (76.4%). Neither sex nor I.Q. *(P.P.V.T.)* variables achieved significance when the data for all subjects were combined and subjected to Chi-square analyses.

The Chi-square analyses performed on the data of number of correct responses for different experimental orders yielded significant values at Years 3 ($X^2 = 28.74$), 4 ($X^2 = 27.53$) and 6 ($X^2 = 18.4$) when Crit $X^2 = 16.92$, d.f. = 9, $\alpha = 0.05$. When the data for each presentation order were considered in more detail it was found that subjects at Years 3 and 4 made more errors on the third presentation order. However, at Year 6 the effect was due to more errors being made on presentation order 10. The effect of presentation order also proved to be significant when the data from all years were pooled ($X^2 = 24.73$; Crit $X^2 = 16.92$, d.f. = 9, $\alpha = 0.05$).

6.2.2 Error Analysis

The error responses made by experimental subjects in this sentence frames task were classified into four major categories. These categories were as follows:-

(1) *Semantically Appropriate*, an "opposite" response which was of the same pole as the correct response but a synonym of it, e.g. *before - behind*.

(2) *Synonym*, a response which was a synonym of the *spatio-temporal* term appearing in the first sentence of a given pair, e.g. *behind - after*.

(3) *Repetition*, a response by the subject which simply repeated the term occurring in the first sentence, e.g. *after - after*.

(4) *Other Error*, any other type of error response made by the child, e.g. *last, second, not after*, which did not form part of the stimulus word field of the experiment.

When the types of errors made in the experimental task were examined for all years combined, it was found that the largest proportion could be classified as *semantically appropriate* (72.4%). The other three categories of *synonym* (11.4%), *repetition* (9.9%) and *other error* (6.3%) were found to constitute fairly small percentages in these experimental data. These findings were further reflected in the data for each year level which appear in Table 6.6.

TABLE 6.6. Percentage of Responses in Each Error Category for Each Year Level.

	Semantically Appropriate	*Synonym*	*Repetition*	*Other Error*
Year 3	49.3	16.4	15.8	18.5
Year 4	71.1	15.6	12.2	1.1
Year 5	82.9	6.6	9.2	1.3
Year 6	93.8	2.5	3.7	0
Year 7	87.7	10.8	1.5	0

However, as Table 6.6 illustrates, the proportion of each error category changes as year level changes and age increases. *Semantically appropriate* responses are the largest category of errors for any year group, but this category comes to assume greater importance in the data of older subjects. Furthermore, the other error categories of *synonym, repetition,* and *other error* generally decrease their numbers in the responses of older subjects, being primarily dominant at Years 3 and 4. It is important to note that whilst the *other error* responses constitute a fairly large portion of the error responses of Year 3 subjects, this is not so in the data of the other groups. Indeed, Year 3 subjects made an almost equivalent number of *synonym, repetition*, and *other error* responses, whilst for Years 4 to 7 this is not the case. The error responses of these latter years are largely *semantically appropriate* in nature.

When the error data for congruent and incongruent sentence pairs were considered, it was generally found that error responses of all types were more common on the incongruent pairs. This result was found in the data for each year level and is clearly reflected in Table 6.7. (Appendix III-F lists the type of errors made on each sentence pair at each year level).

TABLE 6.7. Number of Errors of Each Type made by Subjects at Each Year Level on Congruent and Incongruent Sentence Pairs.

	Semantically Appropriate		*Synonym*		*Repetition*		*Other Error*	
	C	I	C	I	C	I	C	I
Year 3	21	51	8	16	12	11	13	14
Year 4	16	48	2	12	2	9	0	1
Year 5	18	45	2	3	0	7	1	0
Year 6	23	52	0	2	1	2	0	0
Year 7	14	43	1	6	0	1	0	0

N.B. C = congruent sentence pair
I = incongruent sentence pair

It is evident from Table 6.7 that the number of errors made on incongruent sentence pairs decreased with age. This decrease is most marked for the error categories of *synonym, repetition,* and *other error. Semantically appropriate* error responses remain fairly high in each year group. Indeed, when this category of error response is examined in relation to all errors made by subjects at any year level on the incongruent sentence pairs, it was found to increase with age. Table 6.8 indicates the increasing prominence of the *semantically appropriate* error category in the error data of older subjects.

TABLE 6.8. *Semantically Appropriate* Error Responses on Incongruent Sentence Pairs Considered in Relation to All Other Errors at Each Year Level (as percentages).

	Semantically Appropriate	All Other Errors
Year 3	55.4	44.6
Year 4	68.6	31.4
Year 5	81.8	18.2
Year 6	92.9	7.1
Year 7	86.0	14.0

Semantically appropriate responses on incongruent sentence pairs will henceforth be called *predicted* (P) errors, in support of the notion of contextual effects on semantic interpretation. All other types of error responses on such sentence pairs will be labelled as *non-predicted* (N.P.). Therefore, it can be concluded that there is a developmental increase in the number of *predicted* errors on incongruent sentence pairs. This increase is not only found when such pairs are considered as a group, but also when each incongruent sentence pair is examined individually. The data presented in Table 6.9 clearly illustrates this finding.

Table 6.9 indicates that there is a general developmental trend for *predicted* errors to increase relative to *non-predicted* errors on incongruent sentence pairs. It is also evident that *predicted* errors generally constitute the larger error category on any sentence pair at each year level.

TABLE 6.9. *Predicted* versus *Non-Predicted* Errors on Each Incongruent Sentence Pair at Each Year Level.

	2		3		6		7		8	
	P	N.P.	P	N.P.	P.	N.P.	P	N.P.	P	N.P.
Year 3	7	7	15	5	7	10	6	9	16	10
Year 4	9	4	12	2	7	6	7	6	13	4
Year 5	9	0	7	1	9	1	8	8	12	0
Year 6	18	0	5	0	11	0	6	4	12	0
Year 7	14	1	6	1	8	1	5	4	10	0

6.3 DICSUSSION

The results of the present experiment confirm the first major hypothesis with regard to performance on congruent as opposed to incongruent sentence pairs. It was found that subjects at all year levels made more errors on those sentences where the linguistic context and the dominant lexical meaning of the adverb conflicted than on those where it did not. The prediction is very strongly supported by the experimental data in Table 6.2. Furthermore, Figures 6.1 and 6.2 (a-e) graphically illustrate this effect. Therefore, it can be concluded that sentence context has a very powerful influence on primary school age children's interpretation of the *spatio-temporal* terms *in front of, ahead of, behind, before* and *after*. The significant main effect found for the congruency (cong) variable under an analysis of variance further corroborates this conclusion. This effect was not only significant when the data for all year levels were combined, but also proved to be

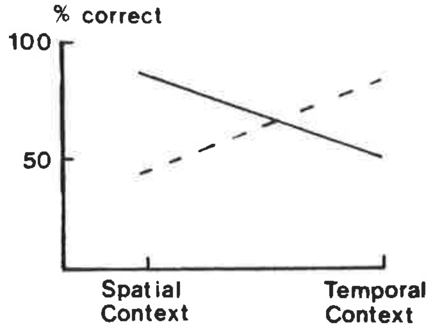


FIGURE 6.1. Predicted Performance of Child Subjects.

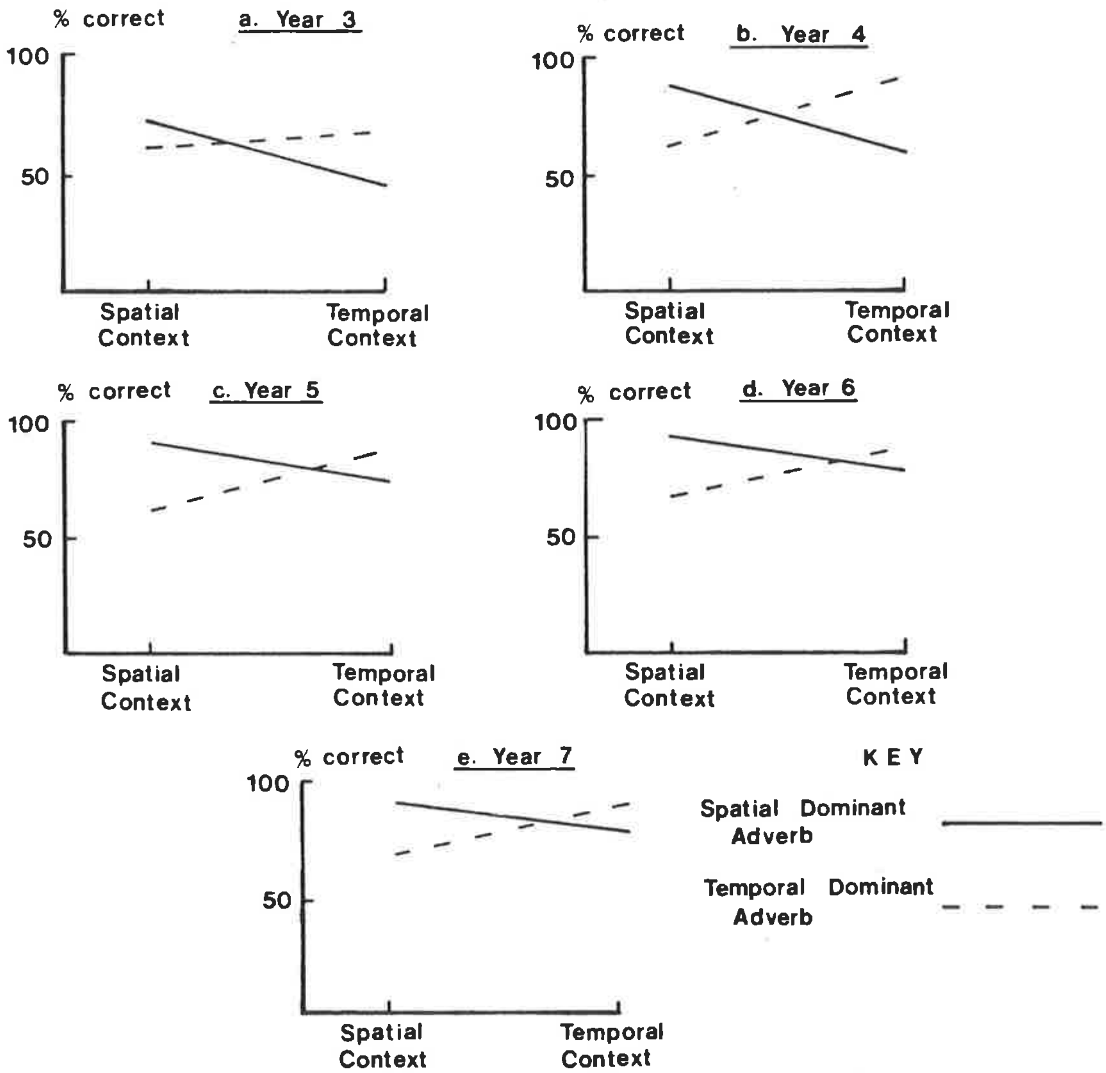


FIGURE 6.2. Experimental Performance of Child Subjects.

significant when analyses of variance were performed on the data for each individual year. In further support of these children's difficulty with incongruent sentence pairs, it was found that all such pairs were harder than the congruent pairs when the 10 sentence pairs were ranked in terms of difficulty for each year level.

Hodun (1975) has reported an analogous result in her research. In this study, child subjects again found it more difficult to comprehend *spatio-temporal* terms in contexts where spatial and temporal cues conflicted. A later study by Wales (1981) has also demonstrated that children have more difficulty processing temporal information in situations where there is conflicting spatial information.

Further support for the strong effect of sentence context on the semantic interpretation of *spatio-temporal* terms is provided by an examination of the types of errors made on incongruent sentence pairs. On both types of incongruent sentences, that is, spatial meaning/temporal context and temporal meaning/spatial context, the majority of error responses could be classified as *semantically appropriate*. This is clearly illustrated for each year level in Tables 6.8 and 6.9. *Semantically appropriate* responses are those which are synonyms of the correct opposite response of the *spatio-temporal* term appearing in the first sentence of a pair. Therefore, they are *predicted* on the basis of linguistic, that is, sentential, context affecting the semantic interpretation of the adverb. The context of the sentence enables the "minor" or "secondary" meaning of the adverb to be comprehended, suppressing, by its effect, the dominant sense. This finding with respect to the nature of errors on incongruent sentence pairs not only confirms the first hypothesis as regards the effects of context, but also its corollary, which states that *semantically appropriate* errors will be more frequent on incongruent sentence pairs.

However, Friedman and Seely (1976) provide evidence in conflict with the effects of context on children's comprehension of *spatio-temporal* terms. These workers found that 3:0 to 5:0 year old children interpreted *before* and *after* in a temporal sense in spatial tasks, whilst in temporal tasks *ahead of* and *behind* were given a spatial interpretation. The results of this study seem to be in contradiction to those found in the present experimental task. However, the difference may be attributed to the nature of the contexts and the tasks used in the two studies. Friedman and Seely utilised experimental tasks and contexts which were non-linguistic, whereas the present study employed a linguistic task in two different (spatial and temporal) linguistic contexts. The difference in the results of the two experiments may also be a necessary consequence of the younger age of Friedman and Seely's subjects. It is only later, during the middle school years, from about 7:0 years onwards, that text comes to play an ever-increasing role in children's comprehension of language (Olson & Nickerson, 1978).

A second hypothesis with respect to the effect of *markedness* on children's comprehension of *spatio-temporal* terms received only very limited support from the present experimental data. Under a three-factor analysis of variance there was no significant main effect for this variable at any year level. Indeed, when the percentage of correct responses on sentence pairs with *unmarked* adverbs are considered in relation to those with *marked* adverbs, the difference exceeds 5% only for Year 5 subjects (5.8%). However, the *markedness* by congruency interaction (mark x cong) did attain significance in the Year 3 subjects' data. Upon closer examination of these data, it was found that the interaction occurred because such subjects made a larger number of correct responses on the *unmarked* adverbs in congruent sentence contexts. Such a finding is indicative of the easier nature of linguistic contexts where semantic cues do not conflict when children are presented with a term, from a particular pair, which is held to be prior in acquisition (E. Clark, 1973c). The fact that this result was only reported for the youngest subjects, demonstrates that the *markedness* of a term ceases to be an important factor in the semantic processing of older subjects. Indeed, even this *markedness* effect would not have been found for Year 3 subjects if there had not been contextual support to aid their semantic interpretation. Consequently, the present findings are contrary to those of E. Clark (1973c) and of H. Clark (1973) who predict that children will understand the *unmarked* member of antonym pairs before acquiring its *marked* opposite.

The dominant lexical meaning of the adverb was only found to affect Year 3 and Year 6 subjects' comprehension of the 5 *spatio-temporal* terms investigated. This effect proved to be significant when an analysis of variance was performed on the data of each group. Upon consideration of the correct responses to spatial dominant and temporal dominant adverbs by Year 3 and Year 6 subjects, it was found in both cases that the significant effect could be attributed to superior performance on spatially dominant adverbs.

These findings confirm the experimental data of E. Clark (1972) who reported that children, in an "opposites" task, performed better on the spatially dominant pair *in front/in back*, than on the temporal pair *before/after*. E. Clark's subjects also used *in front* as a substitute for *before* when asked to give the opposite of *after*. Furthermore, Wales (1981) found that children comprehended *in front of*, and *behind* prior to *before* and *after* in spatial contexts. Such data also confirm H. Clark's (1973) prediction that children will first comprehend the spatial sense of terms labelled as *spatio-temporal* in meaning.

However, the lexical variable (spat) did not achieve significance when the data for Years 4, 5 and 7 were separately subjected to analysis of variance. At each year level the difference between the number of correct responses to spatial and temporal dominant adverbs was never more than 5%. Furthermore, an analysis of variance performed on the pooled group data for Years 3 to 7 also failed to produce a significant main effect for the lexical variable. Therefore, the present experimental data provide only partial support for the fourth hypothesis in relation to the effect of dominant lexical meaning. Only at two Year levels, that is, Years 3 and 6, was the comprehension of spatial dominant adverbs superior to that of temporal dominant adverbs. In the other Years, there was no significant disparity in the children's comprehension of these terms with differing dominant senses. Consequently, the significant interaction effect obtained between the grade and lexical variables in the analysis of the group data can be attributed to the significant effect of the lexical variable at Years 3 and 6.

The present experimental data and analyses also provide only partial confirmation for the findings of Hodun (1975). Hodun found that 4:0 and 5:0 year olds have a better comprehension of terms with a dominant spatial sense *(ahead* and *behind)* than those with a dominant temporal sense *(before* and *after)*. However, such a result was only reported for Year 3 and 6 subjects in the present study. For Years 4, 5 and 7 and the pooled group data, no such effect was obtained. Such a result is in line with the findings of the *M.D.S.* study which indicated that Year 3 subjects were aware of both senses, spatial and temporal, of *spatio-temporal* terms. Therefore, the prediction that the terms with a dominant spatial sense are prior in acquisition, and so will cause fewer errors is not supported. However, this result may be explained by the age of these subjects. By the time children reach primary school age, they are aware of the basic dual meanings of *spatio-temporal* terms and now must only learn what are the appropriate contexts of usage. Therefore, the appearance of a significant lexical effect at Years 3 and 6 is more probably associated with random noise in the data of these subject populations than with any other variable.

Nevertheless, the results do support the conclusions drawn by Friedman and Seely (1976) and Richards and Hawpe (1980). On the basis of their research findings these workers asserted that some words, *ahead* and *behind*, are understood in a spatial sense first, whilst others, *before* and *after*, are first comprehended in their temporal sense. The data of the present study confirm this conclusion as it was found that subjects had most difficulty in comprehending *spatio-temporal* terms when the sentence context and dominant lexical meaning of the adverb conflicted.

The results of the Chi-square analyses indicated significant effects for sex, verbal I.Q., and presentation order at different year levels. In Years 3 and 6 a significant sex difference in performance was found. At Year 3 level this difference was caused by the superior performance of female subjects. The girls in this year level gave a percentage of correct responses which was well above chance level (70%), whilst the boys' performance level was only slightly better than would be expected by chance (57%). However, for subjects in Year 6 the difference was reversed, with males achieving a larger number of correct responses (84%) on this experimental task than females (76%). These differences were unexpected, for according to Maccoby and Jacklin (1974) the early sex difference found in language abilities disappears in the middle school years. Furthermore, there are no large disparities in the verbal I.Q. scores for male and female subjects in Years 3 and 6, and hence the effect cannot be attributed to verbal I.Q. variability. Therefore, it can be concluded that this effect is again due to random noise in the data of Year 3 and Year 6 subjects. A conclusion further corroborated by the non-significant sex difference found for Years 4, 5 and 7 as well as the combined group data.

Only for the Year 7 data was a significant effect found for verbal I.Q. When the data for this group were examined in more detail it was found that subjects whose verbal I.Q.'s fell in the range 86-116 points achieved a higher percentage of correct responses (86.5%) than those whose verbal I.Q.'s were greater than 116 (76.4%). This result can probably be attributed to random fluctuation in the data of subjects from this year group. However, it may be a consequence of the tendency for subjects with verbal I.Q.'s greater than 116 to perceive the task as being more difficult in nature than it was in actuality. Perhaps these subjects were looking for more complex verbal answers than were required due to their greater verbal facility. This difference in perception may therefore have been a possible factor contributing to such subjects' poorer performance on the experimental task.

Under Chi-square analyses, presentation order was found to be a significant effect in the data of Year 3, 4, and 6 subjects. This result was unexpected as the presentation order of sentence pairs was only varied as part of the normal randomisation procedure. However, at two of these Year levels, 3 and 4, the effect was due to the subjects' poorer performance on an order which started with an <u>incongruent</u> sentence pair. Such poor performance is a further reflection of these subjects' difficulty with sentences where context and dominant lexical meaning conflict. Therefore, it corresponds to the earlier reported strong influence of linguistic context on the semantic interpretation of the *spatio-temporal* terms investigated.

The final hypothesis was stated in developmental terms. The data reported for this experiment indicate that performance on both congruent and incongruent sentence pairs did increase with age. Tables 6.2 and 6.3 illustrate this result by demonstrating that the number of correct responses given to both types of sentences generally increased from Year 3 to Year 7. These tables show that performance improved markedly from Year 3 to Year 4, with only a slight improvement occurring to Year 5 from which time a performance plateau is reached. This developmental trend is also supported by the significant grade effect obtained for the pooled group data under an analysis of variance. Consequently, it can be concluded that, as expected, performance improved with age.

This developmental difference is further reflected in the errors made on incongruent sentence pairs. Not only do such errors generally decrease with age, but their nature also changes, as illustrated in Table 6.7. The results indicate that the *semantically appropriate* error category increases from Year 3 to 7, whilst the proportion of errors which can be classified as *synonym, repetition* and *other error* tends to decrease. Such a result is true of both incongruent sentence pairs considered as a group and in isolation or individually. Furthermore, the largest changes in the response level for these error types occurs from Year 3 to 4, with Years 5 to 7 evidencing a more stable level of responding. The only incongruent sentence pair which did not show a dramatic decrease in the proportion of other error types in relation to *semantically appropriate* errors was the seventh pair. In this pair the verb and adverb took the form "-is after-", and therefore may have led to the semantic interpretation of one person chasing another. Consequently, subjects were more likely to give a variety of error responses to this sentence pair than to any other pair.

There are two other experimental findings of relevance to the present discussion. Firstly, Year 3 subjects performed at near chance level (54%) on incongruent sentence pairs. This finding may be a result of the hazy and ill-defined nature of this semantic field for 7:0 and 8:0 year olds. It may also reflect the difficulty such children have when processing a written presentation of semantic information. Children of this age have not yet developed the facile skill with written material which is characteristic of older children and adults, and which enables them to fully comprehend the semantic subtleties of the language (Olson & Nickerson, 1978).

A second important result is that subjects in all Year groups achieved a high level of performance on congruent sentence pairs. As indicated in Table 6.2 subjects, even in Year 3, responded well above chance level on such sentence pairs. Indeed, from Year 4 onwards the response level stabilized at a high level of around 90% correct. Such a result corroborates the findings of the two earlier studies with respect to the antonym relation. Both the "opposites" study and the *M.D.S.* study indicated that children in Year 3 have a firm grasp of the semantic relation of antonymy.

Furthermore, the present study demonstrates that this relationship is clearly comprehended by children in the primary school age group, that is 7:0 to 12:0 year olds.

In conclusion, this experiment points to the major influence of sentential or linguistic context on children's comprehension of the *spatio-temporal* terms *in front of, ahead of, behind, before* and *after*. This context determines whether children interpret the meanings of such terms in either their spatial or their temporal sense. Its powerful influence is reflected in the confusion it creates in children and the errors it causes them to make when faced with a comprehension task in which context and dominant lexical meaning of the adverb conflict. So strong is this effect, that it causes the non-dominant or "minor" meaning of the adverb to come to the fore. This is indicated by the large number of *semantically appropriate* responses subjects gave to incongruent sentence pairs. Such a conclusion is strongly supported by Menyuk (1977) who states that one of the products of language development, in particular the semantic development of the lexicon, in the middle and later childhood years is:

> "The ability to understand and use lexical items appropriately within sentence contexts within situations."
> (Menyuk, 1977, p. 105)

Another conclusion which can be drawn from this study, is that the ability to use contextual information, particularly of a textual or linguistic nature, increases with age. Evidence for this conclusion is to be found in the changing nature of error responses with age, in particular the developmental increase in *semantically appropriate* or *predicted* errors on incongruent sentence pairs. These errors are indicative of the subjects' awareness of the constraints of context, and how it affects their interpretation of a term. The fact that they increase with age demonstrates that subjects develop the ability to utilise contextual information as they progress through the middle and later years of childhood. Such a result is predicted by both Menyuk (1977) and Olson and Nickerson (1978) who emphasize the importance of the primary school age child's increasing facility with the information contained within the sentence context. It is further supported by the results of a variety of studies on the effects of context. Klein et al. (1974) examined the use of contextual information by 10:0 and 12:0 year olds in a word boundary task and found that the ability to use such information to predict later aspects of a written message increased with age. Muma and Zwycewicz-Emory (1979) have reported a similar developmental effect for a word-production task. Only their older subjects, 9:0 year olds, were able to demonstrate any differentiation of contexts in a linguistic production task. Such distinction was missing from the data of 5:0 year olds. Two other studies have shown a similar increase in the ability to use contextual information to interpret semantic ambiguity. James and Miller (1973) found that 7:0 year olds were more capable than 4:0 year olds at identifying, explaining and converting semantically anomalous sentences. Shultz and Pilon (1973) have further demonstrated the greater competence of older subjects in the detection of linguistic ambiguity.

However, whilst Vanevery and Rosenberg (1970) have reported a superior recall of *SWI* sentences by older subjects, Rosenberg et al. (1971) contradict this finding by their demonstration that 5:0 year olds are just as aware of the semantic constraints operating within a sentence as are adults. This was evidenced by a similar recall performance of *SWI* sentences at various age levels.

Nevertheless, the present study has indicated that linguistic context does affect comprehension, and that this effect increases with age as children become more aware of the semantic constraints which operate within a sentence. What now remains to be examined is when the ability to use contextual information reaches an adult performance level. This area will be investigated in the next chapter which will describe a study with adult subjects using the same experimental paradigm to enable a comparison to be made with the child data.

CHAPTER 7.

THE EFFECT OF SENTENCE CONTEXT ON THE COMPREHENSION OF *SPATIO-TEMPORAL* TERMS BY ADULTS

The preceding experiment has demonstrated that linguistic, or more specifically sentential, context does affect children's interpretation of *spatio-temporal* terms. This was evidenced by their performance on a task in which sentential context either supported or failed to support the dominant sense of these dual meaning terms. In particular, when sentence context conflicted with the dominant meaning of the *spatio-temporal* term embedded within it children were able to assign the non-dominant or"minor" meaning to the term. Furthermore, this awareness of the semantic constraints which operate within a sentence did change with age. As children progressed from Year 3 to Year 7 they became more sensitive to the effects that sentence context has on the interpretation of a word. There is, therefore, a developmental increase in the ability to recognise that the sense of a word is determined by the relationships it contracts with other sentence elements. Consequently, it is relevant to consider at what age an adult-like performance is achieved for this ability.

The purpose of this experiment is to look at the semantic system of *spatio-temporal* terms for an adult population. By the time adulthood has been reached, people have been exposed to language in a wide variety of situations. They have experienced both spoken and written language in many different contexts. Therefore, adults are conscious of the fact that the meaning assigned to a word is determined by its context of use. They have come to know the many semantic subtleties which characterise word meaning and how these are affected by both non-linguistic and linguistic context.

Two studies which have been conducted have shown the effects of context on semantic processing in adults. Rosenberg and Jarvella (1970a) have investigated the use of contextual features for sentence perception by adult subjects. This study was carried out using the basic *S.W.I. (semantically well integrated)* and *S.P.I. (semantically poorly integrated)* sentence dichotomy also employed in child studies (Vanevery & Rosenberg, 1970; Rosenberg, Jarvella & Cross, 1971). In the former type of sentence *(S.W.I.)* the contextual features support the subject of the sentence whereas in the latter *(S.P.I.)* these sentence features or constitutents do not. Rosenberg and Jarvella (1970a) required their undergraduate subjects to shadow tape-recorded *S.W.I.* and *S.P.I.* sentences, of the same grammatical form, under both quiet and noise conditions. Immediately the subject had heard each sentence, he had to repeat it. In addition there was an incidental learning task in which subjects were asked to recall the sentences they had heard without prior warning. The results demonstrated that subjects performed better on *S.W.I.* than *S.P.I.* sentences under noise conditions only. Not only were *S.W.I.* sentences shadowed better but they also evidenced a superior performance level on the incidental learning task, in terms of number of words recalled, under noise conditions. These latter results for the noise condition parallel those reported for children which indicated superior recall of *S.W.I.* sentences (Vanevery & Rosenberg, 1970; Rosenberg et al., 1971). However that such effects were not reported for the quiet condition was attributed to the ease of this task, which required only minimal attention to the input message and its meaning, for adult subjects. On the basis of these findings, Rosenberg and Jarvella concluded that adults do use the semantic information contained in contextual features in a sentence perception task where noise reduces intelligibility. The subject's sentence interpretation is aided in such situations by the contextual cues provided by the *semantically well integrated* sentences.

In a second study, Walter (1973) examined the effects of sentence and non-sentence context on the dimensions, in particular semantic and phonemic, of word memory. His 72 female undergraduate subjects were presented with lists of words in either sentence form or random order. After a retention interval of 5 or 20 seconds, during which they completed maths problems, the subject was required to perform a recognition task in which the probe cues were either a homonym of, or a synonym of, or identical to the word in the original list. The subject's task was to indicate *Yes* or *No* to the cued relationship between the probe and the word in the list. Walter's findings of most relevance to the present study were that not only did sentence context aid correct recognition and reduce probe-word latencies, but this effect was greater for synonym (semantic) than homonym (phonemic) recognition. Consequently, Walter concluded that the semantic dimension of word memory was strongly influenced by a sentence context presentation as evidenced by subjects' superior performance with identical and synonym probe cues. Such results and conclusions corroborate the data reported in the preceding chapter from the research of Klein, Klein and Bertino (1974), and Schvaneveldt, Ackerman and Semlear (1977). For both studies found that children's word recognition ability was affected by semantic context in a positive fashion.

Both of these studies, Rosenberg and Jarvella (1970a) and Walter (1973) have provided evidence that adults are aware of the semantic constraints which operate within a sentence. Their semantic processes are affected by the features which reside in the sentence context. Therefore, the present study aims to look at adults' comprehension of the dual meaning *spatio-temporal* terms in different linguistic contexts. In particular, how is adults' understanding of the *spatio-temporal* terms *in front of, ahead of, behind, before* and *after* influenced by different linguistic contexts?

That these terms have two meanings for adults has been amply demonstrated in the earlier reported *M.D.S.* study. In this experiment it was found that adults conceived of these *spatio-temporal* terms as existing in a two-dimensional semantic space whose dimensions were labelled spatial and temporal. [Refer to Figure 5.2, p.149.] However, this study also demonstrated that one of the meanings is dominant for a particular term. As such the data are in line with results reported by Hodun (1975) and Richards and Hawpe (1980) for adult subjects. The former study had subjects rate *spatio-temporal* terms on a spatial to temporal continuum whilst the latter merely asked subjects to provide definitions for such terms. However, both found that adults perceived *ahead* and *behind* as being strongly spatial in meaning whilst *before* and *after* were seen as having a strong temporal sense. Furthermore, Bennett (1975) provides theoretical support for this one dominant sense view in his componential analysis of the terms *in front of, behind, before* and *after* when used as prepositions. [Refer to Table 5.2, p. 135.] Therefore, it can be concluded that whilst adults are aware of both senses of *spatio-temporal* terms, they still see one as being dominant. As a result of this, context can be expected to exert an effect on their comprehension of such terms since it plays a large role in the determination of word meaning.

Consequently, the purpose of the present experiment is to examine how adults' comprehension of the *spatio-temporal* terms *in front of, ahead of, behind, before* and *after* is affected by spatial and temporal sentential contexts. The major aim is to obtain some comparative data by replicating the former experiment with child subjects in an adult population. If it is assumed that children reach adult competence on this experimental task in the primary school years, the present data will enable the determination of when, that is, at what age, such competence is achieved. At the same time the data will demonstrate what effect if any, sentence context exerts on adults' understanding of the *spatio-temporal* terms. Therefore, the present study tested the following predictions utilising the previously employed sentence frames experimental paradigm and in the light of the results of the preceding child study:-

(1) Adult subjects will make more errors on incongruent sentence pairs, in which the sentence context and dominant lexical meaning of the adverb conflict, than on congruent pairs, in which sentence context and lexical meaning are in accord.

(2) Reaction time will also be greater for incongruent than for congruent sentence pairs. This is because in the former pairs the linguistic context does not support the dominant interpretation of the adverb and so such sentence pairs take longer to process semantically. Walter's (1973) results of reduced probe recognition time with words presented in a sentence context predicts such an effect.

(3) Adult subjects will make more *semantically appropriate* errors than any other types of errors on incongruent sentence pairs. Such errors are of the same pole as the correct opposite and share semantic features with it, e.g. *behind-before*. These errors are predicted on the basis of the effects of context.

(4) There will be no significant difference between the number of errors subjects make on spatial and temporal dominant adverbs. Such a prediction is based on the fact that adults have largely acquired the semantics of their language and so are equally aware of both types of adverbs.

(5) This last prediction is stated as a comparative hypothesis. Is adult comprehension of *spatio-temporal* terms like that of children, similarly affected by context? Is the adults' performance on this sentence frames task similar to that of any age group of children previously studied?

It is important to note that the *markedness* hypothesis was not examined in the present adult study because this prediction applies specifically to the area of language acquisition (E. Clark, 1973c; H. Clark, 1973).

7.1 METHOD

7.1.1 Subjects

The subjects for this experiment were 40 monolingual undergraduate students, 20 males and 20 females, who were enrolled for Psychology I at the University of Adelaide. They completed the experimental task as part of a course requirement. The ages of these experimental subjects ranged from 17:3 to 20:3 years with a mean age of 18:2. [Appendix IV-A provides the age range and mean age for each sex group.]

7.1.2 Experimental Design

The present experiment employed the same sentence frames paradigm used in the child study. This involved the use of the 5 terms *in front of, ahead of, behind, before* and *after* placed in simple sentence frames which elicited either a spatial or a temporal context. The form of the sentences, which constituted the experimental stimuli, is listed in Appendix III-B and is as for the child study.

The only difference between this adult study and the preceding child one with respect to experimental design was in the method of presentation. For adult subjects, the 10 sentence pairs were presented one at a time on a VT 100 screen. First the complete sentence of the pair appeared, which the subject read, and then the sentence with (an) element/s missing from it appeared. In this presentation mode the inter-stimulus interval, that is, the time between the first and second sentences of a particular pair was 1250 milliseconds in duration. The time between sentence pairs or the inter-trial interval was 5 seconds in length. Consequently, adult subjects received only visual presentation of the experimental stimuli.

This presentation variance was the only difference in design between the child and adult subjects, as the 10 random presentation orders used with child subjects were again employed with adults. In addition, four subjects, two of each sex, once more received each of these presentation orders.

7.1.3 Procedure

All subjects were seen individually by the experimenter in a quiet room. In this room the subject sat at a desk in front of the VT 100 screen and the experimenter sat to the side to record all of the subject's verbal responses. The only equipment on this desk was a response button which the subject was required to press each time he responded. This response button enabled a reaction time value to be estimated by measuring the time between the end of the presentation of the second sentence of a pair and the subject's response.

Once the subject was comfortably seated at the desk the experimenter explained the task and its requirements with the following instructions:-

"This is a word task. Your job is to watch pairs of sentences which will appear on the screen in front of you. First one sentence of the pair will appear. You will have time to read it before the second sentence of the pair appears. The first sentence of each pair will be a complete sentence. However, the second sentence will have a word or words missing from it. Your task is to respond with the appropriate word or words for this second sentence as quickly and accurately as possible. You are also required to press this button (E indicates) once you have thought of this word and as you say it aloud."

Before doing the experimental task the subject was given a practice session which employed the 10 sentence pairs listed in Appendix IV-B. This practice session was to ensure that all subjects had an adequate understanding of the task requirements (in this respect it fulfilled its aim). Once the subject had completed the 10 practice pairs there was a brief break before the experiment itself commenced. During this interval the experimenter reminded the subject to respond quickly and accurately and to press the button as he responded. Then the experimenter instructed the subject to press the button to start the experimental trials.

Upon completion of the task, the experimenter explained the nature of the study and its expectations to the subject, and answered any questions. Each subject was then thanked for his participation and allowed to leave.

7.2 RESULTS

The results obtained from the adult subjects in this experiment will be considered in two sections. In the first section the subjects' overall performance on the task in terms of the number of correct responses made and the reaction times for the responses will be discussed. This section will also present the statistical analyses performed on these data. The types of errors made by adult subjects on the different sentence pairs will be the topic of the second section.

As with the data of the child study, a correct response was defined as the "direct-opposite" of the *spatio-temporal* term appearing in the first sentence of a pair, e.g. *ahead of-behind*. Any responses other than these were categorised as errors.

7.2.1 Analysis of Correct Responses and Reaction Times

There were 40 subjects in this study who responded to 10 sentence pairs, making the total possible correct responses equal to 400. It was found that the adult subjects performed at better than chance level (200 or 50%) on this task. They achieved an overall high performance level of 76.5% (306).

When the number of correct responses given to the two different types of sentence pairs, congruent and incongruent, was considered it was found that these subjects gave more correct responses to congruent (84.5%) than to incongruent (68.5%) sentence pairs. This superior performance on congruent sentence pairs was also evident when the response data for each of the 10 sentence pairs were considered. These data appear in Table 7.1

which indicates that adult subjects performed better on all <u>congruent</u> sentence pairs than they did on those pairs which were <u>incongruent</u>. [Raw data for adult subjects in terms of number of correct responses appears in Appendix IV-C.]

TABLE 7.1. Number of Correct Responses x Experimental Sentence Pair.

1	2*	3*	4	5	6*	7*	8*	9	10
36+	28	28	34	34	25	30	26	34	31

*Denotes an <u>incongruent</u> sentence pair.
+Possible maximum in each cell = 40.

The finding that subjects performed better on <u>congruent</u> than on <u>incongruent</u> pairs was further supported when a three-factor analysis of variance (A.O.V.) was performed on the number of correct responses to each sentence pair. In this A.O.V. the three factors were Subjects, Spat (spatial or temporal dominant adverb) and Cong (<u>congruent</u> or <u>incongruent</u> sentence pair). Table 7.2 presents the results of this analysis and indicates that only for the <u>congruency</u> (cong) variable was there a significant main effect. No other significant main effects or interaction effects were obtained under this analysis. Therefore, from a consideration of the frequency of correct responses to each sentence pair and the results of the A.O.V. performed on these data it can be concluded the subjects' performance was better on <u>congruent</u> than on <u>incongruent</u> pairs.

TABLE 7.2. Three-way A.O.V. (Subjects x Spat x Cong) Results.

SOURCE	D.F.	S.S.	M.S.	V.R.
Subjects	39	6.31	0.16	3.84+
Spat	1,39	0.001	0.001	0.01
Cong	1,39	0.87	0.87	15.15*
Spat x Cong	1,39	0.14	0.14	3.44

*Significant at $\alpha = 0.05$, $F_{1,39} = 4.10$.
+Subjects served as an error term in the A.O.V.

However, when the reaction time data for <u>congruent</u> and <u>incongruent</u> sentence pairs were considered the results did not support the above findings or conclusion. The overall mean reaction times to <u>congruent</u> and to <u>incongruent</u> sentence pairs examined as groups were found to differ very little. For all <u>congruent</u> sentence pairs this mean value was 2070 milliseconds whilst the mean value for all <u>incongruent</u> pairs was not much longer, being 2195 milliseconds. This lack of difference between <u>congruent</u> and <u>incongruent</u> sentence pairs' reaction times is further emphasised by the reaction time data for each of the 10 sentence pairs which is presented in Table 7.3.

TABLE 7.3. Reaction Time+ x Experimental Sentence Pair.

1	2*	3*	4	5	6*	7*	8*	9	10
1659	1581	2397	2755	1819	2081	1956	2959	2216	1900

+These values are given in milliseconds.

Furthermore, when a three-factor A.O.V. (Subjects x Spat x Cong) was performed on the reaction time data no significant effects were obtained. The results of this analysis appear in Appendix IV-D. From the reaction time results and this analysis it can therefore be concluded that reaction time did not differ significantly between congruent and incongruent sentence pairs for these adult subjects. Consequently, further analyses to be discussed in this section will only examine the frequency data on the number of correct responses.

When a Chi-square analysis was performed on the number of correct responses in relation to presentation order a significant effect was obtained ($X^2 = 27.4$; Crit $X^2 = 16.92$, d.f. = 9, $\alpha = 0.05$). This analysis indicated that adult subjects had most difficulty with presentation orders 6 and 10 as is illustrated in Table 7.4.

TABLE 7.4. Number of Correct Responses x Presentation Order.

1	2	3	4	5	6	7	8	9	10
33+	31	29	33	36	23	34	31	34	22

\+ Possible maximum in each cell = 40.

There were no other significant differences found in these frequency data. For both male and female subjects achieved an equivalent level of performance (153 or 76.5%) on all sentence pairs in this task. Their performance on congruent and incongruent sentence pairs, whether considered as groups or individually, also varied by such small amounts as to be negligible.

7.2.2 Error Analysis

As for the child error data of the preceding experiment, the adult error responses were classified into the four error categories of *semantically appropriate, synonym, repetition* and *other error*. [Refer to p.185, Chapter 6, for an explanation of these categories.]

When the types of errors made by experimental subjects in this task were examined, it was found that the largest proportion (61.7%) could be classified as *semantically appropriate*. Of the other three error categories, only those of *synonym* (18.1%) and *repetition* (20.2%) were represented in the present adult data. These subjects failed to make any responses which could be placed in the *other error* category.

Table 7.5 illustrates the type of errors made by adult subjects on each sentence pair and indicates that errors, of all types, were generally more common on incongruent than congruent pairs.

TABLE 7.5. Type of Error Response x Experimental Sentence Pair.

	1	2*	3*	4	5	6*	7*	8*	9	10
Semantically Appropriate	3	8	9	3	2	11	6	9	4	3
Synonym	-	3	2	-	2	2	1	4	-	3
Repetition	1	1	1	3	2	2	3	1	2	3
Other Error	-	-	-	-	-	-	-	-	-	-

*Denotes an incongruent sentence pair.

From an examination of Table 7.5 it also becomes evident that *semantically appropriate* error responses were more frequent (68.2%) than all other types of error responses (31.8%) on the incongruent sentence pairs. These *semantically appropriate* errors on incongruent pairs are *predicted* on the basis of the effects of context on the semantic interpretation of the adverb. All other error responses on such sentence pairs are *non-predicted*. Therefore, it can be concluded that adult subjects made more *predicted* than *non-predicted* errors on incongruent sentence pairs.

Such a conclusion is also supported by a consideration of these subjects' performance on each incongruent sentence pair. Table 7.6 presents the data on *predicted* and *non-predicted* errors for each incongruent pair and again indicates that the former type of error is more usual.

TABLE 7.6. *Predicted (P)* versus *Non-Predicted (N.P.)* Errors on Each Incongruent Sentence Pair.

2		3		6		7		8	
P	*N.P.*	*P*	*N.P.*	*P*	*N.P.*	*P*	*N.P*	*P*	*N.P.*
8	4	9	3	11	4	6	4	9	5

7.3 DISCUSSION

The results of the present study with adult subjects confirmed the first hypothesis but not the second with respect to their performance on congruent and incongruent sentence pairs. It was found that subjects made more errors on sentence pairs where linguistic context and dominant lexical meaning of the adverb conflicted than on those pairs where it did not. Such a result supports the first hypothesis. However, contrary to the prediction of the second hypothesis, adults did not take longer to respond to incongruent than to congruent sentence pairs. Indeed, their reaction times to these two different sentence pair types differed very little. These findings are most clearly illustrated in Figures 7.1, 7.2 and 7.3 which indicate that only the graphical plot of subjects' correct responses, Figure 7.2, in this experiment conform to the predicted crossover configuration. This effect is not found in the graph of the reaction time data which appears in Figure 7.3.

The analysis of variance performed on the number of correct responses and reaction time data for this experiment provide further confirmation of the first but not the second hypothesis. A significant congruency effect was found in the data on response correctness. However, no such effect reached significance when the reaction time data were subjected to an analysis of variance.

Therefore, it can be concluded that adults' interpretation of the *spatio-temporal* terms *in front of, ahead of, behind, before* and *after* is strongly influenced by sentential context as has been reported earlier for child subjects. Nevertheless, this effect was evident for only one of the performance measures taken. For it was found that not only did subjects score more correct responses on congruent than on incongruent pairs when examined as groups, but, when the 10 sentence pairs were ranked in terms of difficulty, all incongruent pairs were harder than congruent pairs. However, such an effect in favour of the ease of congruent sentence pairs was not reported for the reaction time data.

KEY

Spatial Dominant Adverb

Temporal Dominant Adverb

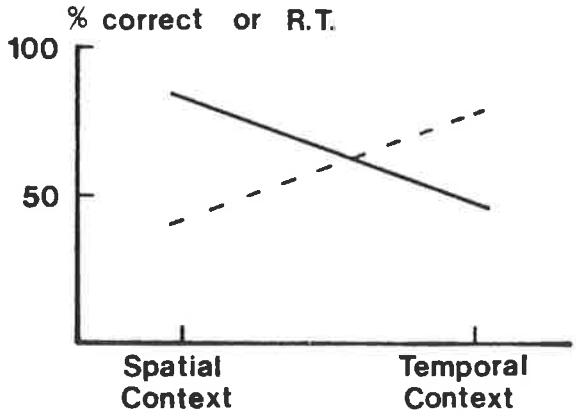


FIGURE 7.1. Predicted Performance of Adult Subjects.

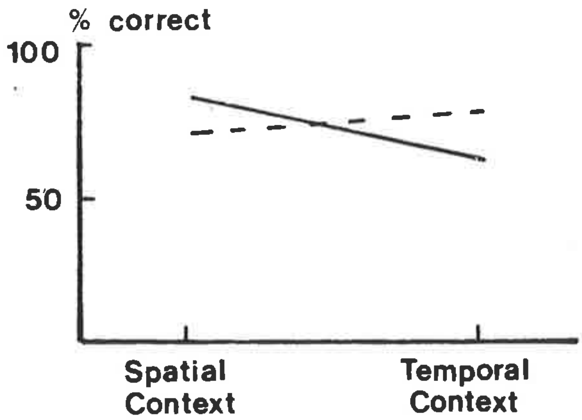


FIGURE 7.2. Experimental Performance of Adult Subjects - Percentage Correct.

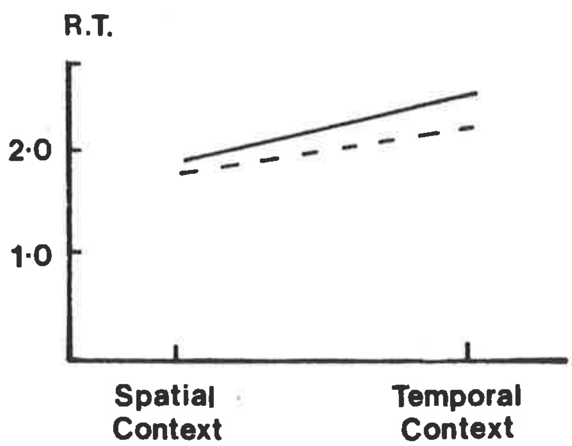


FIGURE 7.3. Experimental Performance of Adult Subjects - Reaction Time.

The lack of difference in the reaction times to congruent and incongruent pairs was unexpected as it was predicted that sentence context would aid the comprehension processes for the former sentences and so reduce reaction time. However, this finding can perhaps be attributed to adults' greater competence with semantic processing tasks. Adults are aware of the many and varied subtleties which characterise the semantics of their language because of their more highly developed linguistic skills. These skills perhaps enable them to learn and use "short-cuts" when processing language input for meaning. Therefore, whilst they still make errors on semantic processing tasks they do not take longer because they may utilise the "short-cuts" they have learnt. Consequently, the adult subjects' poorer performance on incongruent sentence pairs is only reflected in one, correctness of response, but not the other, reaction time, of the measures taken. However, this lack of a significant difference between the processing times for congruent and incongruent sentence pairs may also be a reflection of the crudity of the reaction time measure employed. The equipment may need to be much more sophisticated to enable finer estimates of reaction time to be made so that any small differences which do exist can be detected.

Further support for the strong effect of sentence context on adults' interpretation of the *spatio-temporal* terms was provided by the types of errors made on incongruent sentence pairs. *Semantically appropriate* errors were found to be more common than any of the other error types on such sentence pairs as is evident in Tables 7.5 and 7.6. Such errors are predicted on the basis of the effects of linguistic context. This context allows subjects to assign the non-dominant meaning to the adverb and so results in a large number of *semantically appropriate* responses. Consequently, the error data for incongruent sentence pairs confirm the third hypothesis tested and as a result lend further support to the strong effect of linguistic context on the comprehension of the five *spatio-temporal* terms studied. As such these findings correspond to the earlier cited results of Rosenberg and Jarvella (1970a) and Walter (1973) who both reported that sentence context aided semantic processing in adults.

There are two other aspects of the error response data which need to be considered at this point. The first of these concerns the type of error responses adult subjects made on all sentence pairs in this task. None of the errors made by subjects could be classified in the *other error* category, they all fell into the categories of *semantically appropriate, synonym* or *repetition*. Consequently, all responses given by adult subjects in this task were members of the *spatio-temporal* semantic field being studied. Such a result indicates that adults conceive of this class or field as being comprised of a closely knit group of words strongly related in terms of meaning components. Therefore, it supports the earlier reported two dimensional conceptualisation of *spatio-temporal* terms by adults. [Refer to Figure 5.2, p.149.] Furthermore, this finding demonstrates the strong effects of sentential context in eliciting the spatial or temporal sense of the dual meaning *spatio-temporal* terms.

A second important result found in the error data concerns the subjects' performance on the seventh sentence pair. This is the incongruent sentence pair whose critical verbal and adverbial components were *"-is after-"*. As in the child data, *repetition* error responses were quite common to this pair demonstrating that some adults, as did children, interpreted the first sentence of this pair as meaning one person was chasing another.

The fourth hypothesis to be tested in the present study did receive confirmation in the experimental data. This hypothesis postulated no difference between adults' performance on spatially and temporally dominant adverbs in this sentence frames task. It was supported by the three-factor (Subjects x Spat x Cong) analyses of variance performed on both the number of correct responses and the reaction time data. Both analyses failed to report a significant main effect for the lexical variable (spat). Therefore, it can be concluded that as no difference was found between adults' responses to spatially and temporally dominant adverbs, then the categories of space and time are firmly established in the adult semantic system.

There was only one other significant effect reported for the present adult data. It was found that adults, just like children, performed worse on some experimental presentation orders, 6 and 10, than others. This effect was unexpected as presentation order was merely varied as part of normal randomisation procedure and so was not expected to affect performance. However, this result may be attributed to subjects' poorer performance on, as well as their confusion with, incongruent sentence pairs. Such a postulation can explain the finding for presentation order 6 whose first three sentence pairs were all incongruent. Nevertheless, it is only a partial explanation, for the 10th presentation order began with congruent pairs and therefore any performance difference for this order can only be attributed to random fluctuation in the data.

Finally, it is important to consider the relationship between child and adult performance on this experimental task. When the adult data were compared with that of children at each year level, it was found that the present results most closely approximated those reported for Year 4 subjects. For both age groups there were only small differences in their overall performance on this task, Year 4 achieved 77.5% correct responses whilst that of adults was 76.5%. Furthermore, their performance on congruent (Year 4 = 90%; Adults = 84.5%) and incongruent (Year 4 = 65%; Adults = 68.5%) sentence pairs considered as groups were found to differ very little. This correspondence between the Year 4 and Adult data also becomes evident from a perusal of Figures 6.2(b) (p.190) and 7.2, which are very similar in form, as well as from an examination of each age groups' performance on the different sentence pairs (Tables 6.3 (p.181) and 7.1). Furthermore, when the error types made on incongruent sentence pairs in terms of *predicted* (Year 4 = 68.6%; Adults = 68.2%) and *non-predicted* (Year 4 = 31.4%; Adults = 31.8%) errors are considered, a similar close relationship is found.

Therefore, it can be concluded that adult-like performance on this sentence frames task is achieved by Year 4 or around 9:0 years of age. Such a conclusion is strongly supported by the many similarities between the Year 4 child data and the present adult data. It is further corroborated by the developmental trend found in the former sentence frames study. These data from child subjects indicated that the most dramatic increase in performance occurred from Years 3 to 4. Thereafter, performance remained at a fairly stable level with only minor variations occurring in it. Consequently, from Year 4 onwards subjects demonstrate adult-like competence in their performance of this semantic processing task.

However, there were minor variations in child and adult performance on this experimental task which it is important to consider. Firstly, there were no reported sex differences in the adult data whereas such differences have been previously demonstrated for Year 3 and Year 6 subjects. As such effects were attributed to random fluctuation in the data of these Year groups, they are not of major significance to the present data as they indicate no developmental change. A second variation concerns the types of errors made by child and adult subjects. Adult subjects made no responses outside the word field of the *spatio-temporal* terms *(in front of, ahead of, behind, before, after)* being studied, whereas child subjects up to Year 5 did. However, as responses which could be classified as *other error* constituted a small percentage of both Year 4 (1.1%) and Year 5 (1.3%) error responses it can be assumed that such errors were due to random noise in the data. Therefore, the change in *other error* pattern, that is, those errors outside the *spatio-temporal* semantic field, is of such a small magnitude as to not reflect a strong developmental trend.

In conclusion, sentential or linguistic context appears to strongly influence adults' interpretation of the 5 *spatio-temporal* terms *in front of, ahead of, behind, before* and *after*. This effect is similar to that reported for child subjects, for the data indicate that from about 9:0 years onwards children become aware of how the sense of a word is determined by the linguistic context in which it appears. Furthermore, there seems to be little change in this ability to recognise the effects of context from the 9:0 to 12:0 year old age group to adulthood. Adults as well as children in this age range appear to be equally aware of how a spatial and a temporal sentence context will affect the meaning they assign to these 5 *spatio-temporal* terms.

Such a conclusion is supported by the results reported by Walter (1973) who demonstrated the powerful influence of sentence context on the performance of adult subjects in a probe recognition task. It also corresponds to much of the current theorising in the area of semantics on the effects of context. Researchers such as Dale (1976), Menyuk (1977) and Sinha (1979) all state that the linguistic context or environment in which a word occurs has a strong effect on the word's interpretation. When assigning meanings to words, they cannot be considered in isolation, but must be placed in a linguistic context to enable their meaning to be understood. It is this linguistic context which comes to play an increasing role in language comprehension through the school years as is emphasised by Olson and Nickerson (1978) and demonstrated in the present sentence frames studies. Consequently, it can be said that sentence context aids the semantic interpretation of a term from the middle years of childhood and throughout adulthood.

The preceding experiments have provided evidence which indicates the importance of linguistic context for the processes of language comprehension in child and adult subjects. The next chapter will discuss the effects of context in a language-delayed population. Previous research, Illebrun (1974) and Collins (1974), has suggested that such children differ very little from normal children in their comprehension of spatial and temporal antonym pairs. Furthermore, the work of Liles, Shulman and Bartlett (1977) has shown that language-delayed children are able to judge and correct semantically anomalous sentences, indicating their ability to perform a task which involves the reflection on sentence structure. Therefore, awareness of the semantic constraints which operate within a sentence will be examined in a language-delayed population employing a similar sentence frames paradigm. The aim is to discover if such subjects do possess the capacity to utilise contextual information as an aid to the interpretation of *spatio-temporal* terms.

CHAPTER 8.

THE EFFECT OF SENTENCE CONTEXT ON THE COMPREHENSION OF *SPATIO-TEMPORAL* TERMS BY CHILDREN WITH DELAYED LANGUAGE

The experiments conducted in the two preceding chapters have demonstrated that sentential context does affect children's as well as adults' comprehension of *spatio-temporal* terms. Both children and adults were able to utilise the contextual information contained within the semantic structure of the sentence to assign the non-dominant sense to dual meaning *spatio-temporal* terms. Moreover, this ability to employ the sentence context as an aid in the comprehension of *spatio-temporal* terms was found to change with age, and reach adult-like level at Year 4 or around 9:0 years of age. Therefore, there is a developmental change in children's awareness of the semantic constraints which operate within a sentence and which help determine word meaning. Consequently, it is relevant to consider if this ability or awareness is affected by a delay in language development.

The population to be studied in the present experiment will be those children who can be classified as having a *pure language delay*. Such children have been defined by Irwin and Marge (1972) as possessing language skills at levels below those attained by their age peers. However, Weiner (1974) has most clearly delineated this population by stating that:

> "....*delayed language development* refers to the late appearance or slow development of language

> in a child who does not have sensory, motor, emotional, or intellectual problems that might be considered basic to his difficulties."
> (Weiner, 1974, p. 202)

Therefore, the children to be investigated in this study possess a developmental delay in their language abilities which cannot be attributed to such complicating factors as mental retardation, deafness etc. They have what has been called, for the purposes of this study, *a pure language delay*.

There has been very little experimentation done with this population of language-delayed children. This is probably a reflection of their small numbers in not only the general population (Stevenson & Richman, 1976), but also in the population of children who suffer from speech and language disorders of various types (Campbell, 1979, Appendix V-A). Stevenson and Richman (1976) found that only 4 of the 705 3:0 year olds they surveyed in their study suffered from a *pure language delay*. Furthermore, Campbell (1979) reported that only 7.3% of children receiving treatment in a 7 month period in several speech therapy clinics were classified as being delayed in language development. The data from this latter study are illustrated in Table 8.1 which clearly indicates the infrequency of the delayed language category. Therefore these data demonstrate that the experimental investigation of children with *delayed language development* has been limited by their small numbers and the attendant difficulties of isolating such a population.

TABLE 8.1. Prevalence of Speech and Language Disorders in a Therapeutic Population.

Articulation		Articulation & Language		Delayed Speech		Delayed Speech and Language		Delayed Language		Other		Total	
M	F	M	F	M	F	M	F	M	F	M	F	M	F
214	86	110	34	39	21	122	50	46	20	105	56	636	267
300	33.22%	144	15.95%	60	6.64%	172	19.05%	66	7.31%	161	17.83%	903	

Nevertheless, there have been several studies which have examined the language skills of this group of children. Most of these studies have looked at the syntactic system of language-delayed children and found that it is simpler in structure than that of their age peers. Such children are said to employ a syntax which is characteristic of an earlier stage of linguistic development. However, Lee (1966) has reported a contrary result from her comparative analysis of the spontaneous speech of a normally-developing and a language-delayed child. Her data led her to conclude that the latter child was not merely slower in development, but failed to produce certain syntactic structures, such as the designative construction, e.g. *"that a horse"*, on which later syntactic development depended. Liles, Shulman and Bartlett (1977) have found a similar difference in the ability of linguistically normal and linguistically deviant children to judge and correct agrammatical sentences. The results of their research indicated that linguistically normal children gave a larger number of correct responses on this task as well as fewer inappropriate corrections.

The data from both of these studies have demonstrated that language-delayed children are different in terms of their language development. However, most of the studies which have been conducted in the area of syntax have reported an opposite result, that is, a language delay and not a language difference.

Menyuk (1964) found that children classified as using infantile speech used syntactic rules which were simpler, and less generalised, and less differentiated than those used by children with normal speech. Menyuk and Looney (1972a,b) have further emphasised this point in the results of their experimental tasks which required normal and language-disordered children to repeat various sentence types, e.g. active-declaratives, phonological sequences. From the poorer performance of the language-disordered subjects on these repetition tasks, Menyuk and Looney concluded that such children analyse language at the simplest level using a limited set of syntactic and phonological rules.

Further experimentation which has examined the syntactic systems of language-delayed children has been carried out by Morehead and Ingram (1973) and Leonard, Bolders and Miller (1976). As in the former research of Menyuk and Looney the normal and language-disordered children in these studies differed in terms of chronological age, with the former group being younger. Morehead and Ingram (1973) matched their normal and linguistically deviant children of different ages in terms of mean morphemes per utterance (MM/U) before obtaining the language samples for which grammars were written. Few differences were found in the phrase structure grammars of the two groups when matched for MM/U. Therefore, Morehead and Ingram concluded that the older language-delayed children were merely delayed in their acquisition of language, that is, they were behind their same age peers in terms of grammatical development. This conclusion has been further supported by Leonard et al. (1976) who reported that the grammars written for the language samples of their normal and language-disordered subjects differed very little when such subjects were matched in terms of mean length of utterance (MLU). However, again the language-disordered children were significantly older than the normal children who possessed similar grammars, thus indicating that they, the language-disordered, were functioning at an earlier level of linguistic development.

Two studies have examined the phonological development of children with delayed language. In the first of these Gilbert (1970) had 10 pre-schoolers, 5 normal and 5 delayed with respect to language, learn and then repeat 4 monosyllabic words which were the names for 4 nonsense drawings. His results indicated that language-delayed children experienced difficulty in identifying the normal verbalisations, whilst no such difficulty was evidenced by normal children. Gilbert therefore concluded that children with delayed language are at a less mature level of phonological development. Bond and Wilson (1980) have reported a similar result in their investigation of the acquisition of the voicing contrast. They found that the verbal productions of language-delayed subjects showed a less mature development of the voicing contrast compared with those of normal speaking children.

The above studies lead to the conclusion that both the phonological and syntactic abilities of children classified as having a *pure language delay* are behind those attained by their age peers. Therefore, it is an open question as to whether the semantic abilities of such children reflect a similar delay.

Few studies have been conducted to investigate the semantic abilities of language-delayed children. However, those which have been carried out, Illebrun (1974) and Collins (1974) indicate that when language-delayed and normal children are matched in terms of MLU there are no differences. Illebrun (1974) tested the comprehension of the spatial pairs *high/low, thick/thin, wide/narrow, long/short, tall/short* and *deep/shallow* in their polar, comparative and superlative forms by normal and linguistically deviant children. He found that the comprehension of the two groups of children did not differ for these spatial adjectives. Furthermore, Collins (1974) has reported no differences in the comprehension of temporal order clauses utilising the terms *before* and *after* by normal and linguistically deviant children at similar stages of linguistic development. However, she did report some differences in their comprehension of spatial order sentences employing the terms *before, after, in front of, in back of, ahead* and *behind*.

Although the above studies have found no differences between normal and linguistically deviant children, it is important to note that both matched their subjects on MLU measures. Consequently, their subjects were at similar stages of linguistic development and, as a result, differences in their performance on these tasks would not be expected. However, to achieve comparable MLU levels for their two subject populations Illebrun and Collins had to accept wide disparities in the chronological ages of the groups. In both experiments the language-disordered subjects were considerably older than the normal subjects at a particular linguistic stage. Therefore, the data reported by Illebrun and Collins further support the notion that language-delayed children are slower or behind in the language acquisition process. This idea is further emphasised by Morehead and Ingram (1973):

> "....linguistically deviant children do not develop bizarre linguistic systems that are qualitatively different from normal children. Rather they develop quite similar linguistic systems with a marked delay in onset and acquisition time."
> (Morehead & Ingram, 1973, p. 344)

Therefore, the purpose of the present study is to examine the development of the semantic system in a population of language-delayed children. In particular this study proposes to investigate these children's comprehension of the 5 *spatio-temporal* terms *in front of, ahead of, behind, before* and *after*, and how this comprehension is affected by spatial and temporal sentential contexts. The aim is to replicate the preceding child study utilising the same sentence frames experimental paradigm in order to see if linguistic context affects the language-delayed child's interpretation of *spatio-temporal* terms. It has already been demonstrated that sentential context does affect normal children's and adults' interpretation of such dual meaning terms. Furthermore, this awareness of the effects of context was found to change with age, with adult-like performance being achieved between 9:0 and 10:0 years of age. Consequently, the present study will employ the same experimental paradigm with a group of language-delayed children whose delay puts them at the earliest level of linguistic functioning with respect to this skill. It is expected that the semantics of *spatio-temporal* terms in the linguistic system of such a population will not be as fully articulated as that of normal children of a similar chronological age. This will result in their functioning at an earlier developmental level in their comprehension of such terms.

Therefore, the present study tested the following predictions in the light of the above discussion and the preceding research with normal child and adult subjects:-

(1) Language-delayed subjects will make more errors on incongruent sentence pairs, those where sentence context and dominant lexical meaning of the adverb conflict, than on congruent pairs, where context and lexical meaning agree.

(2) Language-delayed subjects will make more *semantically appropriate* errors, e.g. *after- in front of,* on incongruent sentence pairs than any other types of errors. Such errors are predicted on the basis of the effects of context allowing the "minor" meaning of the *spatio-temporal* term to come to the fore.

(3) Language-delayed subjects will make fewer errors on positive or *unmarked* terms, e.g. *in front of* than on negative or

marked terms, e.g. *behind*. This is predicted by E. Clark's (1973c) *Semantic Feature Hypothesis*.

(4) Language-delayed subjects will make fewer errors on spatially dominant adverbs, e.g. *behind*, than on temporally dominant adverbs, e.g. *after*. The *Complexity Hypothesis* of H. Clark (1973) predicts this effect.

(5) The last prediction is stated in comparative terms. Is the language-delayed child's comprehension of *spatio-temporal* terms, like that of linguistically normal children, similarly affected by sentential context? Is the performance of language-delayed children similar to that of any age group of children previously studied? In particular, is their performance on this task delayed or different?

8.1 METHOD

8.1.1 Subjects

The subjects in this experiment were 19 children, 8 males and 11 females classified as having a *pure language delay*. These subjects were selected from a population of 269 Year 5 to 7 children, 144 males and 125 females, attending 5 upper-middle class suburban primary schools. There were 3 criteria for inclusion in the present experimental population based on the children's scores on form (a) of the *P.P.V.T.* These criteria were as follows:-

(1) Verbal I.Q. $<$ 84

(2) Mental Age - Chronological Age $\geq$ 1:6 years

(3) Percentile $\leq$ 12.

Table 8.2 lists the range and mean values for the variables of chronological age, mental age, verbal I.Q. and percentile in the present experimental population. (Appendix V-B provides data on the mean values of these variables for each sex group.)

TABLE 8.2. Mean Values and Ranges of Chronological Age, Mental Age, Verbal I.Q. and Percentile for Experimental Subjects.

Chronological Age*		Mental Age*		Verbal I.Q.		Percentile	
Mean	Range	Mean	Range	Mean	Range	Mean	Range
11:11	9:7-13:3	8:10	7:1-10:4	78.6	71-84	7.7	1-12

*Age values are in years and months.

8.1.2 Experimental Design

The same sentence frames paradigm previously employed with child and adult subjects was used in the present experiment. This paradigm utilised the 5 *spatio-temporal* terms *in front of, ahead of, behind, before* and *after* placed in either spatial or temporal sentential contexts. The 10 sentence frames in which these terms were placed formed the basis of the experimental sentence pairs as listed in Appendix III-B.

As with the preceding child study, the 10 sentence pairs were presented both orally and visually, that is, on cards. The format of these cards was identical to that used with linguistically normal children with a card for each pair.

The only difference between the present study and that with linguistically normal children was with respect to presentation order. Only one presentation order, order 6, was used in this experiment for the 10 sentence pairs. This order was randomly chosen from the 10 presentation orders previously employed. The purpose of this selection was to reduce the effect of presentation order as a contributing factor to any significant results obtained since this variable had been found to exert a significant effect in the data of linguistically normal subjects.

8.1.3 Procedure

The present experimental procedure was an exact replication of that employed with linguistically normal children for this sentence frames task. There was only one procedural difference. These language-delayed subjects were only given the experimental task at the time of the study, having been selected on the basis of their scores on the earlier administered *P.P.V.T.* (form a). Apart from this one difference, all subjects were seen individually and subjected to a procedure which involved the same example sentences and experimental sentence pairs presented in a like manner to that of the preceding child study.

Again, the subject's task was to supply the missing element/s from the second sentence of each pair. Once the response was given, the experimenter provided reinforcement by such statements as "*good*" and continued to the next sentence pair until the task had been completed.

8.2 RESULTS

As in the analysis of the two preceding sentence frames studies, the results of the present study will be considered in two sections. The first section will examine the subjects' overall performance on the task and the statistical analyses performed on these data. In the second section the types of errors the language-delayed subjects made on the experimental sentence pairs will be discussed.

Once more, the correctness of the responses made was determined by the semantic relationship of antonymy. A response was scored as correct if it was the direct opposite of the *spatio-temporal* term appearing in the first sentence of a pair, e.g. *in front of - behind*. All other responses were scored as incorrect.

8.2.1 Analysis of Correct Responses

This task involved 10 sentence pairs which were responded to by 19 subjects, therefore there were 190 possible correct responses. It was found that the language-delayed subjects performed at only slightly better than chance level on this task. They achieved only 113 or 59.5% correct responses. However, when the number of correct responses made to the two different types of sentence pairs, congruent and incongruent, were considered, it was found that this low performance level could be attributed to the subjects' poorer performance on incongruent pairs. Indeed, whilst these subjects managed to achieve 65 (68.5%) correct on congruent sentence pairs, their score on the incongruent sentence pairs was no better than would be expected by chance alone (48 or 50.5%).

(Appendix V-C provides the raw data, in terms of number of correct responses, for the language-delayed subjects on this task.)

The superior performance of language-delayed subjects on congruent sentence pairs was also evident when the subjects' responses to each of the 10 sentence pairs was examined. These data appear in Table 8.3 which indicates that such subjects generally tended to perform better on congruent than incongruent sentence pairs.

TABLE 8.3. Number of Correct Responses x Experimental Sentence Pair.

1	2*	3*	4	5	6*	7*	8*	9	10
15+	10	12	11	13	12	8	6	13	13

*Denotes an incongruent sentence pair.
+Possible maximum in each cell = 19.

When the number of correct responses on each pair were subjected to analyses of variance (A.O.V.) it was again found that these subjects performed better on congruent than incongruent sentence pairs. Two such A.O.V. were performed on these data both of which involved 3 factors. In the first A.O.V. the 3 factors were Subjects x Spat (spatial or temporal dominant adverb) x Cong (congruent or incongruent sentence pair), whilst in the second the factors were Subjects x Mark (*unmarked* or *marked* adverb) x Cong. The significant results of both analyses appear in Table 8.4 which illustrates that only the congruency (cong) variable achieved significance as a main effect. (Full results of each of these separate A.O.V. appear in Appendix V-D.)

TABLE 8.4. Significant Results of Three-Way A.O.V. [(Sub x Spat x Cong) and (Sub x Mark x Cong)].

A.O.V.	SOURCE	D.F.	S.S.	M.S.	V.R.
Sub x Spat x Cong	Cong	1,18	0.42	0.42	8.21
Sub x Mark x Cong	Cong	1,18	0.53	0.53	17.65

Significant values at $\alpha = 0.05$, $F_{1,18} = 4.41$

Therefore, it is evident from a consideration of these frequency data and the A.O.V. performed on these data that subjects gave significantly more correct responses to congruent than to incongruent sentence pairs.

There were no sex differences found in performance on this task. Males and females differed very little in terms of overall correct performance (males = 61.2%, females = 58.2%). This result was also evident when the subjects' performance on the two sentence types, congruent and incongruent, were considered. These data appear in Table 8.5 which again indicates that males and females differed only slightly with respect to their performance on this sentence frames task.

TABLE 8.5. Percentage of Correct Responses on Congruent and Incongruent Sentence Pairs x Sex.

	Males	Females
Congruent	67.5	69.1
Incongruent	55	47.3

8.2.2 Error Analysis

The four error categories of *semantically appropriate, synonym, repetition* and *other error* were used in the analysis of the error responses made on the 10 experimental sentence pairs. These are the same as those employed in the analysis of the normal child and adult error data on this sentence frames task, and are explained fully in the Results section of Chapter 6, p. 185.

Upon examination of the types of errors made by language-delayed subjects in this experimental task, it was found that the largest proportion could be classified as *repetition* (45.4%). *Semantically appropriate* (33.8%) and *synonym* (19.5%) responses constituted the two next largest categories of errors. *Other error* responses (1.3%) were found to be very infrequent in the errors these subjects made on the sentence pairs of this experimental task.

Table 8.6 lists the number of errors of the various types made by these language-delayed subjects on each sentence pair. It also illustrates that error responses, of all types, were more common on incongruent than on congruent pairs.

TABLE 8.6. Type of Error Response x Experimental Sentence Pair.

	1	2*	3*	4	5	6*	7*	8*	9	10
Semantically Appropriate	1	6	2	1	2	4	2	4	2	2
Synonym	3	1	1	1	2	-	1	4	1	1
Repetition	-	2	4	6	2	3	7	5	3	3
Other Error	--	----	----	----	----	---	1	----	----	---

*Denotes an incongruent sentence pair.

When the types of errors made on all incongruent sentence pairs were examined, it was found that *semantically appropriate* errors (40.4%) were less frequent than all other error types (59.6%). As *semantically appropriate* errors are *predicted* on the basis of the effects of sentence context on the comprehension of the adverb, it can be concluded that language-delayed subjects made more *non-predicted* than *predicted* errors on incongruent sentence pairs.

This conclusion is further supported by a consideration of the *predicted* and *non-predicted* errors made by these experimental subjects on each incongruent sentence pair. These data appear in Table 8.7 and indicate that *non-predicted* errors were more frequent on 3 of the 5 incongruent pairs. Furthermore, this difference was most marked for sentence pairs 7 and 8.

TABLE 8.7. *Predicted* (P) versus *Non-Predicted* (NP) Errors on Each Incongruent Sentence Pair.

2		3		6		7		8	
P	NP	P	NP	P	NP	P	NP	P	NP
6	3	3	4	4	3	2	9	4	9

8.3. DISCUSSION

The results of the present study with language-delayed subjects provide only partial confirmation for the various hypotheses tested. Only the first hypothesis with regard to performance on congruent as opposed to incongruent sentence pairs was supported by the present experimental data. Two other hypotheses, those concerned with error type and the effects of *markedness* were not corroborated whilst two more regarding the effects of lexical meaning and delayed language development were only partially confirmed.

In support of the first prediction, it was found that the language-delayed subjects of the present experiment made more errors on sentence pairs where linguistic context and dominant lexical meaning of the adverb conflicted than on those where it did not. The strong confirmation for this prediction is evident in Table 8.3 and also graphically illustrated in Figures 8.1 and 8.2. Therefore, it can be concluded that the language-delayed child's comprehension of the *spatio-temporal* terms *in front of, ahead of, behind, before* and *after* is affected by sentential context. Furthermore, the significant main effect found for the congruency (cong) variable in the analyses of variance similarly corroborates the importance of this contextual effect.

This finding for language-delayed subjects is comparable to the effect found in the data of both linguistically normal children and adults using the same experimental paradigm. It also corresponds to the results reported by Hodun (1975) who found that children with normal language development had difficulty understanding *spatio-temporal* terms if the spatial and temporal contextual cues conflicted. Further, Wales (1981) has reported similar results for the temporal terms. His normal 4:0 to 6:0 year old subjects found it harder to process temporal information in contexts where there was a lot of interfering spatial information.

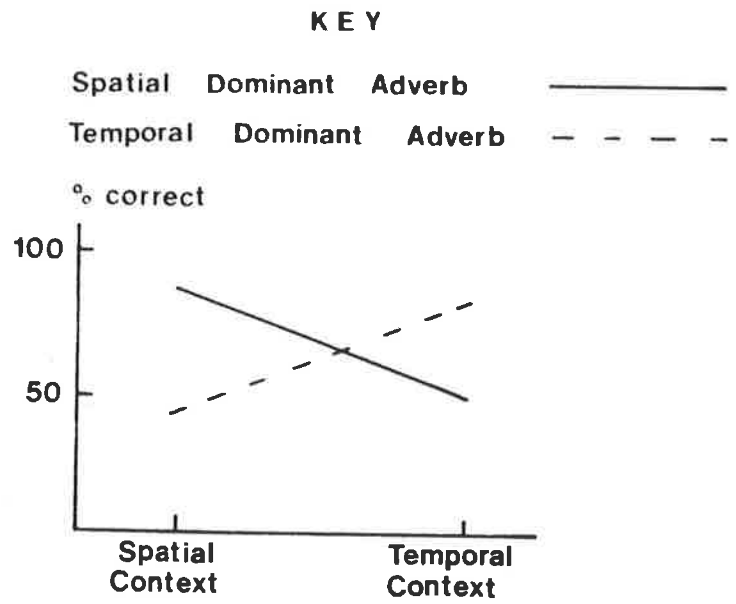


FIGURE 8.1. Predicted Performance of Language-Delayed Subjects.

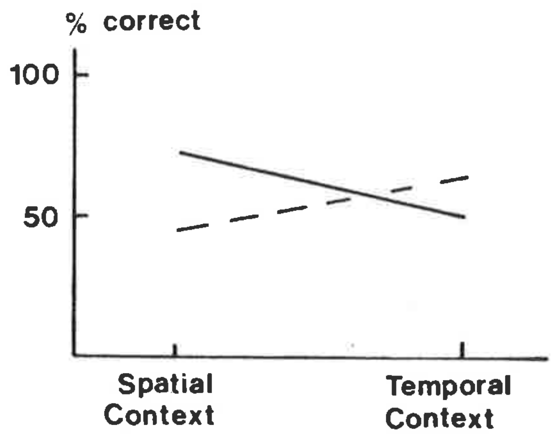


FIGURE 8.2. Experimental Performance of Language-Delayed Subjects.

However, the strong effect of linguistic context was not supported when the types of errors made on incongruent sentence pairs were examined. It was found that language-delayed subjects made more *non-predicted (synonym, repetition, other error)* than *predicted (semantically appropriate)* errors on such sentence pairs. This result is clearly illustrated in Tables 8.6 and 8.7 which further indicate that these subjects' large number of *repetition* error responses on incongruent sentence pairs 3, 7, and 8 was the cause. Consequently, the errors results for the language-delayed subjects are contrary to those reported earlier for linguistically normal children and adults. For the former data fail to indicate a large number of *semantically appropriate* responses on incongruent sentence pairs. Therefore, these data do not confirm the second hypothesis with respect to error type and, as a result do not further emphasise the effects of context.

The third hypothesis regarding the effects of *markedness* was not corroborated in the present experimental data. This variable (mark) did not achieve significance as a main effect when a three factor analysis of variance was performed on the data. Furthermore, the percentage of correct responses to *unmarked* and *marked* adverbs differed by less than 3%. Consequently, the present results correspond to those previously reported for linguistically normal children as no *markedness* effect is significantly evident in either set of data. Therefore, the prediction that the *unmarked* member of antonym pairs is developmentally prior to its *marked* counterpart (E. Clark, 1973c; H. Clark, 1973) was not confirmed.

The number of correct responses to spatial and temporal dominant adverbs was also found to differ very little for these language-delayed subjects. Indeed, when a three factor analysis of variance was performed on these data the lexical variable (spat) did not attain significance as a main effect indicating that such subjects responded equally well to spatial and temporal dominant adverbs. Such a result is contrary to results reported by E. Clark (1972), Hodun (1975) and Wales (1981). These researchers all found that spatially dominant terms were understood before temporally dominant terms by normal children. The present data also conflict with the *Complexity Hypothesis* of H. Clark (1973) which predicts that children first learn the spatial sense of *spatio-temporal* terms. However, the data do correspond with that previously reported for linguistically normal children. Such subjects gave a similar number of correct responses to spatial and temporal dominant adverbs in the same experimental task.

Finally, it is important to compare the present data with that of linguistically normal children in order to determine if the subjects in this experimental study are delayed or different with respect to this ability. The mental age, on the *P.P.V.T.*, of the present population of language-delayed children indicated that they were functioning linguistically at about an 8:0 year old level. Therefore, their data will be compared with that of Year 3 linguistically normal children. This is similar to the approach taken by other studies (Morehead & Ingram, 1973; Illebrun, 1974; Collins, 1974; Leonard et al., 1976; Bond & Wilson, 1980) which have used a linguistic measure in comparative studies of normal and linguistically deviant children.

When the data for these two groups of children were examined in detail it was found that both performed at near chance level on the incongruent sentence pairs of this task. Year 3 children gave only slightly more correct responses (54%) to such pairs than did the language-delayed children (50.5%). Furthermore, the performance of the two groups on spatial dominant adverbs in either spatial or temporal sentential contexts differed very little, by less than 5%. However, when their performance on the temporal dominant adverbs was considered, it was found that Year 3 subjects achieved more correct responses in both types of contexts than did the language-delayed subjects. This is evident from an examination of Figures 6.2(a) (p. 190) and 8.2. Therefore, it can be concluded that while the language-delayed children appear to be functioning at an earlier level, commensurate with their linguistic age (on the *P.P.V.T.*), with respect to spatially dominant adverbs such is not the case for adverbs with a dominant temporal meaning.

Such a finding is contrary to the research of Collins (1974) which found that children with normal and deviant language development differed only as regards their comprehension of spatial and not temporal order information. However, it does provide partial confirmation for H. Clark's (1973) prediction of the priority of spatial meaning in language acquisition. The spatial dominant adverbs which are held to be the first acquired, were less delayed in their development for this population of language-delayed subjects than were the temporal dominant adverbs. These latter terms seem to be understood at an earlier linguistic stage than the former as they are comprehended at a level below that indicated by the linguistic mental age of this group of subjects whereas the spatial terms are comprehended at this linguistic mental age level.

Upon examination of the error data of Year 3 and language-delayed subjects on incongruent sentence pairs a somewhat different picture emerges. Both groups of subjects did make a similar number of errors on such pairs, however, the nature of these errors differed. The majority of errors made by Year 3 subjects could be classified as *semantically appropriate* and therefore were *predicted* on the basis of contextual effects on the semantic interpretation of the adverb. However, *repetition* responses constituted the largest category of error responses for language-delayed subjects, and such responses were particularly common on sentence pairs 3, 7 and 8. This predominance of *repetition* errors for the 7th pair is similar to that reported for Year 3 subjects. Indeed, the 7th pair caused all subjects, children as well as adults, to give a large number of *repetition* responses. Such a finding can be explained by the notion that the key elements of the first sentence of this pair, that is, "___ *is after* ___", evoke a sense of one person chasing another. This idea gains further credence in the present data from the finding that the language-delayed subjects made a large number of *repetition* errors on the 4th sentence pair ("____ *came after* ____"). However, the large number of *repetition* errors on sentence pairs 3 and 8 cannot be attributed to a diverse interpretation evoked by the sentence structure.

Therefore, the difference in the nature of the errors made by Year 3 and language-delayed subjects leads to the conclusion that perhaps the latter group of subjects are deviant and not merely delayed, with respect to the linguistic ability this task requires.

This conclusion was further supported when the error types on all sentence pairs in this experimental task were considered. Again it was found that the language-delayed subjects made more errors which could be classified as *repetition* responses. The number of *semantically appropriate* responses they gave (33.8%) was well below that of Year 3 normal subjects. Furthermore, unlike Year 3 children, the language-delayed children did not make equivalent numbers of errors in the categories of *synonym, repetition* and *other error*. Consequently, all of these findings point to the conclusion that such children perform differently on this task than do linguistically normal children. .

In conclusion, this experiment has demonstrated that linguistic context does affect the meaning which language-delayed children assign to the 5 *spatio-temporal* terms *in front of, ahead of, behind, before* and *after*. Such children are aware of how the semantic constraints operating within the context of a sentence influence word meaning. However, their ability with, or awareness of, such constraints is limited compared with that of their linguistic age peers. This conclusion is especially evident when the large number of *repetition* errors these children made on this task were considered. Such errors are indicative of these children's different interpretation of the sentence pairs as well as their lack of complete comprehension of the semantic relation of antonymy. Unlike their mental linguistic age peers, the language-delayed children do not fully grasp the antonymous relationship. Therefore, it is concluded that on this sentence frames task language-delayed children display linguistic skills which are <u>different</u> from those of children who are developing language normally. Such a conclusion confirms the research of Lee (1966) and Liles <u>et al</u>. (1977) on the syntax of language disorder but is contrary to the results of other researchers in the areas of syntax (Menyuk, 1964; Menyuk & Looney, 1972a,b; Morehead & Ingram, 1973; Leonard <u>et al</u>., 1976), semantics (Illebrun, 1974; Collins, 1974), and phonology (Gilbert, 1970; Bond & Wilson, 1980).

Therefore, having shown that linguistic context does affect the semantic interpretation of *spatio-temporal* terms by both normal and linguistically deviant subjects, it is relevant to consider these contextual effects in more detail. To do this such terms will be placed in spatial, temporal and ambiguous (spatial/temporal) sentence contexts to discover how children will respond in an ambivalent meaning situation.

CHAPTER 9.

THE EFFECTS OF AN AMBIVALENT OR DUAL MEANING LINGUISTIC CONTEXT ON PRIMARY SCHOOL CHILDREN'S COMPREHENSION OF *SPATIO-TEMPORAL* TERMS

The preceding chapters have demonstrated that children of primary school age are aware of the dual meaning of terms which comprise the *spatio-temporal* semantic field. This has been evidenced by their responses to a task which required them to rate such terms for degree of subjective similarity with respect to meaning. In such a task, 8:0 year olds were found to conceptualise these terms as existing in a two dimensional semantic space as illustrated in Figure 5.1 (p. 149), whose dimensions were labelled spatial and temporal. Furthermore, not only do children realise that *spatio-temporal* terms have both a spatial and a temporal sense, but they are also aware of how this meaning is affected by linguistic context. This latter fact was demonstrated by children's performance on a task in which sentential context either supported or failed to support the dominant interpretation of the *spatio-temporal* term. Of particular interest were their responses to sentences where the linguistic context and the dominant lexical meaning of the *spatio-temporal* term conflicted. In such contexts, children's responses indicated that they were assigning a non-dominant interpretation to the *spatio-temporal* term. Therefore, the data from both of these tasks demonstrated that primary school age children are aware of both senses of *spatio-temporal* terms and how such meaning or sense is determined by contextual factors which reside in the sentence.

The foregoing studies have also shown that populations of both adult and language-delayed child subjects realise that the semantic constraints operating within a sentence affect the interpretation of dual meaning *spatio-temporal* terms. Furthermore, they have demonstrated that this semantic awareness is influenced by developmental factors. It changes with age and seems to reach an adult level of competence at Year 4 or around 9:0 years of age.

Consequently, the purpose of the present study is to investigate in more detail the effects of linguistic context on children's comprehension of *spatio-temporal* terms, in particular *in front of, behind, before* and *after*. The *spatio-temporal* term *ahead of* has been omitted from the present experiment on the basis of previous empirical findings, which indicate the primary school age child's limited use of this term. In the "Opposites" Study it was found that Year 3 children only gave *ahead of* as the opposite of *behind* on 4 occasions whereas *in front of* was given as its antonym 41 times. Similarly, in the previous sentence frames study *in front of* was the predominant response to the spatially dominant term *behind* for all subject populations tested. Therefore, only the terms *in front of, behind, before* and *after* were studied in more detail in the present sentence contexts experiment.

The double meaning attributed to these *spatio-temporal* terms has been demonstrated empirically in the preceding *M.D.S.* and Sentence Frames studies as well as in the dictionary definitions which appear in Table 5.1 (p. 132). It has also been discussed by H. Clark (1973) and Traugott (1978) who both state that the

English temporal terms have a spatial basis in the human organism's *front-back* perceptual plane. Therefore, a close connection exists between space and time conceptions in the English language, and it is this link which allows or enables a dual sense to be assigned to *spatio-temporal* terms.

However, it is held that only one of the two senses of *spatio-temporal* terms is dominant. The linguist Bennett (1975) states that *in front of* and *behind* have a strong spatial sense while the temporal sense is primary for *before* and *after*. This is evident in his componential analysis of these prepositional terms which appears in Table 5.2 (p. 135). Furthermore, the results of the *M.D.S.* study, whilst reporting that all of these terms have both a spatial and a temporal sense, indicate that such a distinction on the spatial dimension characterises *in front* and *behind* whereas *before* and *after* are primarily distinguished on the temporal dimension.

The dominance of the spatial sense for *ahead of* (a synonym of *in front of*) and *behind*, and the temporal sense for *before* and *after* has been similarly reported by many researchers using both child and adult subjects (Hodun, 1975; Friedman & Seely, 1976; Richards & Hawpe, 1980). These workers have also demonstrated that children's comprehension of such terms is affected by the non-linguistic contexts in which they occur. Friedman and Seely (1976) found that their child subjects performed better on *before* and *after* in temporal tasks whilst *ahead of* and *behind* were comprehended better in spatial tasks. Furthermore, their subjects reinterpreted these terms in their dominant sense, that is, *before* and *after* temporally and *ahead of* and *behind* spatially, in non-linguistic task situations which were in conflict with these primary meanings.

Other studies with child subjects have also demonstrated the effects of non-linguistic context on children's interpretation of *spatio-temporal* terms. Both Hodun (1975) and Wales (1981) reported that children had more difficulty comprehending *spatio-temporal* terms where spatial and temporal cues conflicted. Hodun (1975) found that when the spatial information was in opposition to the contextual information on temporal sequence, children performed worse on tasks requiring their comprehension of the pairs *ahead/behind* and *before/after*. Similarly Wales' (1981) study provides evidence of children's difficulty in understanding temporal information, or the terms *before* and *after*, in situations where there are conflicting spatial cues.

In a final study on the effects of non-linguistic context on children's interpretation of *spatio-temporal* terms, Richards and Hawpe (1980) investigated 4:0 to 6:0 year olds' understanding of the pairs *ahead/behind, before/after* and *first/last* in spatial, temporal and spatial/temporal tasks. Similar to the results of other researchers they found that *ahead* and *behind* were comprehended better in spatial tasks whilst the comprehension of *before* and *after* was better in temporal tasks. Richards and Hawpe further reported that children's understanding of these pairs was better in spatial/temporal tasks than in tasks whose nature differed from their dominant semantic sense, that is temporal tasks for *ahead/behind* and spatial tasks for *before/after*. Consequently, they concluded that one sense of *spatio-temporal* terms is learnt through its association with the other sense in contexts which jointly represent notions of space and time. Therefore, it can be concluded that the data from the study by Richards and Hawpe (1980) demonstrate that comprehension of the non-dominant sense of *spatio-temporal* terms is aided by contexts or tasks which provide both spatial and temporal cues, that is spatial/temporal tasks. However, while these data do indicate the importance of spatial/temporal contexts for 4:0 to 6:0 year olds' interpretation of *spatio-temporal* terms they only do so for non-linguistic contexts. Therefore, it is relevant to consider how spatial/temporal contexts which are linguistic in nature will affect the older child's, that is 7:0 years and over, comprehension of dual meaning *spatio-temporal* terms. For, it is during these middle school years that linguistic context comes to play an ever increasing role in the child's understanding of his language (Menyuk, 1977; Olson & Nickerson, 1978).

The purpose of the present study is to investigate how a spatial/temporal linguistic context will affect the primary school age child's comprehension of the *spatio-temporal* terms *in front of, behind, before* and *after*. This study will look at children's understanding of these terms in spatial, temporal and spatial/temporal (ambivalent) contexts to examine in more detail the effects of linguistic or sentential context on the semantic interpretation of *spatio-temporal* terms. In particular, when confronted with a sentence context where either a spatial or a temporal interpretation is equally probable, which one will primary school age children make? Furthermore, will this interpretation show a developmental trend, as was evidenced in the earlier sentence frames study, and change with age?

Based on the above discussion and the earlier reported research findings, the following hypotheses were tested in the present experiment:-

(1) In spatial sentential contexts the spatial responses *in front of* and *behind* will predominant at all age levels. This prediction was based on the work of Hodun (1975), Friedman and Seely (1976) and Richards and Hawpe (1980) who all reported a dominant spatial interpretation for these terms. Such responses are labelled as <u>correct</u>.

(2) In temporal sentential contexts, the temporal responses *before* and *after* will predominate at all age levels. This prediction was again based on the results of research by Hodun (1975), Friedman and Seely (1976) and Richards and Hawpe (1980) which has found that such terms have a dominant temporal sense. Again, these responses are termed <u>correct</u>.

(3) In spatial/temporal sentential contexts, the nature of the responses will change with age.

 (a) Younger subjects (<u>Year 3</u>) will give mainly spatial responses, e.g. *in front of*. H. Clark's (1973) postulation of the priority of the spatial sense of *spatio-temporal* terms provides the basis for this prediction.

 (b) From <u>Year 4</u> (around 9:0 years of age) onwards there will be a mixture of both spatial, e.g. *behind*, and temporal, e.g. *after*, responses in such contexts. This prediction is based on the findings of the earlier sentence frames study which demonstrated adult competence at Year 4 level. By Year 4 it is expected that children will be equally aware of both senses of *spatio-temporal* terms. Therefore, they will not evidence any strong bias in either a spatial or a temporal direction in the responses they give in spatial/temporal contexts.

(4) There will be a difference between the responses given to *unmarked*, e.g. *in front of, before*, and *marked*, e.g. *behind, after,* word pairs in all sentential contexts. E. Clark's (1973c) *Semantic Feature Theory* provides the basis for this prediction. Specifically,

(a) In spatial contexts, subjects at all age levels will give more spatial responses with *unmarked* than with *marked* stimulus pairs.

(b) In temporal contexts, *unmarked* stimulus pairs will elicit more temporal responses than *marked* stimulus pairs from subjects of all age levels.

(c) In spatial/temporal contexts, response variability, defined in terms of a mixture of spatial and temporal responses, will first be apparent with *unmarked* stimulus pairs.

9.1 METHOD

9.1.1 Subjects

The subjects in this experiment were 100 monolingual children attending an upper-middle class suburban primary school. These experimental subjects were selected from Years 3, 4, 5, 6 and 7, and ranged in age from 7:6 to 12:11 years. There were 20 subjects, 10 males and 10 females, at each year level. On form (a) of the *P.P.V.T.* these subjects' verbal I.Q.'s varied between 102 and 140 with an overall mean of 118.5. The mean values and ranges for age and verbal I.Q. scores appear in Table 9.1. (Appendix VI-A provides the mean scores for each year group on the *P.P.V.T.*)

TABLE 9.1. Mean Values and Ranges of Age and I.Q. (*P.P.V.T.*) for Subjects at Each Year Level.

	AGE*		*P.P.V.T.* - I.Q.	
	Mean	Range	Mean	Range
Year 3	8:4	7:6-8:10	120.7	102-137
Year 4	9:2	8:8-9:9	118.7	102-140
Year 5	10:2	9:9-10:9	121.6	105-135
Year 6	11:5	10:9-12:4	114.4	105-136
Year 7	12:4	11:8-12:11	117	108-137

*Age values are given in years and months.

9.1.2 Experimental Design

The experiment involved the use of the 4 *spatio-temporal* terms *in front of, behind, before* and *after*. These words served as the experimental word stimuli which the subjects were to place in various sentence frames.

There were 15 sentence frames, 5 each representing spatial, temporal and spatial/temporal sentential contexts, which comprised the experimental sentence stimuli. These sentence frames were chosen on the basis of being clearly spatial, or clearly temporal, or ambiguous, that is, evoking a spatial or a temporal interpretation with equal probability, in nature. Ratings by 3 independent judges, linguists, confirmed that the nature of these sentence frames was as postulated by the experimenter. Appendix VI-B lists the 15 sentence frames which were employed in this study.

These 15 sentence frames were presented twice to each subject, once with an *unmarked* stimulus pair, e.g. *in front of, before* and once with a *marked* stimulus pair, e.g. *behind, after*. They were presented in booklet form in which 6 sentences appeared per page. The format of each sentence frame and word pair in this booklet was as in the following example:-

in front of,   before

The plane flew ________________ *the mountain.*

The order of the 30 sentence frames in the experimental booklets was randomised using a random numbers table. All subjects at each year level were presented with this one experimental order. The only other randomisation procedure employed was with respect to the stimulus word pairs. At each year level, 10 subjects (5 males and 5 females) received the *unmarked* word stimuli in the order *in front of, before* and the *marked* stimuli in the order *after, behind*. For the remaining 10 subjects in each year group, the presentation order of word stimulus pairs was reversed, that is, the *unmarked* order was *before, in front of*, and the *marked* order *behind, after*.

9.1.3 Procedure

Subjects at all year levels, except Year 3, were seen by the experimenter in pairs in a quiet room set apart from the classrooms. Year 3 subjects were seen individually to counteract any effects their lack of confidence in an experimental situation might have. This slight modification of the procedure also enabled the experimenter to ensure that such young subjects understood the task fully.

All subjects were put at their ease before the experimenter handed them the experimental booklet on which they were required to write their age, grade and sex. They were then asked to read the instructions which appeared on the front page of the booklet as the experimenter read them aloud. These instructions were the same for each subject and were as follows:-

> *Your task is to read carefully each sentence on the following pages. There is a gap in each sentence and you have to decide which word (from the two appearing above this sentence) goes in this gap. Which word makes the sentence sound good or better? Circle the word at the top of each sentence which fits it best.*
>
> *Take your time in this task and give the answer which soundsbest to you. There are no right or wrong answers. You decide which word goes in the gap in each sentence and circle it.*

When the instructions had been read, the experimenter told the subjects to turn the page and work the 6 example sentences. The format of this page was the same as that of the experimental pages and appears in Appendix VI-C.

Upon completion of this page the subjects were instructed by the experimenter to now complete each experimental page at their own pace. Subjects were also told not to look back at a page once it had been completed.

The presentation format was the same for all subjects. However, whilst Year 4 to Year 7 subjects only received visual presentation of the experimental stimuli, Year 3 subjects received both visual and oral presentation. This difference was necessitated by the younger subjects' lack of familiarity with and confidence in this task situation. Older subjects were found to be capable of adequately handling the demands of the experiment.

Once the subjects had completed the task, the experimenter collected their booklets, checked that they had completed all sentences, and then thanked them for their participation.

9.2 RESULTS

The results of this experimental task will be considered in 3 sections to correspond with the nature of the linguistic contexts (spatial, temporal and spatial/temporal) employed. In all sections the overall performance of the subjects in each linguistic context as well as the statistical analyses performed on the data will be discussed. Furthermore, all data will be considered from the perspective of each individual year and also from that of the total group, where the data from all years are combined.

For the analysis in each linguistic context, the sentence frames employed will be labelled A, B, C, D and E to correspond with the 5 different sentence frames used for a particular context.

In addition, only in spatial/temporal contexts will both the number of spatial and temporal responses made by subjects be examined. For the other two linguistic contexts, spatial and temporal, only one category of response type, that is, spatial in the former and temporal in the latter, will be considered.

9.2.1 Spatial Contexts

There were 5 spatial sentence frames responded to twice, once with *unmarked* and once with *marked* word stimuli, by 20 subjects at each year level. Therefore, there were 200 possible spatial responses at each year level. It was found that subjects in each year group gave a number of spatial responses in spatial contexts which was well above chance level (100 or 50%). Table 9.2 lists the number of spatial responses given by subjects at each year level in all spatial sentence frames combined.

TABLE 9.2. Spatial Responses in Spatial Contexts for Each Year.

	Number	Percentage
Year 3	165	82.5
Year 4	181	90.5
Year 5	174	87
Year 6	184	92
Year 7	179	89.5

Table 9.2 indicates that the number of spatial responses made in spatial sentence contexts increased very little with age, being higher than 80% even for the youngest, Year 3 subjects. Indeed, as age increased variations in performance in these sentence contexts were quite small.

This conclusion was further supported when the spatial responses made in each spatial context at each year level were considered. These data appear in Table 9.3.

TABLE 9.3. Spatial Responses in Each Spatial Context for Each Year.

	A+	B	C	D	E
Year 3	34	31	35	31	34
Year 4	40	39	38	28	36
Year 5	36	36	32	32	38
Year 6	38	38	38	31	39
Year 7	37	37	34	32	39
$\bar{X}$	37	36.2	35.4	30.8	37.2

+Possible maximum in each cell = 40.

Again Table 9.3 illustrates that subjects in each year gave a large number of spatial responses in each spatial context and that this number evidenced only small age related changes. [Appendix VI-D(1) lists the raw data for each year group in terms of spatial responses to positive (*unmarked*) and negative (*marked*) word stimuli in each spatial context.]

Chi-square analyses were performed on the responses made by subjects at each year level in each spatial context when positive and negative word stimuli were used. Significant X^2 values were found for the data at Years 4, 5, 6 and 7. A significant result was also reported when the data for all Years were combined and subjected to a Chi-square analysis. Table 9.4 lists the significant X^2 values obtained in these analyses. [Appendix VI-E provides the full results of the Chi-square analyses.]

TABLE 9.4. Significant Results of Chi-Square Analyses Performed on the Spatial Contexts Data.

	X^2 Value
Year 4	40.07
Year 5	32.89
Year 6	32.88
Year 7	18.57
OVERALL	72.57

Crit X^2 = 16.92, d.f. = 9, α = 0.05

Table 9.4 indicates that the particular spatial sentence frame employed did affect the number of spatial responses given by subjects at all year levels except Year 3.

An Analysis of Variance (A.O.V.) was performed on the spatial context response data. However, as this analysis also considered response data from the temporal contexts, it will be dealt with after a discussion of the temporal context frequency data.

9.2.2 Temporal Contexts

As with the spatial contexts, there were 200 possible temporal responses which subjects at each level could make in temporal contexts. It was found that subjects in each year produced a number of temporal responses in temporal contexts which were well above the chance level of 50% (100). Furthermore, the percentage of temporal responses in such contexts given by subjects at each year level was close to 100%. This is indicated in Table 9.5 which lists the number of temporal responses given to all temporal sentence frames combined by subjects in each year group.

TABLE 9.5. Temporal Responses in Temporal Contexts for Each Year.

	Number	Percentage
Year 3	192	96
Year 4	197	98.5
Year 5	198	99
Year 6	198	99
Year 7	200	100

Table 9.5 illustrates that the percentage of temporal responses given in temporal contexts did not change very much with age, being maintained at a high level of over 95% in each year group.

Table 9.6 which lists the temporal responses given in each temporal context by the various year groups, further supports this conclusion. It can be seen from an examination of the data which appear in Table 9.6 that the majority of the responses given in each temporal context by subjects at any year level could be classified as temporal in nature.

TABLE 9.6. Temporal Responses in Each Temporal Context for Each Year.

	A+	B	C	D	E
Year 3	39	40	34	39	40
Year 4	40	40	38	40	39
Year 5	40	40	38	40	40
Year 6	40	40	39	40	39
Year 7	40	40	40	40	40
$\bar{X}$	39.8	40	37.8	39.8	39.6

+Possible maximum in each cell = 40

[Appendix VI-D(2) lists the raw data, in terms of temporal responses to positive and negative word stimuli in temporal contexts, for each year group.]

The responses made by subjects at each year level in each temporal context when positive and negative stimuli were employed were analysed using Chi-square analyses. These analyses revealed significant effects for Years 3 and 5. Furthermore, a significant effect was obtained when a Chi-square analysis was performed on the combined data for all year groups. The significant results of these Chi-square analyses appear in Table 9.7. [Full results of these analyses appear in Appendix VI-E.]

TABLE 9.7. Significant Results of Chi-square Analyses Performed on the Temporal Contexts Data.

	X^2 Value
Year 3	28.12
Year 5	18.18
OVERALL	45.01

Crit $X^2 = 16.92$, d.f. = 9, $\alpha = 0.05$

These results lead to the conclusion that the number of temporal responses given by subjects was affected by the particular temporal sentence context used, especially at Year 3 and Year 5 levels.

9.2.3 Analysis of Combined Spatial and Temporal Context Data

A four factor A.O.V. [Subjects x Sex x Conx (spatial or temporal) x Stim (positive or negative)] was performed on the response data for both spatial and temporal contexts for each year group. The significant results of these analyses appear in Table 9.8. [Appendix VI-F(1) gives the full results of each A.O.V. for the different year levels.]

TABLE 9.8. Significant Results of Four-way A.O.V. (Sub x Sex x Conx x Stim) Performed on the Spatial and Temporal Context Data for Each Year.

	SOURCE	D.F.	S.S.	M.S.	V.R.
Year 3	Sex	1,18	9.11	9.11	6.55
	Conx	1,18	9.11	9.11	9.36
	Sex x Conx	1,18	6.61	6.61	6.79
Year 4	Conx	1,18	3.20	3.20	9.93
Year 5	Conx	1,18	7.20	7.20	12.83
Year 6	Conx	1,18	2.45	2.45	9.59
Year 7	Stim	1,18	1.01	1.01	6.94
	Conx	1,18	5.51	5.51	8.84
	Stim x Conx	1,18	1.01	1.01	6.94

Significant at $\alpha = 0.05$, $F_{1,18} = 4.41$

As indicated in Table 9.8 there was a significant main effect for context at all year levels ($\alpha = 0.05$, $F_{1,18} = 4.41$). Only in Year 3 and Year 7 did any of the other variables achieve significance as a main effect. For Year 3 the sex variable was significant whilst for Year 7 the significant effect was attributed to the type of word stimuli, *unmarked*/positive or *marked*/negative, used (α = 0.05, F 1,18 = 4.41). However, in both year groups these significant effects were compounded by the effects of context as demonstrated by the significant interaction effects (Sex x Conx at Year 3 and Stim x Conx at Year 7) obtained. Therefore, it can be concluded that the type of sentence context employed, that is, spatial or temporal, influenced the nature of the responses given by subjects at all Year levels.

This conclusion was further supported when the data for all years were combined and subjected to a five factor A.O.V. (Grade x Subjects x Sex x Conx x Stim). The context (conx) variable again proved to be significant as a main effect (α = 0.05, F 1,90 = 3.94). Furthermore, two other significant effects were found in these data, a main effect for sex and an interaction effect of Sex x Conx (α = 0.05, F 1,90 = 3.94). Results of this A.O.V. appear in Table 9.9.

TABLE 9.9. Five-way A.O.V. (Gr x Sub x Sex x Conx x Stim) Results.

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,90	4.41	4.41	6.86*
Grade	4,90	4.96	1.24	1.93
Grade x Sex	4,90	6.21	1.55	2.42
Stim	1,90	0.49	0.49	2.39
Sex x Stim	1,90	0.36	0.36	1.76
Gr x Stim	4,90	1.53	0.38	1.87
Gr x Sex x Stim	4,90	0.16	0.04	0.20
Conx	1,90	26.01	26.01	47.53*
Sex x Conx	1,90	2.56	2.56	4.68*
Gr x Conx	4,90	1.46	0.37	0.67
Gr x Sex x Conx	4,90	4.71	1.18	2.15

*Significant value at α = 0.05, F 1,90 = 3.94, F 4,90 = 2.46.

9.2.4 Spatial/Temporal Contexts

There were 5 spatial/temporal sentence frames responded to twice by 20 subjects in each year group. Therefore, there was a total of 200 possible responses in spatial/temporal contexts for each year level. If the assumption is made that spatial and temporal responses should occur with equal probability in such contexts, then there should be 100 possible spatial responses and 100 possible temporal responses in spatial/temporal contexts for each year group.

In spatial/temporal contexts it was found that both spatial and temporal responses produced by subjects in each year group were above the chance level of 50% (50). However, it was noteworthy that at each year level the proportion of temporal responses given by subjects was at least twice that of their spatial responses in spatial/temporal contexts. These findings are evident in Table 9.10 which lists the number of spatial and temporal responses subjects at each year level gave in spatial/temporal contexts.

TABLE 9.10. Spatial Responses and Temporal Responses in Spatial/Temporal Contexts for Each Year.

	Spatial Responses		Temporal Responses	
	Number	Percentage	Number	Percentage
Year 3	68	34	132	66
Year 4	62	31	138	69
Year 5	52	26	148	74
Year 6	61	30.5	139	69.5
Year 7	63	31.5	137	68.5

Table 9.10 further illustrates that the proportion of spatial and temporal responses subjects gave in such contexts changed very little as a function of age. Indeed, both types of responses showed very minor variations with age.

This conclusion was further corroborated when the spatial and temporal responses produced in each spatial/temporal context by each year group were considered. These data appear in Table 9.11.

TABLE 9.11. Spatial and Temporal Responses in Each Spatial/Temporal Context for Each Year.

	A		B		C		D		E	
	Spat+	Temp	Spat	Temp	Spat	Temp	Spat	Temp	Spat	Temp
Year 3	12	28	12	28	16	24	19	21	9	31
Year 4	10	30	14	26	11	29	17	23	10	30
Year 5	6	34	15	25	7	33	16	24	8	32
Year 6	8	32	10	30	13	27	15	25	15	25
Year 7	10	30	15	25	13	27	18	22	7	33
$\overline{X}$	9.2	30.8	13.2	26.8	12	28	17	23	9.8	30.2

+Possible maximum in each cell = 20.

Appendix VI-D(3) lists the raw data for each spatial/temporal context with respect to positive and negative word stimuli for each year group.

Both Tables 9.10 and 9.11 illustrate that subjects in all year groups were generally more likely to give temporal than spatial responses to spatial/temporal sentence frames. This trend was evident in the combined spatial/temporal context data as well as in each individual spatial/temporal context.

Chi-square analyses were performed on the response data for each year group in spatial/temporal contexts. These analyses considered the subjects' responses in each spatial/temporal context when positive and negative word stimuli were employed. Only for Years 5 and 7 were significant X^2 values reported. However, when the data for all year groups were combined and subjected to a Chi-square analysis a significant result was again found. The significant results of these Chi-square analyses appear in Table 9.12. [Appendix VI-E lists the full results of each Chi-square analysis at each year level.]

TABLE 9.12. Significant Results of Chi-Square Analyses Performed on Spatial/Temporal Context Data.

	X^2 Value
Year 5	25.36
Year 7	17.25
OVERALL	38.54

Crit X^2 = 16.92, d.f. = 9, α = 0.05.

Therefore, it can be concluded that the number of temporal responses given by subjects varied as a function of the particular spatial/temporal context employed.

A three-factor A.O.V. [Subjects x Sex x Stimulus (positive or negative)] was performed on the response data for spatial/temporal contexts for each year group. Each of these analyses employed the variability index. This index was calculated for each type of stimulus word pair (positive or negative) in the 5 sentence contexts in which they occurred using the following formula:-

ABS (Number of Spatial Responses - 2.5)

This measure was employed for the present A.O.V. as it was the response variability which was of interest in spatial/temporal contexts. The significant results of each A.O.V. at each year level appear in Table 9.13. [Appendix VI-F(2) lists the full results of each A.O.V. for each year group.]

TABLE 9.13. Significant Results of Three-Way A.O.V. (Sub x Sex x Stim) on Variability Index Data for Each Year in Spatial/Temporal Contexts.

	SOURCE	D.F.	S.S.	M.S.	V.R.
Year 7	Sex	1,18	4.22	4.22	7.57
	Stim	1,18	3.02	3.02	5.21

$\alpha = 0.05$, $F_{1,18} = 4.41$

Table 9.13 indicates that only in the Year 7 data were any significant effects reported for the variability index. These were the significant main effects for sex and stimulus type (positive or negative) ($\alpha = 0.05$, $F_{1,18} = 4.41$). Therefore, at Year 7 the sex of the subject as well as the type of stimulus word pair, positive (*unmarked*) or negative (*marked*), employed, affected the value of the variability index.

Only one of these main effects, that of stimulus word type, was reported when a four factor A.O.V. (Grade x Sub x Sex x Stim) was performed on the response data in spatial/temporal contexts for all years combined. In this analysis the <u>variability index</u> was again used. Table 9.14 illustrates the results of this A.O.V.

TABLE 9.14. Four-way A.O.V. (Gr x Sub x Sex x Stim) Results.

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,90	0.50	0.50	0.76
Gr	4,90	0.28	0.07	0.11
Gr x Sex	4,90	5.80	1.45	2.21
Stim	1,90	4.50	4.50	6.75*
Sex x Stim	1,90	0.98	0.98	1.47
Gr x Stim	4,90	1.30	0.32	0.49
Gr x Sex x Stim	4,90	1.22	0.30	0.46

*Significant value at $\alpha = 0.05$, $F_{1,90} = 3.94$, $F_{4,90} = 2.46$.

The results illustrated in Table 9.14 further support the conclusion drawn from the Year 7 data that the type of stimulus word pair, positive (*unmarked*) or negative (*marked*), significantly influences the value of the <u>variability index</u>.

9.3 DISCUSSION

The data of the present experiment provide strong confirmation for only two of the hypotheses, those concerning the nature of the responses made in spatial and temporal sentential contexts, tested. In the spatial/temporal linguistic contexts the types of responses made by children at every year level failed to corroborate the predictions of the third hypothesis. Similarly no evidence was found in support of the *markedness* effect in any linguistic context for any year group.

In confirmation of the first hypothesis it was found that child subjects at all year levels gave a majority of spatial responses in spatial contexts. Furthermore, the predominance of spatial responses in such contexts changed very little with age, being at an already high level of 82.5% for Year 3 children. The strong corroboration of this first hypothesis is further evident in the spatial response data illustrated in Tables 9.2 and 9.3.

Nevertheless, there was one unexpected finding in the response data for spatial sentential contexts. It was assumed that each of the 5 separate spatial sentence contexts would be equally likely to evoke a spatial interpretation from children and so would yield roughly equivalent numbers of spatial responses. However, this expectation was not supported in the present experimental data when Chi-square analyses were performed on the subjects' responses in each spatial context. The results of these analyses revealed that only in Year 3, did children give about the same number of spatial responses in each spatial context. For Years 4 to 7 as well as for the combined group data, significant X^2 values were obtained, as indicated in Table 9.4. Upon closer examination of the response data for each year group in these spatial contexts, it was found that the effect could be attributed to subjects making fewer spatial responses in spatial context D, that is, the sentence frame *Tony ran______the trailer*. [Refer to Table 9.3 and Appendix VI-D(1)]. Furthermore, this effect was more noticeable when negative word stimuli, that is, *after, behind*, were used. In this sentence context, children frequently chose *after* as being the "best fit", and thus rendered its complete form as *Tony ran after the trailer.* Therefore, when negative or *marked* word stimuli were used, subjects assigned this sentence frame an interpretation of a person chasing an object. Consequently, this finding conforms to the results reported for the earlier sentence frames study which indicated that both normal and language-delayed child subjects comprehended the sentence *Paul is after John* as meaning one person was chasing another.

However, the spatial response data for Year 5 and Year 7 subjects also demonstrated that these subjects gave fewer spatial responses in spatial context C, that is, *The chair stood* __________ *the table*, when positive word stimuli (*in front of, before*) were employed. This result appears to be inexplicable since an alternate disparate semantic interpretation, such as that put forth for spatial context D, cannot be postulated. Therefore, the variation in the responses of the Year 5 and Year 7 subjects to this spatial context is seen to be the result of random fluctuation in the data for these age groups.

The second hypothesis with respect to the subjects' performance in temporal sentential contexts was also strongly supported in the present study. It was found that in such contexts more than 95% of the responses produced by subjects in any year group were temporal in nature, as is evident in Table 9.5. In addition, as with spatial sentence contexts, this result changed little with age and was relatively unaffected by the different temporal sentential contexts employed. (Refer to Table 9.6.)

Nevertheless, Chi-square analyses performed on the temporal response data for each Year level as well as the combined group data revealed some significant effects as illustrated in Table 9.7. Such effects were caused by subjects in Years 3 and 5 giving fewer temporal responses in temporal context C. *(Wendy packed the bag ____________ leaving the table.)* when positive word stimuli, that is, *before, in front of*, were used. [Refer to Appendix VI-D(2).] This effect was also replicated in the combined group data for all year levels. As there seems to be no diverse or ambivalent semantic interpretation which can be assigned to this sentence frame, the result appears to be uninterpretable and may perhaps be attributed to the operation of random noise in the response data for temporal contexts.

The findings reported for both spatial and temporal contexts in the present sentence frames task provide support for those researchers who postulate one sense of *spatio-temporal* terms as being dominant (Bennett, 1975; Hodun, 1975; Friedman & Seely, 1976; Richards & Hawpe, 1980). It was just those terms, that is, *in front of*, and *behind*, which these workers have stated are primarily spatial in meaning, which primary school age children chose as being the "best fit" in the spatial sentence frames. Similarly *before* and *after*, which are seen as having a dominant temporal sense, were more frequently selected as being the most appropriate response in temporal sentential contexts. Consequently, the present data confirm the dominant meaning view postulated by the linguist Bennett (1975), and reported in the research work of Hodun (1975), Friedman and Seely (1976) and Richards and Hawpe (1980) for both child and adult subjects.

An A.O.V. performed on the response data for both spatial and temporal contexts revealed that there was a significant main effect for context (conx) at each year level. In each year group, this effect could be attributed to subjects' achieving more correct responses in temporal than spatial sentential contexts. (For the purpose of this discussion, a correct response was defined as a spatial response in a spatial context and a temporal response in a temporal sentence frame.) Furthermore, this significant effect was also reported when the response data for all year groups in spatial and temporal linguistic contexts were combined and analysed using an A.O.V. The prominence of this contextual effect in the present data lends support to Navon's (1978) notion of the primacy of the temporal dimension over the spatial dimension in the human organism's conceptualisation of stimuli. Consequently, it is contrary to H. Clark's (1973) prediction that the spatial sense of *spatio-temporal* terms is initially dominant in children's semantic systems.

The results reported for the subjects' performance in spatial/temporal sentential contexts failed to confirm the third hypothesis. The nature of the responses given in these contexts did not change with age, with younger subjects (Year 3) giving mainly spatial responses as would be predicted by H. Clark (1973). In addition, older subjects' responses demonstrated no evidence of response variability, in terms of a mixture of spatial and temporal responses, in such spatial/temporal contexts. Subjects at all year levels gave predominantly temporal responses to these spatial/ temporal sentence frames. Indeed, they produced at least twice as many temporal as spatial responses when given such sentence frames. This result was evident at all year levels as is indicated in Table 9.10. Furthermore, it was found that subjects generally tended to give a larger proportion of temporal than spatial responses when the data for each separate spatial/temporal context were examined. (Refer to Table 9.11.)

Such a finding was not predicted as it was assumed that subjects from Year 4 onwards would make about the same number of spatial and temporal responses in spatial/temporal linguistic contexts. However, this result does corroborate the data reported in the earlier *M.D.S.* study which investigated children's and adults' conceptualisations of the *spatio-temporal* terms *in front, ahead, behind, before, after, first* and *last.* The *dimensional* solutions plotted for both the child and adult data in this experiment (Figures 5.1 and 5.2, p. 149) demonstrated that *in front* and *behind* were mainly distinguished on the spatial dimension whereas *before* and *after* seemed to be equally well perceived as possessing both a spatial and a temporal dimension. Hodun (1975) has also reported a similar result. Her adult subjects rated *ahead* (synonym of *in front*) and *behind* as being primarily spatial in meaning whilst *before* and *after* were seen as possessing a more neutral sense, as having both spatial and temporal aspects. Therefore, the present finding of the predominance of temporal responses, that is, *before* and *after*, in spatial/temporal sentential contexts conforms to the data of earlier studies which have demonstrated that this pair is more readily assigned a dual sense than the pair *in front of/behind*.

Chi-square analyses performed on the response data for each year group in spatial/temporal sentential contexts revealed significant X^2 values for the Year 5 and Year 6 data. In both year groups, these results were due to subjects giving fewer temporal, and therefore more spatial, responses in spatial/temporal contexts B (*Jane walked onto the stage____________Anne.*) and D (*The car went under the bridge____________ the taxi.*). This effect was also replicated in the Chi-square analyses of the combined group data for spatial/temporal contexts. It is difficult to explain such a result since it was assumed that each spatial/ temporal sentential context would be equally likely to evoke both spatial and temporal responses at each year level.

The fourth hypothesis with respect to the effects of *markedness* on the responses given received no confirmation in the present experimental data. This finding was reported for all year levels in the 3 different sentence contexts (spatial, temporal and spatial/temporal) employed. Furthermore, some of the analyses performed on the data revealed effects which went in the opposite direction to that predicted by E. Clark (1973c) for *unmarked/marked* antonym pairs. Negative (*marked*) word stimuli, that is, *behind, after,* were found to evoke more spatial responses in spatial contexts as well as to produce more response variability in spatial/ temporal contexts for Year 7 subjects. Similarly, when the combined group data for spatial/temporal contexts were examined it was again reported that the negative word pair caused subjects to demonstrate more response variability than the positive word pair (*in front of, before*). All of these results proved to be significant when the data were subjected to A.O.V. Consequently, it can be concluded that the present data fail to confirm E. Clark's (1973c) postulation of the acquisitional priority of *unmarked* terms. These findings also indicate that the fourth experimental hypothesis received no corroboration. Indeed, the present data evidence findings in direct contradiction to two of the predictions, that is, those for spatial and spatial/temporal contexts, of this hypothesis.

Finally, there were some sex differences reported in the present study when A.O.V. were performed on the group as well as individual year results. These analyses revealed significant sex effects for Year 3 subjects and the combined group data in spatial and temporal linguistic contexts. Furthermore, both of these significant results were compounded by the effects of sentence context which indicated that males gave more <u>correct responses</u> than females in spatial sentential contexts only. In temporal contexts, males and females differed very little with respect to the number of <u>correct responses</u> they produced. Only one other significant sex effect was reported when the response data were analysed by A.O.V. This effect was found in the analysis of the <u>variability index</u> data of Year 7 subjects in spatial/temporal sentential contexts, and revealed that males of this age demonstrated more <u>response variability</u>, that is, a mixture of spatial and temporal responses, than females in such contexts.

All of the above findings with respect to sex differences indicate that males performed better than females on certain aspects of this sentence frames task. As such, they are contrary to the results of research cited by Maccoby and Jacklin (1974) which reported no difference in the language abilities of males and females in the middle school years. Therefore, the significant sex differences found in the present experiment would not be predicted on the basis of previous research. Consequently, they are inexplicable and as such indicate an area in which future research might permit the determination of the strength of this anomalous result.

In conclusion, this experiment has demonstrated that linguistic or sentential context does affect the semantic interpretation which primary school age children assign to the *spatio-temporal* terms *in front of, behind, before* and *after*. In clearly spatial or temporal sentence frames, these children place the term whose dominant meaning corresponds to the contextual meaning of the sentence, e.g. *in front of* in a spatial context and *after* in a temporal context. However, when they are given an ambivalent sentence frame, whose semantic interpretation can be either spatial or temporal, they tend to give terms with a dominant temporal sense, that is, *before* and *after*, as responses. Therefore, it can be concluded that primary school age children more readily assign the temporally dominant pair *before/after* a spatial and a temporal sense than they do the pair *in front of/behind* which is seen as possessing a strong dominant spatial sense. Primary school age children appear to find it more difficult to comprehend the double meaning of this latter *spatio-temporal* pair. For these children, the dual meanings, that is, spatial and temporal, of the *spatio-temporal* pair *before/after* are more readily available as semantic interpretations when the appropriate contextual support, of a linguistic nature, is available.

CHAPTER 10.

CONCLUSIONS

The aim of this thesis was to look at the development of the semantic field of *spatio-temporal* terms in children of primary school age, that is, the middle and later years of childhood. In particular, emphasis was placed on the effects of sentential context on children's comprehension of such terms. For, as discussed by Menyuk (1977) and Olson and Nickerson (1978), linguistic context or sentence structure is an important factor in the semantic processing of children during the school years.

This study was conducted in the light of the many and varied research investigations which have looked at the child's comprehension of antonym pairs employing the theoretical model of the *Semantic Feature Hypothesis* (E. Clark, 1973c). Such research has provided only partial support for this theory, for many studies have reported results in direct contradiction to the predictions of the *Semantic Feature Hypothesis*. However, as the predictions postulated by this theory enable specific testable hypotheses to be studied, it was seen to be a viable research model to employ as a basis for the present experimental design. Nevertheless, because of the conflicting findings, *Prototype Theory* (Rosch, 1973; Nelson, 1974a; Palermo, 1978), which is offered as an alternative explanation of the child's semantic development, was viewed as being a further model with possible application to the results of the present study. Therefore, this research was conducted in view of the postulations of two theoretical models, *Semantic Feature Theory* and *Prototype Theory*, to enable the determination of which, if either, offered a better explanation of the development of the word-field of *spatio-temporal* terms in children of primary school age.

In addition to studying the primary school age child's comprehension of *spatio-temporal* terms, this thesis also looked at how both adults and children, who were characterised as being delayed in terms of language development, understood these terms. Adult subjects' performance was examined to generate comparative data for the child's developing comprehension. Such data would enable the determination of when, in their development, primary school age children appear to reach adult competence in their understanding of *spatio-temporal* terms. Similarly, children who were classified as *language-delayed* were required to complete one experimental task to see if they were delayed or different with respect to their linguistic ability with words from the *spatio-temporal* semantic field.

Therefore, the present research investigated the development of the *spatio-temporal* semantic field in a series of separate experiments which employed and tested various predictions of the *Semantic Feature Hypothesis* as expounded by E. Clark (1973c) and H. Clark (1973). It was necessary in these experiments to first establish that children of primary school age were not only aware of the relation of antonymy which existed between the word pairs in this field but also that such words could be characterised as having two (a spatial and a temporal) senses. Consequently, two studies were conducted to investigate these aspects of semantic awareness. The results of these experiments demonstrated that children at the lower limit, that is, Year 3, or 7:0 to 8:0 years, of the age range to be studied realised that word pairs comprising the *spatio-temporal* semantic field did exist in antonymous relationships and, further, that they possessed both a spatial and a temporal meaning. Therefore, it was seen to be necessary to examine the effects of linguisitic context or sentence structure on the comprehension of these dual meaning *spatio-temporal* words, in particular, the terms *in front of, ahead of, behind, before* and *after*. Linguistic context was studied in detail as Olson and Nickerson (1978) state that linguistic factors are important determinants of language comprehension during the school years for now children have learnt to confine interpretation to the information contained in the text. Therefore, it was assumed that linguistic context would affect primary school age children's comprehension of the dual meaning *spatio-temporal* terms, as a series of studies with younger children (Hodun, 1975; Friedman & Seely, 1976; Richards & Hawpe, 1980) have demonstrated that the sense of these terms is influenced by context of usage. Consequently, a series of four experiments examined the effects of sentence context on the comprehension of *spatio-temporal* words by normal and *delayed language* child subjects as well as adults. These experiments enabled the determination of the effects of specific linguistic contexts, that is, spatial, temporal and spatial/temporal, on the semantic processing of *spatio-temporal* terms. Furthermore, they demonstrated that awareness of these effects does change with development, and is also affected by a delay in the acquisition of linguistic skills or abilities.

10.1 RESEARCH FINDINGS

10.1.1 The Variables of Verbal I.Q. and Sex

Before considering how the results of the above experiments support, or fail to support, the predictions of *Semantic Feature Theory*, the theoretical model used as the basis for the present research methodology, it is necessary to discuss any differences in the response data which could be attributed to the variables of verbal I.Q. and sex.

None of the studies conducted in the present research revealed any differences which could be related to variation in subjects' verbal I.Q. as measured on the *P.P.V.T.* This lack of a performance difference as a function of verbal I.Q. was found in several tasks (an "Opposites" experiment and two Sentence Frames studies) and, therefore, its generality is underlined. However, it is important to note that verbal I.Q. was found to significantly affect the number of correct responses given by Year 7 subjects in the first Sentence Frames Study. Nevertheless, as this result was reported for such a small subset of the population studied, it was seen to be a reflection of random fluctuation in the data of this age group. Therefore, it can be concluded that children of primary school age demonstrated no reliable difference in their performance on a variety of tasks which assessed their comprehension of *spatio-temporal* terms as a function of variation in verbal I.Q. Moreover, this lack of difference can be seen to be a result of the large number of subjects clustered around the middle of the I.Q. (*P.P.V.T.*) range in each subject population tested. Variations in verbal I.Q. were not large enough in extent for performance differences to be expected.

The series of studies undertaken in this thesis also indicated little variation in performance which could be attributed to the sex of the subject. Males and females achieved a similar number of correct responses in both the "Opposites" study as well as the two Sentence Frames tasks. Furthermore, there was relatively little difference in the dimensional solutions of male and female child subjects in the *M.D.S.* study when subjects were asked to rate *spatio-temporal* terms with respect to their similarity in meaning. The few sex differences which were apparent in the analysis of the data were only evident for a few year levels in each of the Sentence Frames studies. In the first Sentence Frames task, female subjects performed better than male subjects at Year 3 level, whilst in Year 6 the reverse was true. Similarly, in the second Sentence Frames task, male subjects at Year 3 were found to give more correct responses in spatial contexts and also to demonstrate more response variability, that is, a mixture of spatial and temporal responses, at Year 7 level. However, since in both of these tasks, the sex differences in performance were reported in only a small number of subjects and only on certain aspects of the tasks, it was concluded that they were a result of random noise in the data of the year levels in which they occurred.

Consequently, the results of the experiments of this research thesis indicate that there were no reliable differences in the linguistic abilities which male and female children of primary schoolage demonstrated with terms from the *spatio-temporal* semantic field. As such, the present results corroborate the research findings cited by Maccoby and Jacklin (1974) which show that sex differences are not evident in children's performance on a variety of linguistic tasks during the middle years of childhood.

Similar results were also reported in the data of adult and *language-delayed* child subjects. Both groups of subjects failed to evidence any significant sex differences in their performance on the sentence pairs of the first Sentence Frames study. Indeed, male and female adult subjects achieved identical numbers of correct responses in this study. Furthermore, as for the child data, the dimensional solutions for the 7 *spatio-temporal* terms *in front, ahead, behind, before, after, first* and *last* obtained from the male and female adults' judgments of meaning similarity were found to differ very little. Therefore, it can be stated, in conclusion, that no sex differences were evident in the performance of any subject population with respect to comprehension of *spatio-temporal* terms.

10.1.2 Corroboration of the *Semantic Feature Theory*

There were two major predictions of *Semantic Feature Theory* as expounded by E. Clark (1973c) and H. Clark (1973) which were examined in the present research. The first of these is concerned with the effect of *markedness* on the acquisition of members of antonym pairs. E. Clark (1973c) predicts that in any antonym pair the *unmarked* member will be acquired before its *marked* opposite. Therefore, it was predicted that the *unmarked* or positive (*in front of, ahead of, before*) *spatio-temporal* terms would be learnt before their *marked* or negative counterparts (*behind, after*). The second prediction tested, was more specific since it relates to a particular domain of antonym pairs, that is, *spatio-temporal* terms. H. Clark (1973) postulates that the spatial sense is developmentally prior to the temporal sense of terms which possess both a spatial and a temporal meaning. Further, he bases this prediction on the notion that the temporal terms of English have a specific spatial basis, the *front/back* axis of the human perceptual apparatus. Consequently, the present experimentation examined whether these predictions were valid when the primary school age child's comprehension of *spatio-temporal* pairs was assessed in a variety of tasks.

10.1.3 (a) *Markedness*

The results of this research indicated that there were no differences between subjects' performance with the *unmarked* and *marked* members of the *spatio-temporal* antonym pairs studied. This result was reported for all of the experiments which were conducted. Indeed, any variations in subjects' performance with *unmarked* and *marked* terms which were found in this data were demonstrated on only minor aspects of the experimental tasks. Furthermore, those differences which were reported failed to support E. Clark's (1973c) prediction of the priority of the *unmarked* member of antonym pairs.

The first experiment conducted demonstrated that 7:0 year old children evidenced no differential error rate to the *unmarked* and *marked* members of the 10 *spatio-temporal* antonym pairs (refer to Table 4.2, p. 117) studied. Indeed, these subjects were just as likely to give the correct opposite in response to a *marked* as to an *unmarked* term. Moreover, the A.O.V. performed on these data indicated that the *markedness* of the term did not achieve significance as a main effect. Such a result is contrary to E. Clark's (1973c) prediction. But it does corroborate the research results of E. Clark (1972) and Heidenheimer (1975) who both found no significant differences in the number of opposite responses given to *unmarked* and *marked* terms in an antonym elicitation task.

The two Sentence Frames studies undertaken in this research further emphasised the lack of a *markedness* effect in the comprehension of *spatio-temporal* terms by children in the primary school age group. In the first of these studies, the data indicated that all subjects from Year 3 to Year 7 gave a similar number of correct responses to *unmarked* and *marked* terms. Furthermore, this result was reflected in the lack of significance reported for the mark (*markedness*) variable under a 3 factor A.O.V. Indeed, the only significant effect found for the *markedness* variable in these data was reported for Year 3 subjects. Such subjects gave more correct responses to *unmarked* terms in congruent contexts (where dominant lexical meaning and linguistic context agree) only. This result can be seen to be caused by contextual factors, which aided the interpretation of the *unmarked* but not the *marked* term. However, this *markedness* effect is limited in extent, for without contextual support no *unmarked-marked* difference was reported.

A similar lack of support for the *markedness* prediction was also found in the response data for the *language-delayed* children. Again, it was reported that the percentage of correct responses to *unmarked* and *marked spatio-temporal* terms differed very little. A finding which was further corroborated by the non-significance of the mark (*markedness*) variable in the A.O.V. performed on these data.

The results of the second Sentence Frames study also failed to confirm the *markedness* prediction, as no difference was found in favour of the *unmarked* members of the *spatio-temporal* pairs studied at any year level. Indeed, when the data were analysed by A.O.V., some of the significant effects obtained, revealed that subjects performed at a superior level on *marked* than *unmarked* terms. Such a result was reported for the Year 7 data in spatial and spatial/temporal contexts, as well as for the combined group data in spatial/temporal contexts. Therefore, the results of this experiment demonstrated that subjects performed better on the *marked* than *unmarked* members of *spatio-temporal* pairs in certain linguistic contexts.

In conclusion, the results of this research question the applicability of E. Clark's (1973c) *markedness* prediction to the word-field of *spatio-temporal* terms. The findings from all of the experiments have failed to indicate that primary school age children evidence a superior performance level on the *unmarked* member of *spatio-temporal* antonym pairs. Although such a result is contrary to that predicted by E. Clark (1973c), it may be a reflection of the older age of the present subjects. These subjects were outside of the age range (3:0 to 6:0 years) in which E. Clark initially formulated and tested this hypothesis. Therefore, it is perhaps not surpring that the data from these primary school age children fail to confirm the *markedness* prediction. The present contradictory data may also be an indication of the subjects' familiarity with the terms studied. Such a familiarity, according to Shaffer and Ehri (1980), means that there will be no evidence of a performance difference as a result of the term's *markedness*. For, when the:

> "....comprehension of relational statements containing familiar adjectives [is] examined.... polarity may have little bearing on performance." (Shaffer & Ehri, 1980, p. 202)

Consequently, the lack of support for the *markedness* prediction may have been caused by the children's experience with the *spatio-temporal* terms studied. Such an explanation seems fairly viable because children of primary school age have been exposed to language in a wide variety of situations. Thus, they have heard such simple *spatio-temporal* terms as *in front of, ahead of, behind, before, after, first* and *last* used on many occasions in a large number of non-linguistic and linguistic contexts.

This lack of a reported difference between the primary school age child's comprehension of the *unmarked* and *marked* members of *spatio-temporal* pairs in a variety of linguistic tasks is in line with the results of Friedman and Seely's (1976) research. These workers found that their 3:0 to 5:0 year old subjects responded equally well to *unmarked (before, first, ahead of)* and *marked (after, last, behind)* terms in both spatial and temporal contexts. Furthermore, this finding corroborates that reported by a variety of workers for comparative terms, e.g. *more, less* (Griffiths et al., 1967; Harasym et al., 1971; Schwam, 1980), *dimensional* adjectives (Illebrun, 1974; Bartlett, 1974, 1976; Eilers et al., 1974; Coots, 1976; Dunckley, 1976; Layton & Stick, 1979), spatial/relational terms, e.g. *in front, behind* (Harris & Strommen, 1972; Sinha & Walkerdine, 1974; Kuczaj & Maratsos, 1975), and temporal terms, e.g. *before, after* (Amidon & Carey, 1972; Collins, 1974; Coker, 1975, 1978; French & Brown, 1977; Kavanaugh, 1979; Harner, 1980; Townsend & Ravelo, 1980).

10.1.2 (b) Is the spatial sense of *spatio-temporal* terms primary?

The second prediction of *Semantic Feature Theory* specifically related to the word field of *spatio-temporal* terms, also failed to receive confirmation in the present study. It was found that the spatial sense of *spatio-temporal* terms was not prior in acquisition as is predicted by H. Clark (1973). Indeed, it was generally reported in all of the different experimental tasks of the present research that subjects' performance on spatial (e.g. *in front of, ahead of, behind*) and temporal (e.g. *before, after*) dominant terms tended to differ very little. Furthermore, some of the differences which were found went in the direction opposite, that is, temporal before spatial meaning, to that predicted by H. Clark (1973).

The results of the "Opposites" study demonstrated that subjects made more errors on the terms *in front/ahead/behind* than on the pairs *before/after*, *first/last*, and *early/late*. This result was unexpected, since H. Clark (1973) states that the former terms are the spatial basis for the latter 3 temporal pairs and so should be first developmentally. Moreover, this result also contradicts the predicted acquisition order postulated by E. Clark (1972) as illustrated in Table 4.1 (p. 112). However, these results do support Navon (1978) who states that the temporal dimension is primary in the human's conceptualisation of stimuli.

Such a result was replicated in the second Sentence Frames study, which indicated that subjects at all Year levels gave more correct responses in temporal than spatial linguistic contexts. (In this study a correct response was defined as a term whose dominant meaning agreed with the sentential context, e.g. *in front of* in a spatial context.) Therefore, these data again demonstrate that the temporal sense of *spatio-temporal* terms appears to be primary in the comprehension abilities displayed by 7:0 to 12:0 year old children.

Further research findings from the first Sentence Frames study indicated that for normal and *language-delayed* children as well as adults, there were no differences in their understanding of spatial dominant (*in front of, ahead of, behind*) and temporal dominant (*before, after*) terms. In all subject populations, the number of correct responses to each of these types of terms was generally found not to differ significantly when A.O.V. were performed on the response data. However, at two Year levels, Years 3 and 6, subjects did give more correct responses to spatially than temporally dominant terms as would be predicted by H. Clark (1973). Nevertheless, these differences were attributed to random noise in the data of these subject groups since they were not found in the results of the other year (4, 5 and 7) levels tested, nor in the A.O.V. done on the combined group data.

This lack of variation in performance on spatial and temporal dominant terms was also reported for adult and language-delayed subjects. The result for the former group was expected since adults are held to have firmly established categories of time and space in their semantic systems. Although, the finding for the language-delayed subjects was not predicted, it does corroborate the data reported for linguistically normal children. Thus, it further emphasises the lack of difference between primary school age children's comprehension of spatial dominant and temporal dominant *spatio-temporal* terms.

Consequently, it can be concluded that neither of the theoretical predictions of the *Semantic Feature Theory* examined in the present research were confirmed. Children of primary school age failed to show superior performance on either *unmarked* or spatially dominant *spatio-temporal* terms when their comprehension of such pairs was assessed in a variety of task situations.

10.1.3 Children's Conceptions of *Spatio-Temporal* Terms

The research experiments conducted in this thesis also allowed a determination of how children of primary school age perceived the *spatio-temporal* terms *in front of, ahead of, behind, before, after, first* and *last*. It is held by many researchers that although these terms possess a dual spatial and temporal sense, one of these meanings is dominant for a particular term. For the terms *in front of, ahead of* and *behind* the spatial sense is assumed to be dominant, whilst for *before* and *after* the temporal sense is seen as being dominant. This conception has been advocated by the linguist Bennett (1975) as illustrated in Table 5.2 (p. 135). Moreover, it has been experimentally verified in the research of Hodun (1975), Friedman and Seely (1976) and Richards and Hawpe (1980) who have investigated both children's and adults' comprehension of *spatio-temporal* terms. Friedman and Seely (1976) have further designated the terms *first* and *last* as possessing a dominant temporal sense. Consequently, it can be concluded that for the terms *in front of, ahead of* and *behind* the spatial meaning is held to be dominant, whilst the temporal sense of *before, after, first* and *last* is seen as being more evident.

The results of the *M.D.S.* study carried out with child and adult subjects provided only some confirmation for the dominant meaning view for it was found that in the dimensional solutions for both child and adults subjects (Figures 5.1 and 5.2, p. 149) the terms *in front, ahead* and *behind* were more clearly distinguished on the spatial dimension. However, the results for the terms *before, after, first* and *last* were less clear cut. Both children and adults seemed to distinguish *before* and *after* equally well on both spatial and temporal dimensions. Furthermore, *first* and *last* were distinguished on only the spatial dimension by children but on both dimensions by adults. Therefore, the results of the *M.D.S.* study can be seen as providing partial support for the dominant sense perspective. Although, *in front*, *ahead* and *behind* were perceived as possessing a dominant spatial sense for all subjects, the other terms studied were either seen as possessing two senses by both groups (*before* and *after*), or a dominant sense in direct contradiction to that predicted for child subjects (*first* and *last*).

The results of the two Sentence Frames studies also provide some corroboration of the dominant meaning view. In the first of these studies both normal and *language-delayed* children as well as adults were found to perform worse on incongruent sentence pairs, where the sentential context and dominant lexical meaning of the *spatio-temporal* term conflicted. Such results are seen as supporting the viewpoint which assigns *before* and *after* a dominant temporal sense whilst *in front of*, *ahead of* and *behind* are seen as having a primary spatial sense, since it was in just those contexts where linguistic support was not available for the dominant interpretation of a term that subjects had most comprehension difficulties.

The second Sentence Frames study also demonstrated that primary school age children perceived one of the senses of the dual meaning *spatio-temporal* terms *in front of*, *behind*, *before* and *after* as being dominant. Such children more frequently gave *in front of* and *behind* as responses in spatial contexts, and *before* and *after* as the appropriate responses in temporal contexts, when asked to select which of two terms, e.g. *behind, after*, was the "best fit" in a particular sentence frame. However, when the same children were asked to choose the appropriate term for a spatial/temporal sentential context, they more often chose a temporally dominant term, e.g. *before*, than a spatially dominant term, e.g. *behind*. Consequently, whilst the results of this Sentence Frames study do indicate that the spatial sense is dominant for *in front of* and *behind*, and the temporal sense for *before* and *after*, they also demonstrate that for these latter terms a spatial sense is also readily perceived. As such these data confirm the results reported in the *M.D.S.* study which also provided evidence that children as well as adults seem to perceive the spatial and temporal senses of *before* and *after* with equal facility.

Therefore, the results of the present research corroborate the view that the terms *in front of, ahead of* and *behind*, have a dominant spatial sense (Bennett, 1975; Hodun, 1975; Friedman & Seely, 1976; Richards & Hawpe, 1980). However, they fail to confirm the dominant meaning view for the words *before* and *after*. These terms were not found to have only a strong dominant temporal sense as proposed by Friedman and Seely (1976) and Richards and Hawpe (1980). Indeed, in support of Hodun (1975), the spatial and temporal meanings of these terms were found to be equally well comprehended by child and adult subjects.

10.1.4 The Effects of Sentential Context

The effects of sentential or linguistic context on children's comprehension of *spatio-temporal* terms was also examined in this research. It was necessary to look at the effects of linguistic context since both Menyuk (1977) and Olson and Nickerson (1978) have stated that in the middle and later years of childhood, children become aware of how sentence structure affects their comprehension processes. Consequenlty, they now come to realise that the semantic constraints operating within a sentence can affect the interpretation they assign to a lexical item. Furthermore, the results of several research studies with children have indicated that there is a developmental change in the ability to utilise information contained within a linguistic context (Vanevery & Rosenberg, 1970; James & Miller, 1973; Shultz & Pilon, 1973; Klein et al., 1974; Muma & Zwycewicz-Emory, 1979).

The Sentence Frames studies conducted in this thesis both demonstrated that linguistic context does exert a strong influence on primary school age children's comprehension of the *spatio-temporal* terms *in front of, ahead of, behind, before* and *after*. In the First Sentence Frames Study, children from Years 3 to 7 were found to make more errors on incongruent sentence pairs, where the sentence context and dominant lexical meaning of the adverb conflicted, than on congruent pairs, where context and lexical meaning conflicted. (Refer to Table 6.2, p. 180 and Table 6.3, p. 181.) Moreover, this effect proved to be highly significant when the response data for each year level were subjected to A.O.V. The powerful influence of sentence context was further emphasised by the types of errors these subjects made on incongruent sentence pairs. It was found that child subjects made more *semantically appropriate* errors, that is, terms which were synonyms of the correct opposite of the term appearing in the first sentence of the pair, than any other type of errors on such pairs. (Refer to Table 6.8, p. 188, and Table 6.9, p. 189.) Such errors were *predicted* on the basis of the effects of context allowing the "minor" or non-dominant meaning to come to the fore. Therefore, again the influence of sentential context on the semantic processing of *spatio-temporal* terms was demonstrated.

The nature of the responses made by child subjects in the second Sentence Frames study further supported the strong effects of context on the primary school age child's interpretation of *spatio-temporal* terms. The results of this study indicated that children most frequently gave the term whose dominant meaning was supported by the sentence structure, e.g. *after* in temporal contexts, as the appropriate response in both spatial and temporal linguistic contexts. Furthermore, in spatial/temporal contexts they more often gave as responses those terms, that is, *before* and *after*, which had been found to be more readily perceived in both a spatial and a temporal sense by child and adult subjects in the *M.D.S.* study.

Therefore, the results of these studies demonstrate that sentence context does affect the semantic interpretation which children of primary school age assign to dual meaning *spatio-temporal* terms. This conclusion is further corroborated in the data for adult and *language-delayed* child subjects. For, the results of both of these studies evidenced a similar strong contextual effect as indicated by a superior performance on congruent as opposed to incongruent sentence pairs. (Refer to Table 7.1, p. 213, and Table 8.3, p. 239.) This result again proved to be significant when the response data for both subject populations were subjected to A.O.V. Furthermore, as for the Year 3 to 7 child data, the adult subjects were found to make mainly *semantically appropriate* errors on incongruent sentence pairs, thus underlining how their awareness of contextual features affects and determines their interpretation of *spatio-temporal* terms.

An examination of the response data in the first Sentence Frames study indicated that performance on this task did improve from Year 3 to Year 7. This was evidenced both in terms of the number of correct responses made on congruent and incongruent sentence pairs as well as the changing nature of errors made by subjects on these latter sentence pairs. For, child subjects tended to make more errors which could be classified as *semantically appropriate* on incongruent sentence pairs as age increased. Furthermore, the greatest changes in both of these measures occurred between Years 3 and 4, with only slight improvements occurring in performance thereafter. Therefore, by Year 4 it can be concluded that a plateau has been reached with respect to subjects' performance in this Sentence Frames task.

A comparison of the data of adult and *language-delayed* subjects with that of normal children for this Sentence Frames task further indicated that not only was adult-like competence on this task achieved during the primary school years, but also that this competence was affected by a delay in language development. The response data for adult subjects conformed very closely to that reported for Year 4 child subjects on a number of measures, e.g. number of correct responses and number of *predicted* errors, thus demonstrating that children acquire adult-like ability with this task in Year 4. However, the data for *language-delayed* child subjects, demonstrated that their ability to utilise contextual information was not merely delayed, as expected, but different. Such a result was evident in the types of errors they made on incongruent sentence pairs, where they made a large number of *non-predicted* errors.

Consequently, it can be concluded that children are aware of the manner in which sentence context affects their interpretation of *spatio-temporal* terms, allowing them to perceive both meanings. Moreover, this awareness has been shown to change with age, demonstrating an increasing facility with the information contained within the structure of a sentence as postulated by Menyuk (1977) and Olson and Nickerson (1978).

10.2 APPLICATION OF THE THEORETICAL MODELS TO THE PRESENT RESEARCH RESULTS

The above discussion has indicated that the theoretical predictions of the *Semantic Feature Theory* (E. Clark, 1973c; H. Clark, 1973) are not applicable to the present research findings. Therefore, it is necessary to postulate an alternative model which may account for the primary school age child's comprehension of *spatio-temporal* terms.

The alternative postulation which is offered as a theoretical model to explain primary school age children's understanding of *spatio-temporal* terms envisages a possible amalgamation of *Semantic Feature* and *Prototype Theories* as espoused by Bowerman (1978b). In this model the dominant meaning of the *spatio-temporal* term is held to exist in the strong central core of the prototypic concept whilst the "minor" or secondary meaning exists within the vague peripheral boundaries. However, the composition of these prototypes is held to be featural as proposed by *Semantic Feature* theorists such as E. Clark (1973c). It is this featural composition which allows the child to realise that the term can be used in a wide variety of contexts. These features indicate what are the appropriate contexts of usage for a particular word. Moreover, for a specific *spatio-temporal* term the featural composition of its dominant meaning is more fully articulated and organised in a strong central core, whilst the features associated with its "minor" meaning are more widely spread in the vague peripheral boundaries of the prototypical concept.

This model can be used to explain why children more readily assign a particular meaning to a *spatio-temporal* term. It is this meaning which exists in the strong central core and, therefore, is more readily available as a semantic interpretation. Consequently, when applied to the terms *in front of, ahead of, behind, before* and *after*, this model predicts that the dominant sense of these dual meaning *spatio-temporal* terms will be the one which exists in the central core of the prototypic concept for a specific word. Therefore, children should assign a spatial sense to *in front of, ahead of* and *behind*, whereas their semantic interpretation of *before* and *after* will be temporal. These are the respective dominant senses of such terms (Bennett, 1975; Friedman & Seely, 1976; Richards and Hawpe, 1980) and as such will be of primary importance and prominence in the children's prototypic conceptions of these *spatio-temporal* terms.

Furthermore, it is possible to apply this model to the effects of sentence context on the comprehension of these dual meaning terms to understand, to some extent, why such effects occur. When the context supports the dominant meaning of the *spatio-temporal* term, children have little difficulty with a comprehension task and so make few errors. In such situations, the linguistic context agrees with that meaning of the *spatio-temporal* term which exists in the core of the prototype, and thus reinforces the strong dominant interpretation assigned to a particular term. However, when such contextual support is lacking, children experience confusion and make more errors. Nevertheless, the linguistic context in this latter case does enable them to process the featural information which exists in the periphery of the *spatio-temporal* term's prototype. In this situation, the context directs the children's attention to the information which exists in the boundary regions of the prototype and so enables them to comprehend the second or "minor" sense of the dual meaning *spatio-temporal* term.

10.3 FUTURE RESEARCH

The above is an hypothesized model which is postulated as being an alternative to *Semantic Feature* and *Prototype Theories* as an explanation of how primary school age children comprehend *spatio-temporal* terms. However, it is important to note that it is formulated with respect to this very limited semantic field. Further, it needs to be tested more definitively to allow empirical validation.

The form such research might take is to present child subjects with a list of *spatio-temporal* terms and get them to rate each term on a scale for the extent to which it fits their idea or image of the categories of Space and Time. Such research would employ the methodology used by Rosch (1973, 1975). This author found the rating scale to be a useful technique in isolating which members of several categories, e.g. *fruit, birds, sports,* subjects perceived as existing in the strong central core of the prototypic concept for that category. Thus, the data gathered from this experiment would enable the determination of which terms existed in the central cores of the spatial and temporal prototypes. Furthermore, it would indicate the extent to which each *spatio-temporal* term was seen as possessing both a spatial and a temporal sense, that is, the strength of these senses which is associated with a particular *spatio-temporal* term.

The present thesis has also pointed to the need for further research on the effects of linguistic context on the comprehension of lexical items. In particular, as children become aware, during the primary school years, of how the information contained in a written text affects their interpretation of a word, it is important to look at words which have a dual meaning. It is just these terms whose comprehension is aided by linguistic context. The contextual constraints of the sentence enable the child to establish which meaning a term should be assigned in a particular linguistic presentation. Therefore, it is important to investigate in more detail how lexical meaning is determined by linguistic context, and, furthermore, whether this ability to perceive the effects of context and use them as an aid in semantic processing is subject to age-related changes. In particular, are children capable of recognising and handling lexical ambiguity with more skill as they become more aware of linguistic structure and its effect on meaning during the primary school years? Such research should also investigate the effects of sex on this ability, since some sex differences were reported in the present research on children's understanding of *spatio-temporal* terms in sentential contexts.

10.4 CONCLUSION

In conclusion, this thesis has demonstrated that children of primary school age are aware of how linguistic context, in particular, sentential structure, affects the interpretation of dual meaning *spatio-temporal* terms. Futhermore, this awareness or ability has been shown to change with age. However, an explanation of this process is still very much a postulated solution which needs to be tested. Indeed, even this hypothesized model may prove to be lacking in certain areas as semantic development is a complex process which occurs throughout a lifetime. As such there seems to be no one model which can explain all aspects of this development. A fact which is most clearly acknowledged by Dale (1976):

> "There is no single framework that covers
> all children, all word meanings, and all
> patterns of development."
> (Dale, 1976, p. 189)

APPENDICES

APPENDICES (continued)

APPENDICES (continued)

APPENDIX I-A. Mean *P.P.V.T.* (form a) scores for subjects in Opposites Study.

	C.A (Years & months)	Raw Score	I.Q.	Percentile	M.A.
Males	7:8	72.1	112.8	71.1	9:3
Females	7:8	66.1	102.7	56.5	8:1

APPENDIX I-B. Response Data for Subjects in Opposites Study.

S.No.	Experimental Order	Sex	*Adult Correct*	*Semantically Appropriate*	*Other Error*
1-15	A	F	237	33	15
31-45	A	M	221	41	23
16-30	B	F	222	51	12
46-60	B	M	244	31	10

APPENDIX II-A. Mean *P.P.V.T.* (form a) scores for subjects in *M.D.S.* Study.*

	C.A. (Years & Months)	Raw Score	I.Q.	Percentile	M.A.
Males	8:7	76.2	112.8	76.1	10:0
Females	8:6	73.9	109.5	66.2	9:8

* These data were collected at a later date due to the unavailability of subjects for testing at the time of initial experimentation.

APPENDIX II-B(1). Experimental Sheets for Rating Task. (Adult and Child Subjects.)

P.1. **IN FRONT.**

Ahead	___	: ___	: ___	: ___	: ___
First	___	: ___	: ___	: ___	: ___
Last	___	: ___	: ___	: ___	: ___
Before	___	: ___	: ___	: ___	: ___
Behind	___	: ___	: ___	: ___	: ___
After	___	: ___	: ___	: ___	: ___

P.2. **AHEAD.**

First	___	: ___	: ___	: ___	: ___
Behind	___	: ___	: ___	: ___	: ___
In front	___	: ___	: ___	: ___	: ___
Before	___	: ___	: ___	: ___	: ___
Last	___	: ___	: ___	: ___	: ___
After	___	: ___	: ___	: ___	: ___

P.3. **BEHIND.**

After	___	: ___	: ___	: ___	: ___
Before	___	: ___	: ___	: ___	: ___
Last	___	: ___	: ___	: ___	: ___
First	___	: ___	: ___	: ___	: ___
In front	___	: ___	: ___	: ___	: ___
Ahead	___	: ___	: ___	: ___	: ___

APPENDIX II-B(1) cont.

P.4. BEFORE.

Last	:	:	:	:	
In front	:	:	:	:	
Ahead	:	:	:	:	
Behind	:	:	:	:	
After	:	:	:	:	
First	:	:	:	:	

P.5. AFTER.

Ahead	:	:	:	:	
In front	:	:	:	:	
Behind	:	:	:	:	
First	:	:	:	:	
Last	:	:	:	:	
Before	:	:	:	:	

P.6. FIRST.

After	:	:	:	:	
Last	:	:	:	:	
Behind	:	:	:	:	
Ahead	:	:	:	:	
In front	:	:	:	:	
Before	:	:	:	:	

APPENDIX II-B(1) cont.

P.7.			LAST.		
First	______ :	______ :	______ :	______ :	______
After	______ :	______ :	______ :	______ :	______
In front	______ :	______ :	______ :	______ :	______
Behind	______ :	______ :	______ :	______ :	______
Before	______ :	______ :	______ :	______ :	______
Ahead	______ :	______ :	______ :	______ :	______

APPENDIX II-B(2). Instructions and Examples given to Child Subjects in the Rating Task.

"This is a rating task in which you have to say how alike two words are in meaning. There is no right or wrong answer. You merely have to say how alike in meaning the two words are for you."

"To do this task you have to put a cross in one of the spaces of a five point scale. The scale looks like this:-"
(Now the children were shown the first page of the booklet and E pointed to each space as it was described.)

x very alike				
	x alike			
		x almost alike		
			x a little bit alike	
				x not at all alike

"If you put a cross in the first space the two words are very alike in meaning. If you put a cross in the second space the words are alike in meaning. Not as much as in the first space (E points) but still quite a lot alike in meaning. If you put a cross in the third space then the two words are almost alike in meaning. This is the middle or mid point of the scale. If you put a cross in the fourth space the two words are a little bit alike in meaning. And if you put a cross in the last space the two words are not at all alike in meaning."

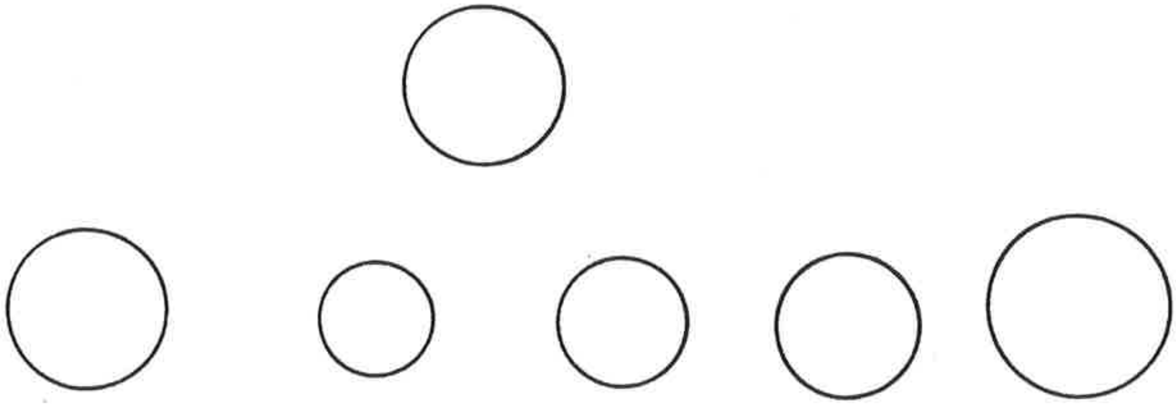
"Now remember each space represents how much alike the two words are in meaning, ranging from very alike at one end (E points) to not at all alike at the other end (E points). As you move from left to right the two words become less and less alike in meaning."

"Before going on to look at the word lists let us do a few examples. Each of these examples will involve 6 objects. One object will be standard and your task is to tell me how alike each of the other 5 objects is to this standard. When you have done this I want you to place a cross in the space on the scale where each of the 5 objects should go, based on how alike it is to the standard."

The children then completed the examples on the second page of the booklet and E answered any questions.

Examples

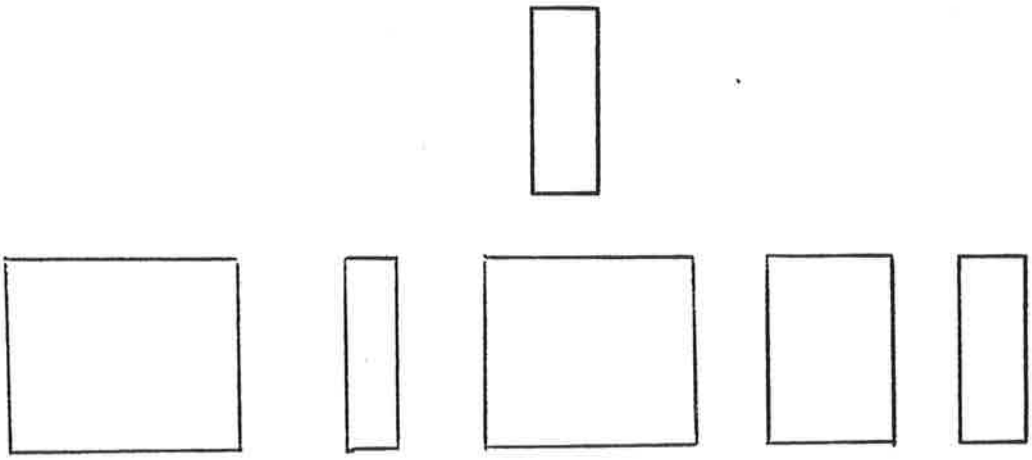
1. Circles



_____ : _____ : _____ : _____ : _____

very alike — not at all alike

2. Planks



_____ : _____ : _____ : _____ : _____

very alike — not at all alike

3. Sticks

_____ : _____ : _____ : _____ : _____

very alike — not at all alike

"Now let us start on the lists of words. Your task is to pair the word at the top of each page with each of the words in the list on the left hand side of the page. You then have to decide how alike in meaning the two words are and put a cross in one of the spaces on the scale opposite which appears to be right to you. Once you have finished one page, go on to the next until you have completed all pages."

APPENDIX II-B(3). Instructions and Examples given to Adult Subjects in Rating Task.

INSTRUCTIONS

P.1

This is a rating task in which you have to indicate how alike two words are in meaning. There is no right or wrong answer. It is simply a matter of what the words mean to you - how alike in meaning the two words are for you.

To do this task you have to put a cross in one of the spaces on a five point scale. Each of the spaces on this scale represents how much alike in meaning the two words are. This scale ranges from very alike (1) at one end of the scale to not at all alike (5) at the other end. As you move from left to right on this scale the two words become less and less alike in meaning. The scale is illustrared over the page with what the various spaces represent inidcated.

P.2

If you put a cross in the first space, as indicated, the two words are very alike in meaning.

A cross in the second space indicates the two words are merely alike in meaning.

If you put a cross in the third space then the two words are almost alike in meaning. This is the mid- or neutral point of the scale.

A cross in the fourth space indicates the two words are a little bit alike in meaning.

And, if you place a cross in the last space the two words are not at all alike in meaning.

RATING SCALE

x very alike (1)	:	:	:	:
:	x alike (2)	:	:	:
:	:	x almost alike (3)	:	:
:	:	:	x a little bit alike (4)	:
:	:	:	:	x not at all alike (5)

APPENDIX II-B(3) cont.

N.B. Numerical values for each space are given in brackets.

P.3

Now let us begin on the actual rating task itself. Your task is to pair the word at the top of the page, which is the standard word, in turn with each of the words appearing in the list on the left-hand side of the page. You then have to decide how alike in meaning the two words are to you. Remember it is what the word means to you and there are no right or wrong answers. Once you have decided how alike in meaning the two words are, put a cross in the appropriate space of the scale which appears to the right of each word on the list. Repeat this procedure for all words which appear in the list paired with the standard word.

Before starting the task itself let us work through an example.

UP

Over ________ : ________ : ________ : ________ : ________

Below ________ : ________ : ________ : ________ : ________

Once you have finished a page, move on to the next one. There is a different standard word at the top of each page. However, your task remains the same:-

(1) Compare the standard word with each of the words in the list.

(2) Decide how alike in meaning the two words are.

(3) Indicate this "alikeness" by placing a cross in one of the spaces of the scale which appears to the right of each word.

DO THIS TASK QUICKLY AND QUIETLY.

DO NOT LOOK BACK ONCE A PAGE HAS BEEN COMPLETED.

APPENDIX II-C(1). Frequency of Each Rating Score for Word Pairs - Child Subjects.

Rating Score (Similarity).

		1	2	3	4	5
IN FRONT -	Ahead	32	11	1	1	11
	Behind	8	4	4	16	24
	Before	18	13	11	6	8
	First	6	10	14	6	20
	Last	35	10	5	4	2
		4	4	4	5	39
AHEAD -	In front	35	7	7	2	5
	Behind	5	11	5	6	29
	Before	24	5	16	5	6
	After	13	3	8	10	22
	First	30	8	5	3	10
	Last	2	3	1	10	40
BEHIND -	In front	15	7	4	5	25
	Ahead	8	7	8	10	23
	Before	10	15	6	7	18
	After	17	10	8	3	18
	First	7	5	11	6	27
	Last	23	7	7	4	15

APPENDIX II-C(1) cont.

Rating Score (Similarity).

		1	2	3	4	5
BEFORE -	In front	21	12	11	4	8
	Ahead	24	8	10	9	5
	Behind	9	4	11	8	24
	After	10	5	10	13	18
	First	26	8	3	6	13
	Last	11	4	3	7	31
AFTER -	In front	6	12	10	9	19
	Ahead	10	14	8	3	21
	Behind	17	9	8	7	15
	Before	11	11	10	6	18
	First	11	8	13	5	19
	Last	13	13	5	11	14
FIRST -	In front	36	12	3	2	3
	Ahead	26	11	10	4	5
	Behind	2	9	11	13	21
	Before	20	16	6	3	11
	After	9	16	5	8	18
	Last	13	4	4	2	33
LAST -	In front	11	3	4	12	26
	Ahead	9	5	5	7	30
	Behind	19	9	6	10	12
	Before	8	7	8	11	22
	After	14	10	12	9	11
	First	17	4	1	2	32

APPENDIX II-C(2). Frequency of Each Rating Score for Word Pairs - Adult Subjects.

		Rating Score (Similarity).				
		1	2	3	4	5
IN FRONT -	Ahead	175	68	9	6	1
	Behind	2	1	1	39	216
	Before	38	117	53	27	24
	After	1	7	5	42	204
	First	105	101	37	15	1
	Last	1	0	1	19	238
AHEAD -	In front	176	63	11	8	1
	Behind	2	2	0	27	228
	Before	60	101	40	31	27
	After	1	9	11	50	188
	First	70	127	32	27	3
	Last	2	0	1	19	237
BEHIND -	In front	4	0	2	17	236
	Ahead	5	0	2	19	233
	Before	5	12	16	46	180
	After	77	91	35	33	23
	First	2	0	1	30	226
	Last	45	110	42	56	6

APPENDIX II-C(2) cont.

		Rating Score (Similarity).				
		1	2	3	4	5
BEFORE -	In front	73	100	36	29	21
	Ahead	78	109	28	23	21
	Behind	4	8	12	49	186
	After	2	4	5	30	218
	First	36	110	67	24	22
	Last	2	8	9	37	203
AFTER -	In front	4	16	5	41	193
	Ahead	3	11	11	51	183
	Behind	63	102	33	37	24
	Before	2	6	10	26	215
	First	1	5	8	43	202
	Last	32	88	53	62	24
FIRST -	In front	146	76	23	14	0
	Ahead	57	131	47	21	3
	Behind	2	2	2	36	217
	Before	48	101	50	32	28
	After	2	2	6	53	196
	Last	5	2	2	3	247
LAST -	In front	5	2	1	22	229
	Ahead	4	2	0	18	235
	Behind	64	93	46	50	6
	Before	3	11	10	44	191
	After	21	75	63	85	15
	First	5	2	1	2	249

APPENDIX III-A. Mean *P.P.V.T.* (form a) scores for subjects in First Sentence Frames Study.

(1) Year 3.

	C.A. (Years & Months)	Raw Score	I.Q.	Percentile	M.A. (Years & Months)
Males	8:0	72.2	109.1	65.7	9:3
Females	7:11	71.2	109.3	68.3	9:1

(2) Year 4.

	C.A. (Years & Months)	Raw Score	I.Q.	Percentile	M.A. (Years & Months)
Males	9:2	76.4	113.4	76.2	10:2
Females	9:1	76.1	113.5	72.2	10:1

(3) Year 5.

	C.A. (Years & Months)	Raw Score	I.Q.	Percentile	M.A. (Years & Months)
Males	10:4	86.9	112.2	71.6	12:3
Females	10:3	83.0	108.0	67.2	11:6

(4) Year 6.

	C.A. (Years & Months)	Raw Score	I.Q.	Percentile	M.A. (Years & Months)
Males	11:4	88.6	108.3	66.8	12:10
Females	11:2	88.5	108.8	69.3	12:10

(5) Year 7.

	C.A. (Years & Months)	Raw Score	I.Q.	Percentile	M.A. (Years & Months)
Males	12:1	95.3	113.8	72.3	14:3
Females	12:3	91.3	106.9	67.2	13:4

APPENDIX III-B. Sentence Pairs used in First Sectence Frames Study.

(1) John is in front of Paul.

So Paul is ________ John.

*(2) John is before Paul.

So Paul is ________ John.

*(3) Paul came in front of John.

So John came ________ Paul.

(4) John came after Paul.

So Paul came ________ John.

(5) Paul is ahead of John.

So John is ________ Paul.

*(6) John came behind Paul.

So Paul came ________ John.

*(7) Paul is after John.

So John is ________ Paul.

*(8) John came ahead of Paul.

So Paul came ________ John.

(9) John is behind Paul.

So Paul is ________ John.

(10) Paul came before John.

So John came ________ Paul.

* Incongruent sentence pairs, that is, where sentence context and dominant lexical meaning conflict.

APPENDIX III-C. Raw Scores for Subjects in First Sentence Frames Study for each Experimental Order.

(1) Year 3

			Sentence Pairs									
S.No.	Exptal. Order	Total Correct	1	2*	3*	4	5	6*	7*	8*	9	10
1,6, 11,23	1	27	3	2	1	3	3	3	2	3	4	3
7,18, 33,34	2	30	3	4	1	4	3	3	4	3	2	3
9.13, 19,21	3	17	2	1	2	2	3	2	2	0	2	1
14,24, 25,30	4	18	3	2	0	3	2	1	2	0	1	4
4,5, 17,29	5	22	3	3	3	1	2	2	1	1	2	4
3,10, 16.35	6	27	4	3	2	3	2	3	3	1	3	3
15,20, 22,27	7	30	4	2	4	4	4	1	3	1	3	4
26,28, 36,37	8	31	4	4	2	3	3	3	3	2	3	4
31,32, 38,39	9	21	2	3	2	3	1	1	2	2	2	3
2,8, 12,40	10	31	4	2	3	2	4	4	3	1	4	4

* Incongruent Sentence Pairs.

APPENDIX III-C cont.

(2) Year 4

S.No.	Exptal. Order	Total Correct	Sentence Pairs 1	2*	3*	4	5	6*	7*	8*	9	10
1-4	1	32	4	3	2	3	4	3	3	3	4	3
5-8	2	31	4	3	3	4	4	2	2	3	2	4
9-12	3	20	3	1	2	2	3	2	2	0	2	3
13-16	4	31	4	3	1	4	3	2	4	2	4	4
17-20	5	32	3	3	3	4	3	3	3	3	3	4
21-24	6	38	4	3	4	4	4	4	4	3	4	4
25-28	7	29	4	3	3	4	4	2	0	2	3	4
29-32	8	31	4	2	3	3	3	3	3	2	4	4
33-36	9	35	4	3	4	3	4	3	3	3	4	4
37-40	10	31	4	3	1	4	3	3	3	2	4	4

(3) Year 5

S. No.	Exptal. Order	Total Correct	Sentence Pairs 1	2*	3*	4	5	6*	7*	8*	9	10
1-4	1	34	4	3	4	4	3	3	2	3	4	4
5-8	2	36	4	3	4	4	4	4	3	3	4	3
9-12	3	28	4	3	3	4	3	1	2	4	2	2
13-16	4	35	4	3	4	3	3	3	3	4	4	4
17-20	5	34	4	3	4	4	4	2	2	4	3	4
21-24	6	27	3	2	3	2	4	4	0	2	4	3
25-28	7	33	4	4	3	3	3	3	3	3	3	4
29-32	8	34	4	2	3	4	3	4	4	2	4	4
33-36	9	32	4	4	3	3	3	3	2	2	4	4
37-40	10	31	4	4	1	3	4	3	3	1	4	4

*Incongruent Sentence Pairs.

APPENDIX III-C cont.

(4) Year 6

Sentence Pairs

S.No.	Exptal. Order	Total Correct	1	2*	3*	4	5	6*	7*	8*	9	10
1-4	1	35	4	3	3	4	4	3	4	3	3	4
5-8	2	33	4	3	4	3	4	3	3	2	3	4
9-12	3	32	4	2	4	3	4	3	3	3	4	2
13-16	4	29	4	2	4	2	4	2	2	4	2	3
17-20	5	31	4	1	4	4	4	2	3	3	4	2
21-24	6	32	4	0	3	4	4	4	3	3	4	3
25-28	7	35	4	2	4	3	4	4	3	4	4	3
29-32	8	32	4	3	4	3	3	3	3	2	4	3
33-36	9	37	4	4	3	4	4	4	3	3	4	4
37-40	10	24	4	2	2	3	1	1	3	1	3	4

(5) Year 7

Sentence Pairs

S. No.	Exptal. Order	Total Correct	1	2*	3*	4	5	6*	7*	8*	9	10
1-4	1	34	4	3	3	4	3	3	4	2	4	4
5-8	2	29	4	2	2	3	4	2	2	4	3	3
9-12	3	33	4	1	4	4	4	3	2	4	3	4
13-16	4	36	4	3	4	4	4	4	4	2	3	4
17-20	5	34	4	2	4	4	4	3	2	3	4	4
21-24	6	34	4	2	3	3	3	3	4	4	4	4
25-28	7	32	3	4	2	4	4	3	3	3	4	2
29-32	8	36	4	1	4	4	4	4	3	4	4	4
33-36	9	34	3	4	4	4	4	3	3	1	4	4
37-40	10	33	4	3	3	4	3	3	4	3	3	3

*Incongruent Sentence Pairs.

APPENDIX III-D(1). Results of Three-way A.O.V. (Subjects x Spat x Cong) in First Sentence Frames Study.

Year 3

Source	D.F.	S.S.	M.S.	V.R.
Subjects	39	11.48	0.29	8.61+
Spat	1,39	0.54	0.54	4.19 *
Cong	1,39	1.11	1.11	21.28*
Spat x Cong	1,39	0.14	0.14	3.98

Year 4

Source	D.F.	S.S.	M.S.	V.R.
Subjects	39	5.80	0.15	3.73+
Spat	1,39	0.04	0.04	0.36
Cong	1,39	2.46	2.46	49.30*
Spat x Cong	1,39	0.004	0.004	0.11

Year 5

Source	D.F.	S.S.	M.S.	V.R.
Subjects	39	3.16	0.08	1.57+
Spat	1,39	0.11	0.11	1.15
Cong	1,39	1.25	1.25	30.56*
Spat x Cong	1,39	0.004	0.004	0.08

APPENDIX III-D(1) cont.

Year 6

Source	D.F.	S.S.	M.S.	V.R.
Subjects	39	3.87	0.10	2.15+
Spat	1,39	0.53	0.53	4.45*
Cong	1,39	1.03	1.03	17.64*
Spat x Cong	1,39	0.0002	0.0002	0.004

Year 7

Source	D.F.	S.S.	M.S.	V.R.
Subjects	39	3.91	0.10	1.43+
Spat	1,39	0.07	0.07	0.85
Cong	1,39	1.35	1.35	36.02 *
Spat x Cong	1,39	0.07	0.07	0.98

+ Subjects served as the error term in the A.O.V. (Genstat,1977).

* Significant value at α = 0.05, $F_{1,39}$ = 4.10

APPENDIX III-D(2). Results of Three-way A.O.V. (Subjects x Mark x Cong) in First Sentence Frames Study.

Year 3

Source	D.F.	S.S.	M.S.	V.R.
Subjects	39	12.17	0.31	8.42+
Mark	1,39	0.00001	0.00001	0.00
Cong	1,39	1.11	1.11	23.66*
Mark x Cong	1,39	0.34	0.34	9.13*

Year 4

Source	D.F.	S.S.	M.S.	V.R.
Subjects	39	6.28	0.16	4.13+
Mark	1,39	0.005	0.005	0.07
Cong	1,39	2.29	2.29	44.44*
Mark x Cong	1,39	0.11	0.11	2.77

Year 5

Source	D.F.	S.S.	M.S.	V.R.
Subjects	39	3.29	0.08	1.33+
Mark	1,39	0.14	0.14	2.37
Cong	1,39	1.23	1.23	29.43*
Mark x Cong	1,39	0.02	0.02	0.38

APPENDIX III-D(2) cont.

Year 6

Source	D.F.	S.S.	M.S.	V.R.
Subjects	39	3.80	0.10	1.45+
Mark	1,39	0.00009	0.00009	0.001
Cong	1,39	0.89	0.89	14.93*
Mark x Cong	1,39	0.10	0.10	1.45

Year 7

Source	D.F.	S.S.	M.S.	V.R.
Subjects	39	4.24	0.11	3.04+
Mark	1,39	0.01	0.01	0.36
Cong	1,39	1.16	1.16	36.38*
Mark x Cong	1,39	0.02	0.02	0.46

+ Subjects served as an error term in the A.O.V. (Genstat,1977)

* Significant value at $\alpha = 0.05$, $F1,39 = 4.10$.

APPENDIX III-E. Results of Chi-square Analyses Performed on Data from First Sentence Frames Study.

(1) Sex x Number Correct

Year 3 - 7.29*

Year 4 - 0.23

Year 5 - 0.065

Year 6 - 4*

Year 7 - 1.49

* Significant value at $\alpha = 0.05$, d.f. = 1, Crit $\chi^2 = 3.84$.

(2) I.Q. (*P.P.V.T.*) x Number Correct

Year 3 - 2.05

Year 4 - 3.52

Year 5 - 3.17

Year 6 - 0.75

Year 7 - 6.07*

* Significant value at $\alpha = 0.05$, d.f. = 1, Crit. $\chi^2 = 3.84$

(3) Presentation Order x Number Correct

Year 3 - 28.74*

Year 4 - 27.53*

Year 5 - 12.74

Year 6 - 18.44*

Year 7 - 6.7

* Significant value at $\alpha = 0.05$, d.f. = 9, Crit. $\chi^2 = 16.92$

APPENDIX III-F. Type of Error Response made on Each Sentence Pair in First Sentence Frames Study.

Year 3

	1	2*	3*	4	5	6*	7*	8*	9	10
S.A.	4	7	15	3	8	7	6	16	3	3
Synonym	0	3	2	1	2	6	2	3	4	1
Repetition	2	3	1	4	1	2	4	1	4	1
O.E.	2	1	2	4	2	2	3	6	3	2

Year 4

	1	2*	3*	4	5	6*	7*	8*	9	10
S.A.	2	9	12	3	4	7	7	13	5	2
Synonym	0	3	1	0	1	4	1	3	1	0
Repetition	0	1	1	2	0	2	4	1	0	0
O.E.	--	--	--	--	--	--	1	--	--	--

Year 5

	1	2*	3*	4	5	6*	7*	8*	9	10
S.A.	1	9	7	5	4	9	8	12	4	4
Synonym	0	0	1	1	1	1	1	0	0	0
Repetition	--	--	--	--	--	--	7	--	--	--
O.E.	--	--	--	--	1	--	--	--	--	--

APPENDIX III-F cont.

Year 6

	1	2*	3*	4	5	6*	7*	8*	9	10
S.A.	0	18	5	6	4	11	6	12	5	8
Synonym	--	--	--	--	--	--	2	--	--	--
Repetition	--	--	--	1	--	--	2	--	--	--
O.E.	--	--	--	--	--	--	--	--	--	--

Year 7

	1	2*	3*	4	5	6*	7*	8*	9	10
S.A.	2	14	6	1	3	8	5	10	4	4
Synonym	0	1	1	1	0	1	3	0	0	0
Repetition	--	--	--	--	--	--	1	--	--	--
O.E.	--	--	--	--	--	--	--	--	--	--

* Denotes an incongruent sentence pair.

APPENDIX IV-A. Age Range and Mean Age Vales for Adult Subjects in the Sentence Frames Study.

	Age* Range	Mean Age*
Males	17:3 - 20:3	18:4
Females	17:3 - 19:11	18:0

* Values in years and months.

APPENDIX IV-B. The Ten Sentence Pairs used in the Practice Trials for Adult Subjects Participating in the Sentence Frames Study.

(1) The wire is thinner than the cable.

So the cable is ________ than the wire.

(2) The man is older than the woman.

So the woman is ________ than the man.

(3) The river is wider than the stream.

So the stream is ________ than the river.

(4) The boat is below the bridge.

So the bridge is ________ the boat.

(5) The girl is taller than the boy.

So the boy is ________ than the girl.

(6) The kite is lower than the bird.

So the bird is ________ than the kite.

(7) Janet was later than Ellen.

So Ellen was ________ than Janet.

(8) The crate is bigger than the carton.

So the carton is ________ than the crate.

(9) The string is shorter than the rope.

So the rope is ________ than the string.

(10) The bucket is over the matchbox.

So the matchbox is ________ the bucket.

APPENDIX IV-C. Raw Scores for Adult Subjects in Sentence Frames Study for Each Experimental Order.

Sentence Pairs.

S. No.	Exptal. Order	Total Correct	1	2*	3*	4	5	6*	7*	8*	9	10
1,3,5, 6	1	33	4	3	3	3	4	4	2	4	3	3
2,4,7, 9	2	31	4	4	3	4	2	1	4	1	4	4
8,10, 11,12	3	29	2	3	3	4	3	2	4	3	2	3
13-16	4	33	4	4	3	3	4	1	3	4	4	3
17,18, 19,22	5	36	4	3	4	4	4	4	3	4	4	2
20,21, 25,26	6	23	4	0	2	2	3	2	2	2	3	3
23, 24 27,29	7	34	4	3	4	4	4	3	4	2	4	2
28, 30, 31, 32	8	31	4	1	3	4	4	3	3	1	4	4
33 - 36	9	34	4	4	2	3	4	4	2	3	4	4
37-40	10	22	2	3	1	3	2	1	3	2	2	3

*Incongruent Sentence Pairs.

APPENDIX IV-D. Results of the Three-way A.O.V. (Subjects x Spat x Cong) on the R.T. Data.

SOURCE	D.F.	S.S.	M.S.	V.R.
Subjects	39	355705792	9120661	1.51+
Spat	1,39	542424	542424	0.12
Cong	1,39	837	837	0.00
Spat x Cong	1,39	14758605	14758605	2.45

$\alpha = 0.05$

$F_{1,39} = 4.10$

\+ Subjects served as an error term in this analysis. (Genstat, 1977)

Campbell, L. (1979). A Survey of the Child Treatment Populations of Speech Therapy Clinics in South Australia 1977. *Australian Journal of Human Communication Disorders, 7*(1), 16-23.

APPENDIX V-B. Mean and Range Values for Chronological Age, Mental Age, Verbal I.Q. and Percentile for Male and Female Language-Delayed Subjects.

	Chronological Age*		Mental Age*		Verbal I.Q.		Percentile	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Males	12:1	10:11-13:2	9:0	7:8-10:2	79	71-84	7.6	1-12
Females	11:9	9:7-13:3	8:8	7:1-10:4	78.3	72-84	7.8	3-12

*Age values in years and months.

APPENDIX V-C. Raw Scores of Delayed-Language Subjects in Sentence Frames Task.

S.No.	Total Correct	1	2*	3*	4	5	6*	7*	8*	9	10
1	8	1	1	1	1	1	1	0	0	1	1
2	8	1	1	1	1	1	1	0	0	1	1
3	4	1	0	0	0	1	1	0	0	1	0
4	4	0	1	0	0	0	1	0	0	1	1
5	9	1	1	1	1	1	0	1	1	1	1
6	6	1	0	1	0	1	1	0	1	1	0
7	6	1	0	1	1	1	1	1	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	4	1	0	0	0	0	1	0	1	1	0
11	6	1	1	1	0	1	0	0	0	1	1
12	7	1	1	1	0	1	1	0	0	1	1
13	9	1	0	1	1	1	1	1	1	1	1
14	5	1	0	1	1	0	0	1	0	0	1
15	6	1	1	0	1	1	0	1	0	0	1
16	10	1	1	1	1	1	1	1	1	1	1
17	3	0	1	0	1	0	0	0	0	0	1
18	10	1	1	1	1	1	1	1	1	1	1
19	8	1	0	1	1	1	1	1	0	1	1

* Denotes an incongruent sentence pair.

APPENDIX V-D. Results of Three-way A.O.V. Performed on the Data from Language-Delayed Subjects.

(1) Subjects X Spat X Cong.

Source	D.F.	S.S.	M.S.	V.R.
Subjects	18	6.36	0.35	7.81+
Spat	1,18	0.04	0.04	0.26
Cong	1,18	0.42	0.42	8.21*
Spat X Cong	1,18	0.04	0.04	0.80

(2) Subjects X Mark X Cong.

Source	D.F.	S.S.	M.S.	V.R.
Subjects	18	6.24	0.35	9.30+
Mark	1,18	0.01	0.01	0.27
Cong	1,18	0.53	0.53	17.65*
Mark X Cong	1,18	0.07	0.07	1.93

+Subjects served as the error term in the A.O.V. (Genstat, 1977)

* Significant value at $\alpha = 0.05$, $F_{1,18} = 4.41$.

APPENDIX VI-A. *P.P.V.T.* (form a) scores for subjects in Second Sentence Frames Study.

(1) Year 3.

	C.A. (Years & Months)	Raw Score	I.Q.	Percentile	M.A. (Years & Months)
Males	8:5	79.7	118.7	89.0	10:9
Females	8:3	80	122.7	86.2	10:11

(2) Year 4*

	C.A. (Years & Months)	Raw Score	I.Q.	Percentile	M.A.
Males	9:3	77.3	118.1	79.9	10:4
Females	9:2	77.4	119.3	87.2	10:4

(3) Year 5*

	C.A. (Years & Months)	Raw Score	I.Q.	Percentile	M.A.
Males	10:3	79.8	119.1	86.9	10:10
Females	10:1	81.4	124.1	89.8	11:2

(4) Year 6*

	C.A. (Years & Months)	Raw Score	I.Q.	Percentile	M.A.
Males	11:6	87.9	116	82.6	12:8
Females	11:4	84.9	112.7	77.2	11:10

(5) Year 7*

	C.A. (Years & Months)	Raw Score	I.Q.	Percentile	M.A.
Males	12:5	95	117.7	85.8	14:4
Females	12:2	93.3	116.3	85.6	13:11

* Subjects from these year levels were selected from the population which had been tested 12 months earlier with the *P.P.V.T.* (form a).

APPENDIX VI-B. Sentence Frames or Contexts used as Stimuli in the Second Sentence Frames Study.

SPATIAL

(1) The plane flew ________ the mountain.

(2) Dean must remove his car from ________ the bus.

(3) The chair stood ________ the stool.

(4) Tony ran ________ the trailer.

(5) The ball rolled ________ the wall.

TEMPORAL

(1) John washed the dishes ________ doing the floor.

(2) Paul left ________ Doug arrived.

(3) Wendy packed the bag ________ leaving the table.

(4) Arthur had his meal ________ going to the shop.

(5) Janet closed the door ________ opening the window.

SPATIAL/TEMPORAL

(1) Tom stepped out of the house ________ Fred.

(2) Jane walked onto the stage ________ Anne.

(3) The cat jumped over the rope ________ the dog.

(4) The car went under the bridge ________ the taxi.

(5) Mary came into the room ________ Peter.

APPENDIX VI-C. Format of Examples Page in Second Sentence Frames Study.

(1) The dog is below, under ____________ the table

(2) My hand is over, above ____________ the table.

(3) The village is beyond, past ____________ the bus stop.

(4) The picture is above, over ____________ the shelf.

(5) The clock is under, below ____________ the mirror.

(6) The car is past, beyond ____________ those trees.

APPENDIX VI-D(1). Raw Scores for Subjects at Each Year Level in Spatial Contexts in the Second Sentence Frames Study.
(+ and - refer to positive and negative word stimuli.)

Year 3

	A+		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Spatial Responses	17	17	16	15	18	17	16	15	15	19

Year 4

	A[+]		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Spatial Responses	20	20	20	19	18	20	17	11	17	19

Year 5

	A[+]		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Spatial Responses	17	19	16	20	13	19	20	12	19	19

Year 6

	A[+]		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Spatial Responses	18	20	19	19	19	19	19	12	19	20

Year 7

	A[+]		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Spatial Responses	17	20	17	20	15	19	17	15	19	20

+ Possible maximum in each cell = 20.

APPENDIX VI-D(2). Raw Scores for Subjects at Each Year Level in Temporal Contexts in the Second Sentence Frames Study.
(+ and - refer to positive and negative word stimuli.)

Year 3

	A+		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Temporal Responses	19	20	20	20	15	19	20	19	20	20

Year 4

	A+		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Temporal Responses	20	20	20	20	19	19	20	20	19	20

Year 5

	A+		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Temporal Responses	20	20	20	20	18	20	20	20	20	20

Year 6

	A+		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Temporal Responses	20	20	20	20	19	20	20	20	20	19

Year 7

	A+		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Temporal Responses	20	20	20	20	20	20	20	20	20	20

+Possible maximum in each cell = 20.

APPENDIX VI-D(3). Raw Scores for Subjects at Each Year Level in Spatial/Temporal Contexts in the Second Sentence Frames Study.
(+ and - refer to positive and negative word stimuli.)

Year 3

	A+		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Spatial	5	7	7	5	8	8	10	9	4	5
Temporal	15	13	13	15	12	12	10	11	16	15

Year 4

	A+		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Spatial	5	5	7	7	8	3	8	9	3	7
Temporal	15	15	13	13	12	17	12	11	17	13

Year 5

	A+		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Spatial	2	4	10	5	1	6	6	10	1	7
Temporal	18	16	10	15	19	14	14	10	19	13

APPENDIX VI-D(3) cont.

Year 6

	A+		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Spatial	2	6	4	6	8	5	6	9	5	10
Temporal	18	14	16	14	12	15	14	11	15	10

Year 7

	A+		B		C		D		E	
	+	-	+	-	+	-	+	-	+	-
Spatial	4	6	5	10	6	7	7	11	1	6
Temporal	16	14	15	10	14	13	13	9	19	14

+Possible maximum in each cell = 20,

APPENDIX VI-E. Results of Chi-square Analyses Performed on Data from Second Sentence Frames Study.

(1) Spatial Contexts: Response Type x Context.

Year 3 - 5.71

Year 4 - 40.07*

Year 5 - 32.89*

Year 6 - 32.88*

Year 7 - 18.57*

* Significant value at α = 0.05, d.f.=9,,Crit χ^2 = 16.92.

(2) Temporal Contexts: Response Type x Context.

Year 3 - 28.12*

Year 4 - 7.11

Year 5 - 18.18*

Year 6 - 8.08

Year 7 - 0

*Significant value at α =0.05, d.f.=9.,Crit χ^2 = 16.92.

(3) Spatial/Temporal Contexts: Response Type x Context.

Year 3 - 7.93

Year 4 - 9.26

Year 5 - 25.36*

Year 6 - 12.03

Year 7 - 17.25*

*Significant value at α =0.05, d.f.= 9.,Crit χ^2 = 16.92.

APPENDIX VI-F(1). Results of Four-way A.O.V. - Subjects x Sex x Conx x Stim.

Year 3

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,18	9.11	9.11	6.55*
Stim	1,18	0.31	0.31	1.55
Sex x Stim	1,18	0.31	0.31	1.55
Conx	1,18	9.11	9.11	9.36*
Sex x Conx	1,18	6.61	6.61	6.79*
Stim x Conx	1,18	0.11	0.11	0.22
Sex x Stim x Conx	1,18	1.01	1.01	1.20

Year 4

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,18	0.05	0.05	0.18
Stim	1,18	0.05	0.05	0.23
Sex x Stim	1,18	0.05	0.05	0.23
Conx	1,18	3.20	3.20	9.93*
Sex x Conx	1,18	0	0	0
Stim x Conx	1,18	0.20	0.20	1.0
Sex x Stim x Conx	1,18	0.20	0.20	1.0

APPENDIX VI-F(1) cont.

Year 5

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,18	0.20	0.20	0.38
Stim	1,18	0.45	0.45	1.16
Sex x Stim	1,18	0.05	0.05	0.13
Conx	1,18	7.20	7.20	12.83*
Sex x Conx	1,18	0.20	0.20	0.36
Stim x Conx	1,18	0.05	0.05	0.17
Sex x Stim x Conx	1,18	0.05	0.05	0.17

Year 6

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,18	1.25	1.25	3.12
Stim	1,18	0.20	0.20	2.77
Sex x Stim	1,18	0	0	0
Conx	1,18	2.45	2.45	9.59*
Sex x Conx	1,18	0.45	0.45	1.76
Stim x Conx	1,18	0.20	0.20	0.84
Sex x Stim x Conx	1,18	0	0	0

Year 7

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,18	0.01	0.01	0.02
Stim	1,18	1.01	1.01	6.94*
Sex x Stim	1,18	0.11	0.11	0.77
Conx	1,18	5.51	5.51	8.84*
Sex x Conx	1,18	0.01	0.01	0.02
Stim x Conx	1,18	1.01	1.01	6.94*
Sex x Stim x Conx	1,18	0.11	0.11	0.77

*Significant value at α =0.05, $F_{1,18}$=4.41.

+Subjects served as the error term in the A.O.V.

(Genstat, 1977)

APPENDIX VI-F(2). Results of Three-way A.O.V. - Sub+ x Sex x Stim.

Year 3

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,18	0.40	0.40	0.59
Stim	1,18	0.10	0.10	0.11
Sex x Stim	1,18	0.10	0.10	0.11

Year 4

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,18	0.22	0.22	0.40
Stim	1,18	1.22	1.22	1.74
Sex x Stim	1,18	0.62	0.62	0.89

Year 5

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,18	1.22	1.22	2.55
Stim	1,18	1.22	1.22	1.57
Sex x Stim	1,18	1.22	1.22	1.57

Year 6

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,18	0.22	0.22	0.22
Stim	1,18	0.22	0.22	0.67
Sex x Stim	1,18	0.22	0.22	0.67

Year 7

SOURCE	D.F.	S.S.	M.S.	V.R.
Sex	1,18	4.22	4.22	7.57*
Stim	1,18	3.02	3.02	5.21*
Sex x Stim	1,18	0.02	0.02	0.04

*Significant value at α =0.05, $F_{1,18}$=4.41.

+Subjects served as the error term in the A.O.V.

(Genstat, 1977)

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